Board of Directors Agenda

January 16, 2025

Click link to access the meeting:

https://www.zoomgov.com/j/1602805839

Zoom Meeting ID

Ways to Join

Computer: Click the link above. You will be prompted to run the Zoom browser or Zoom application. Once signed on to the meeting, you will have the option to join using your computer audio system or phone.

Webinar Features:

Raise Hand	▶	Use the **raise hand** feature every time you wish to make a public comment.
CC	▶	Participants can enable **closed captioning** by clicking the CC icon. You may also view the full transcript and change the font size by clicking 'subtitle settings'. These features are not available via phone.
	▶	This symbol shows you are **muted**, click this icon to unmute your microphone.
	▶	This symbol shows you are currently **unmuted**, click this button to mute your microphone.
	▶	The chat feature should be used by panelists and attendees solely for "housekeeping" matters as comments made through this feature will not be retained as part of the meeting record. See the **Live Verbal Public Comment** for instructions on how to make a public comment.

Smartphone or Tablet: Download the Zoom app and join the meeting by clicking the link or using the webinar ID (found in the link).

Download on the App Store

GET IT ON Google Play

Phone:

1. If you are joining the meeting audio by phone and viewing the meeting on a device, dial the number provided in the 'join audio' phone call tab of the initial pop-up, and enter the Meeting ID (found in the link).
2. If you are joining by phone only, dial: **+1-669-900-9128** or **+1-253-215-8782** and type the meeting ID found in the link, press #. You will have access to the meeting audio, **but will NOT be able to view the PowerPoint presentations.**

Live Verbal Public Comments: Use the 'Raise Hand' icon every time you wish to make a public comment on an item. Raise your hand once the agenda item you wish to comment on has been called. In person public comments will be taken first, virtual attendees will be taken in the order in which they raise their hand. Requests to speak will not be taken after the public comment period ends, unless under the Chair's discretion. General Public Comment, at the beginning of the Board of Directors meeting only, will be limited to five speakers. Additional speakers with general public comments will be heard at the end of the meeting. Two-minutes of time is allotted per speaker, unless otherwise directed by the Chair.

Public Comments Made Via Zoom

1. Click the link found at the top of this instruction page
2. Click the raise hand icon located in the bottom center of the platform
3. The Clerk will announce your name when it is your turn to speak
4. Unmute yourself to speak

Public Comments Made by Phone Only

1. Dial **+1-669-900-9128**
2. Type in the zoom meeting ID found in the link and press #
3. Dial *9 to raise your hand via phone
4. The Clerk will call out the last 4 digits of your phone number to announce you are next to speak
5. Dial *6 to unmute yourself

Written Public Comments (before the meeting): Written public comments will be recorded in the public record and will be provided to MTS Board Members in advance of the meeting. Comments must be emailed or mailed to the Clerk of the Board* by 4:00pm the day prior to the meeting.

Translation Services: Requests for translation services can be made by contacting the Clerk of the Board* at least four working days in advance of the meeting.

In-Person Participation: In-person public comments will be heard first. Following in-person public comments, virtual attendees will be heard in the order in which they raise their hand via the Zoom platform. Speaking time will be limited to two minutes per person, unless specified by the Chairperson. Requests to speak will not be taken after the public comment period ends, unless under the Chair's discretion.

Instructions for providing in-person public comments:

1. Fill out a speaker slip located at the entrance of the Board Room;
2. Submit speaker slip to MTS staff seated at the entrance of the Board Room;
3. When your name is announced, please approach the podium located on the right side of the dais to make your public comments.

Members of the public are permitted to make general public comment at the beginning of the agenda or specific comments referencing items on the agenda during the public comment period. General Public Comment, at the beginning of the Board of Directors meeting only, will be limited to five speakers. Additional speakers with general public comments will be heard at the end of the meeting.

Assistive Listening Devices (ALDs): ALDs are available from the Clerk of the Board* prior to the meeting and are to be returned at the end of the meeting.

Reasonable Accommodations: As required by the Americans with Disabilities Act (ADA), requests for agenda information in an alternative format or to request reasonable accommodations to facilitate meeting participation, please contact the Clerk of the Board* at least two working days prior to the meeting.

***Contact Information:** Contact the Clerk of the Board via email at ClerkoftheBoard@sdmts.com, phone at **(619) 398-9561** or by mail at **1255 Imperial Ave. Suite 1000, San Diego CA 92101.**

Agenda de la Junta de Directores

January 16, 2025

Haga clic en el enlace para acceder a la reunión:

https://www.zoomgov.com/j/1602805839

ID de la reunión en Zoom

Formas de Participar

Computadora: Haga clic en el enlace más arriba. Recibirá instrucciones para operar el navegador de Zoom o la aplicación de Zoom. Una vez que haya iniciado sesión en la reunión, tendrá la opción de participar usando el sistema de audio de su computadora o teléfono.

Funciones del Seminario En Línea:

Levantar la mano	▶	Use la herramienta de **levantar la mano** cada vez que desee hacer un comentario público.
CC	▶	Los participantes pueden habilitar **el subtitulado** haciendo clic en el ícono CC. También puede ver la transcripción completa y cambiar el tamaño de letra haciendo clic en “configuración de subtítulos”. Estas herramientas no están disponibles por teléfono.
	▶	Este símbolo indica que usted se encuentra en **silencio**, haga clic en este ícono para quitar el silenciador de su micrófono.
	▶	Este símbolo indica que su micrófono se encuentra **encendido**. Haga clic en este símbolo para silenciar su micrófono.
	▶	La herramienta de chat deben usarla los panelistas y asistentes únicamente para asuntos “pertinentes a la reunión”, ya que comentarios realizados a través de esta herramienta no se conservarán como parte del registro de la reunión. Consulte el **Comentario público verbal** en vivo para obtener instrucciones sobre cómo hacer un comentario público.

Teléfono Inteligente o Tableta: Descargue la aplicación de Zoom y participe en la reunión haciendo clic en el enlace o usando el ID del seminario web (que se encuentra en el enlace).

Descarga en el App Store

Obténla en Google Play

Teléfono:

1. Si está participando en la reunión mediante audio de su teléfono y viendo la reunión en un dispositivo, marque el número indicado en la pestaña de llamada telefónica “unirse por audio” en la ventana emergente inicial e ingrese el ID de la reunión (que se encuentra en el enlace).
2. Si está participando solo por teléfono, marque: **+1-669-900-9128** o **+1-253-215-8782** e ingrese el ID de la reunión que se encuentra en el enlace, pulse #. Tendrá acceso al audio de la reunión, **pero NO podrá ver las presentaciones en PowerPoint.**

Comentarios Públicos Verbales en Vivo: Use la herramienta “levantar la mano” cada vez que desee hacer un comentario público sobre alguno de los artículos. Levante la mano una vez que el artículo de la agenda sobre el que desea comentar haya sido convocado. Los comentarios públicos en persona se escucharán primero, se escuchará a los asistentes virtuales en el orden en el que levanten la mano. No se aceptarán solicitudes para hablar después de que termine el periodo para hacer comentarios públicos, a menos de que el presidente determine de otra forma a su discreción. Comentarios públicos generales, únicamente al inicio de la reunión de la Junta de Directores, se limitarán a cinco personas que deseen hablar. Las personas adicionales que deseen aportar comentarios públicos generales podrán hacerlo al final de la reunión. Se otorga dos minutos de tiempo por persona que desee hablar, a menos de que el presidente instruya de otra forma. (*Consulte la página 2 para obtener instrucciones sobre cómo hacer un comentario público.*)

Comentarios Públicos a Través de Zoom

1. Haga clic en el enlace que se encuentra en la parte superior de esta página de instrucciones
2. Haga clic en el ícono de levantar la mano en el centro inferior de la plataforma
3. El secretario anunciará su nombre cuando sea su turno de hablar
4. Desactive el silenciador para que pueda hablar

Comentarios Públicos Realizados Únicamente por Teléfono

1. Marque el **+1-669-900-9128**
2. Ingrese el ID de la reunión en Zoom que se encuentra en el enlace y pulse #
3. Marque *9 para levantar la mano por teléfono
4. El secretario indicará los últimos 4 dígitos de su número de teléfono para anunciar que usted será el siguiente en hablar
5. Marque *6 para desactivar el silenciador

Comentarios Públicos por Escrito (Antes de la Reunión): Los comentarios públicos por escrito se registrarán en el registro público y se entregarán a los miembros de la Junta de MTS antes de la reunión. Los comentarios deben enviarse por correo electrónico o postal al secretario de la Junta* antes de las 4:00 p.m. el día anterior a la reunión.

Servicios de Traducción: Pueden solicitarse servicios de traducción comunicándose con el secretario de la Junta* por lo menos cuatro días hábiles antes de la reunión.

Participación en Persona: Los comentarios públicos en persona se escucharán primero. Después de los comentarios públicos en persona, se escuchará a los asistentes virtuales en el orden en el que levanten la mano a través de la plataforma de Zoom. El tiempo para hablar se limitará a dos minutos por persona, a menos de que el presidente especifique de otra forma. No se recibirán solicitudes para hablar después de que termine el periodo para hacer comentarios públicos, a menos de que el presidente determine de otra forma a su discreción.

Instrucciones para brindar comentarios públicos en persona:

1. Llene la boleta para personas que desean hablar que se encuentran en la entrada de la Sala de la Junta.
2. Entregue la boleta para personas que desean hablar al personal de MTS que se encuentra sentado en la entrada de la Sala de la Junta.
3. Cuando anuncien su nombre, por favor, acérquese al podio ubicado en el lado derecho de la tarima para hacer sus comentarios públicos.

Los miembros del público pueden hacer comentarios públicos generales al inicio de la agenda o comentarios específicos que hagan referencia a los puntos de la agenda durante el periodo de comentarios públicos. Los comentarios públicos generales únicamente al inicio de la reunión de la Junta de Directores, se limitarán a cinco personas que deseen hablar. Las personas adicionales que deseen aportar comentarios públicos generales podrán hacerlo al final de la reunión.

Dispositivos de Asistencia Auditiva (ALD, por sus siglas en inglés): Los ALD están disponibles con el secretario de la Junta* antes de la reunión y estos deberán ser devueltos al final de la reunión.

Facilidades Razonables: Según lo requerido por la Ley de Estadounidenses con Discapacidades (ADA, por sus siglas en inglés), para presentar solicitudes de información de la agenda en un formato alternativo o solicitar facilidades razonables para facilitar su participación en la reunión, por favor, comuníquese con el secretario de la Junta* por lo menos dos días hábiles antes de la reunión.

***Información de Contacto:** Comuníquese con el secretario de la Junta por correo electrónico en ClerkoftheBoard@sdmts.com, por teléfono al **(619) 398-9561** o por correo postal en **1255 Imperial Ave. Suite 1000, San Diego CA 92101.**

Metropolitan Transit System

Board of Directors

Agenda

January 16, 2025 at 9:00 a.m.

In-Person Participation: James R. Mills Building, 1255 Imperial Avenue, 10th Floor Board Room, San Diego CA 92101

Teleconference Participation: (669) 254-5252; Webinar ID: 160 280 5839, https://www.zoomgov.com/j/1602805839

NO.	ITEM SUBJECT AND DESCRIPTION	ACTION
1.	**Roll Call**	
2.	**Public Comments** This item is limited to five speakers with two minutes per speaker. Others will be heard after Board Discussion items. If you have a report to present, please give your copies to the Clerk of the Board.	
	CONSENT ITEMS	
3.	**Approval of Minutes** Action would approve the December 19, 2024 Board of Director meeting minutes.	Approve
4.	**CEO Report**	Informational
5.	**RuBAN Software Maintenance and Development – Contract Amendment** Action would authorize the Chief Executive Officer (CEO) to 1) Ratify Amendment No. 1 to MTS Doc. No. G2795.0-24, with Davra Networks USA (Davra), for Copper Line Estimated Time of Arrival (ETA) development services in the amount of $88,200.00; and 2) Execute Amendment No. 2 to MTS Doc. No. G2795.0-24, with Davra, for trolley Public Address (PA) system Spanish language support development services in the amount of $176,400.00.	Approve
6.	**Dissolution of Security and Passenger Safety Community Advisory Group** Action would approve the dissolution of the Security and Passenger Safety Community Advisory Group.	Approve
7.	**Operations Budget Status Report for November 2024**	Informational

8. **Additional Staffing – One (1) Accounting Supervisor and One (1) Staff Accountant II** — Approve
Action would authorize the Chief Executive Officer (CEO) to add one (1) Accounting Supervisor and one (1) additional Staff Accountant II to the position tables previously approved in the Fiscal Year 2025 operating budget.

9. **Board Policy No. 9: Relocation Assistance Program – Policy Revisions** — Approve
Action would approve revisions to Board Policy No. 9 (Relocation Assistance Program).

10. **Semiannual Uniform Report of Disadvantaged Business Enterprise (DBE) Awards and Payments** — Informational

11. **Imperial Avenue Division (IAD) Zero Emission Bus (ZEB) Overhead Charging Phase 1– Contract Award** — Approve
Action would authorize the Chief Executive Officer (CEO) to execute MTS Doc. No. PWB411.0-25, with G A Abell, Inc. dba Precision Electric Co., for the IAD ZEB Overhead Charging – Phase 1 Construction Project in the amount of $24,648,797.74 plus 10% contingency.

DISCUSSION ITEMS

12. **Elect Chair Pro Tem and Committee Appointments (Sharon Cooney)** — Approve
Action would consider the nominating slate proposed for the election of a Chair Pro Tem and appointment of representatives to MTS committees for 2025 and vote to appoint representatives to those offices and committees.

13. **SANDAG Report on Airport Transit Connection (ATC) (Marisa Mangan, SANDAG)** — Informational

14. **Orange Line Improvement Project Update (Heather Furey, Sharon Humphreys and David Holman of T.Y. Lin)** — Informational

15. **Budget Overview (Mike Thompson)** — Informational

16. **University of California, San Diego (UCSD) Universal Pass (U-Pass) Renewal Agreement (Brent Boyd)** — Informational

OTHER ITEMS

17. **Chair, Board Member and Chief Executive Officer's (CEO's) Communications**

18. **Remainder of Public Comments Not on The Agenda**
This item is a continuation of item No. 2 (Public Comment), in the event all speakers who request to comment on item No. 2 are not called. If all Public

Comment is accepted during item No. 2, no additional public comment will be accepted under this item.

CLOSED SESSION

19. Public Comment for Closed Session

20. Closed Session – Conference with Real Property Negotiators Pursuant to California Government Code Section 54956.8 — Possible Action

8949 Clairemont Mesa Boulevard, San Diego, CA (APN 369-110-04-00)
Agency Negotiators: Sharon Cooney, Chief Executive Officer; Karen Landers, General Counsel; Sean Myott, Manager of Real Estate Assets
Negotiating Parties: Eva Hum, Debbie Wong, Julie J Wong, Joyce Wong-Zecha, Angela C Wong, The Wong Family Irrevocable Trust I, The Wong Family Irrevocable Trust II, The Joseph Wong Irrevocable Trust and the Vivian Lim Irrevocable Trust.
Under Negotiation: Price and Terms of Payment

ADJOURNMENT

21. Next Meeting Date

The next Board of Director's meeting is scheduled for February 13, 2025 at 9:00am.

22. Adjournment

MINUTES

MEETING OF THE SAN DIEGO METROPOLITAN TRANSIT SYSTEM

BOARD OF DIRECTORS

December 19, 2024

[Clerk's note: Except where noted, public, staff and board member comments are paraphrased. The full comment can be heard by reviewing the recording at the MTS website.]

1. Roll Call

Chair Whitburn called the Board meeting to order at 9:03 a.m. A roll call sheet listing Board Member attendance is attached as Attachment A.

2. Public Comment

Peter Zschiesche – Representing the United Taxi workers of San Diego, provided a verbal statement to the Board during the meeting. Peter talked about his collaborative relationship with MTS staff to resolve issues in the taxi industry.

Alex Wong – Provided a verbal statement to the Board during the meeting. Alex expressed dissatisfaction with the trolley to the airport concept.

CONSENT ITEMS:

3. Approval of Minutes
Action would approve the November 14, 2024 Board of Directors meeting minutes.

4. CEO Report

5. Bridge Inspection Services – Work Order Agreement
Action would authorize the Chief Executive Officer (CEO) to execute Work Order WOA2497-CM23 under MTS Doc. No. G2497.0-21, with Jacobs Project Management Company (Jacobs), in the amount of $1,020,332.06 to perform bridge inspection services for a period of twenty-one (21) months.

6. Approve Fiscal Year (FY) 2024-25 State Transit Assistance (STA) Claim and STA Interest Claim
Action would adopt Resolution No. 24-17 approving the FY 2024-25 STA claim.

7. Orange Line Improvement Project Phase 1 – Train Control Wire and Cable – Contract Award
Action would authorize the Chief Executive Officer (CEO) to execute MTS Doc. No. L1687.0-25, with Balfour Beatty Infrastructure, Inc. (Balfour), for the purchase of Train Control Wire and Cable for the Orange Line Phase 1 of the Orange Line Improvement Project (Project) in the amount of $394,629.29 (inclusive of 7.75% CA Sales Tax).

8. Purchase of Tow Tractors – Contract Award
Action would 1) Authorize the Chief Executive Officer (CEO) to execute MTS Doc. No. B0771.0-24, with Blue Angel International LLC (Blue Angel), a Small Business (SB), for the purchase of four (4) base tow tractors with two (2) optional tow tractors, in the amount of $488,801.41 inclusive of 7.75% CA Sales Tax; and 2) Authorize the CEO to exercise the option quantities at CEOs discretion.

9. Americans with Disabilities Act (ADA) Bus Stop Upgrades Construction Services – Contract Award

Action would authorize the Chief Executive Officer (CEO) to execute MTS Doc. No. PWB415.0-25, with Fordyce Construction Inc., a Small Business (SB), for ADA upgrades to eight (8) bus stops, in the amount of $255,805.50.

10. Wheel Truing Machine Removal Structural Design and Kearny Mesa Division (KMD) Parking Deck Structural Survey – Work Order Agreement

Action would authorize the Chief Executive Officer (CEO) to execute Work Order No. WOA352-AE-47 to MTS Doc No. PWL352.0-22, with HDR Engineering, Inc. (HDR), in the amount of $251,534.57 for the Wheel Truing Machine Removal Design and KMD Parking Deck Structural Survey.

11. Revisions to MTS Board Policy No. 41, "Signature Authority"

Action would approve revisions to MTS Board Policy No. 41, "Signature Authority".

12. San Diego State University (SDSU) Monitoring Services for Fire and Safety – Sole Source Contract Award

Action would authorize the Chief Executive Officer (CEO) to execute MTS Doc. No. PWL423.0-25 with Johnson Controls Fire Protection, LP (JCI), in the amount of $345,492.00 for monitoring, inspection, maintenance and as-needed repair services of the fire and safety equipment at the SDSU Trolley Station for a period of five (5) years.

13. Operations Budget Status Report for October 2024

14. Municipal Separate Storm Sewer System (MS4) Support and As-Needed Best Management Practices (BMP) Repair and Consulting Services – Contract Amendment

Action would authorize the Chief Executive Officer (CEO) to execute Amendment No. 1 to MTS Doc. No. PWG367.0-23, with WSP USA (WSP), in the amount of $241,340.35 for inspection, maintenance, and as-needed repair services of the drain insert BMPs at the Imperial Avenue Division (IAD) and Kearny Mesa Division (KMD) facilities as-needed repair and consulting services in accordance with Water Quality Order No. 2013-0001-DWQ for Storm Water Discharges from Small MS4s.

15. Enterprise Resource Planning (ERP) / Transit Asset Management (TAM) Software – Contract Amendment

Action would 1) Ratify Amendment Nos. 5 and 6 to MTS Doc. No. G1680.0-14, with SAP Public Services, Inc. (SAP), for the Calendar Year (CY) 2023-2024 contractual price increases based on Consumer Price Index (CPI) for a total amount of $18,487.89; and 2) Execute Amendment No. 7 to MTS Doc. No. G1680.0-14, with SAP, for a two-year contract extension of perpetual SAP ERP and TAM licensing support in the amount of $428,197.35.

16. PRONTO Fare Collection System – Contract Amendment

Action would 1) Ratify Amendment 18 to MTS Doc. No. G2091.0-18, with Innovations in Transportation, Inc. (INIT), in the amount of $0; and 2) Authorize the Chief Executive Officer (CEO) to execute Amendment 19 to MTS Doc. No. G2091.0-18, with INIT, in the amount of $1,439,125.00 (inclusive of 7.75% CA Sales Tax).

17. Purchase of Trackwork Turnouts for Yard A Track Improvements – Contract Award
Action would authorize the Chief Executive Officer (CEO) to execute MTS Doc. No. L1686.0-25, with Progress Rail Services Corporation (Progress Rail), for the purchase of Trackwork Turnouts for Yard A Track Improvements in the amount of $3,284,290.04 (inclusive of 7.75% CA Sales Tax).

18. San Diego Transit Corporation (SDTC) Pension Plan Investment Consulting Services – Contract Award
Action would 1) Authorize the Chief Executive Officer (CEO) to execute MTS Doc No. G2914.0-24, with RVK, Inc., to provide SDTC Pension Plan Investment Consulting Services in the amount of $1,203,707.33 for five (5) base years with five (5) 1-year options for a total of 10 years; and 2) Authorize the CEO to exercise the five (5) 1-year options at the CEO's discretion.

19. Emergency Repairs: 69th Street Track and Subgrade Repairs – Contract Award
Action would authorize the Chief Executive Officer (CEO) to: 1) Execute MTS Doc. No. PWL424.0-25, with Stacy and Witbeck, Inc. (Stacy and Witbeck), for the track and subgrade repairs at 69th Street in the amount of $1,326,300.00; and 2) Authorize the CEO to execute change orders up to a 20% contingency in the amount of $265,260.00 bringing the total expenditure authority to $1,591,560.00.

20. 2025 State and Federal Legislative Program
Action would approve the 2025 State and Federal Legislative Program.

Public Comment

There were no Public Comments.

Board Comment

There were no Board Comments.

Action on Recommended Consent Items 3-20

Board Member Hall moved to approve Consent Agenda Item Nos. 3 to 20. Board Member McCann seconded the motion, and the vote was 12 to 0 in favor with Board Member Dillard, Board Member Elo-Rivera, and Alternate Board Member Pepin absent.

DISCUSSION ITEMS:

21. Senate Bill (SB) 434 Report (Stacie Bishop and Chris Tatham with ETC)

Stacie Bishop, MTS Manager of Marketing and Communications, along with Chris Tatham with ETC, presented on SB 434 Report. They outlined: the background, methodology, 10 findings, safety improvements suggested by riders and a summary.

Public Comment

There were no Public Comments.

Board Comment

Vice Chair Goble stated that an analysis of trends over the past year, would be helpful for the Board to use as a comparison tool to analyze how people feel vs how things have changed.

Board Member Montgomery Steppe highlighted the balance between enforcement and community-oriented policing. She cited the approved additional security, and the goals associated with hire increases, she was particularly interested in homeless outreach. Tim Curran, Director of Transit Security and Passenger Safety stated that 35 members have been hired over the past year, two officers are assigned to homeless outreach. Board Member Montgomery Steppe asked if the change to address homelessness was to have more collaborative outreach with organizations rather than conducting outreach on the line. Mr. Curran replied that all Code Compliance Inspectors receive training to interact with unhoused members of the public and offer them materials to attain services. Board Member Montgomery Steppe stated that the agency has a lot of work to do to get resources to the community.

Board Member Elo-Rivera asked for additional context for the presented data so that the Board can have a comparison against other jurisdictions. In this way, the Board would be able to have comparable data to understand what mechanisms are successful.

Board Member Moreno asked about the cost to conduct the survey. Ms. Bishop replied that the survey was under $150,000. Ms. Bishop added that the work that has been done is reimbursable by the state. Additional research in the new year would incur cost to MTS. Board Member Moreno asked how often the state mandates that MTS conduct this survey. Ms. Bishop replied that, currently, there are no requirements to make updates. This has been the first time it had been required, so it is yet to be determined if the state will institute this as a recurring requirement. Board Member Moreno asked if MTS proposed to continue the surveys. Ms. Cooney added that the agency conducts a comprehensive customer satisfaction survey, so some of this survey's questions can be incorporated into that survey. Board Member Moreno asked about the percentage of women riders. Ms. Bishop replied that the information would be available in January of 2025. Board Member Moreno asked for a recent statistic. Ms. Cooney replied that the best way to do so is through an on-board survey that SANDAG conducts, the last survey was done was approximately 6 years ago. Brent Boyd, Director of Planning and Scheduling, stated that there are slightly more women than men. He added that the latest SANDAG survey was delayed by the COVID-19 pandemic and that the SANDAG results will be received after the new year. Board Member Moreno asked staff to confirm that most riders were women. Mr. Boyd stated that staff would be able to give the Board a definite answer once the study was released. Karen Landers, MTS General Counsel referenced the study released in 2022 and noted a 46% female ridership. Board Member Moreno stated that several riders reported feeling less safe than others. She was curious about mechanisms that other transit agencies have utilized to make women feel safe.

Board Member Downey asked to see data on the route or line that riders are on while taking the survey. Ms. Bishop replied that the data was captured; however, it was limited in making useful statistical assumptions. Ms. Bishop stated that the data collected by line is available but safety by line will be assessed as part of the customer satisfaction findings.

Board Member Montgomery Steppe added that Circulate San Diego had made extensive research on women riders and the feeling of safety. Ms. Bishop added that the SELT project did fund several lighting programs.

Action Taken

No action taken. Informational item only.

22. Project Labor Agreement (PLA) Monitoring (Samantha Leslie and Katie Rich, The Solis Group)

Samantha Leslie, MTS Deputy General Counsel, and Katie Rich with The Solis Group, presented on PLA Monitoring. She discussed: the PLA facts, local hire goal, covered projects, roles and responsibilities, benefits, Euclid Grade Crossing and Abutment project and future efforts.

Public Comment

There were no Public Comments.

Board Comment

Board Member Elo-Rivera asked staff to explain why a shorter project would make it difficult to meet the agency's local hire goals. Ms. Rich replied that some work is so specialized that a contractor already has a set group of people on their payroll and core worker force that they want to work on the projects. There are times when the unions cannot provide the specialized workers, which poses an issue. If a contractor only has three days of work, they are only going to have one or two of their employees working, so they may not have to reach out to the local union for additional workers. Less time results in less opportunity for workers to perform hours, as it takes time to achieve 40%. Board Member Elo-Rivera asked if this was an obstacle because most of the unionized workforce were already doing work. Ms. Rich stated that with transit and emergency work, there is usually only a set number of contractors that can do the work that is required. She stated achieving the goal is dependent on the number of workers needed on these projects and the number of hours it takes to accomplish the work.

Board Member Montgomery Steppe continued to flag that local workforce is the most important benefit of a PLA. She did not believe that it was acceptable to lower the expectations for the PLA based on this project. She stated that the PLA's original framework was for the 40% local workforce goal. She stated she will continue to push the importance of local workforce, as it benefits families in the community. She suggests working more with pre-apprenticeship programs and develop a pipeline of workers for specialized work, instead of lowering the bar for PLAs. Ms. Rich added that The Solis Group was also disappointed with the way the prime contractor did not communicate after the initial pre-job. Consequently, the contractor is in the process of paying fines to the San Diego Union, because of the misunderstanding of emergency work. Ms. Rich agreed with Board Member Montgomery Steppe and assured the Board that they were also disappointed with the results.

Board Member Foster asked if emergency contracts are chosen from a pre-determined list. Ms. Leslie clarified that because this was an emergency contract, the agency did not solicit through a competitive bid process due to the nature of the quick turnaround. Instead, staff identified a qualified contractor who was able to meet the date and time frame to complete the work. Board Member Foster asked if there was a pre-qualified list to identify the contractor. Ms. Leslie replied that there was not. Heather Furey, Director of Capital Projects added that the contractor, DRS, has an active Job Order Contract (JOC) with MTS. She explained nuances of JOCs and stated

that due to the familiarity of the system, the agency asked them to take on the emergency repair work. Board Member Foster clarified that it was the JOC that allows task orders to be applied to the contract. Ms. Furey replied that a JOC is the current active contract that MTS has with DRS. However, for the emergency procurement, the agency issued a standalone agreement. Board Member Foster asked if this award process was typical for the agency. Ms. Furey stated that emergency work in 2024 had been at a uniquely high rate but typically, the agency attempts not to use JOCs for emergency work because those contracts have a capacity limitation on them. The most recent emergency procurement involved pre-qualified firms for another project. Ms. Landers added that the agency has experienced several key takeaways during the high usage of emergency procurements this year. She explained that the January 22, 2024 flood caused extensive damage throughout the system. Based on the necessary need, the agency evaluated the expertise and availability to mobilize immediately. Ms. Landers listed the agency's priorities to balance facilitating expeditious work while assuring the contractor abides by legal requirements. Board Member Foster asked for an MTS procurement briefing on delivery methods. He asked what electronic certified payroll system is used to monitor the projects. Ms. Rich stated that the organization accommodates to the system that the contractor is currently using, otherwise, The Solis Group has an in-house system that is available for the contractor to use. Board Member Foster asked if the in-house system was configured to capture all the necessary requirements of the PLA. Ms. Rich confirmed that it was and that the system is thorough and customizable to requirements.

Board Member Bush emphasized the importance of local hire in the PLA.

Action Taken

No action taken. Informational item only.

PUBLIC HEARING

23. 'Yield to Bus' Public Hearing and Implementation (Brent Boyd)

Brent Boyd, MTS Director of Planning and Scheduling, presented on 'Yield to Bus' Public Hearing and Implementation. He outlined the following information: Assembly Bill 1904, California Vehicle Code 24617 and staff's recommendation.

Public Comment

There were no Public Comments.

Board Comment

Board Member Hall asked if there was an enforcement component. Mr. Boyd confirmed that the law would allow MTS to add the decal to the buses. No additional enforcement or legal penalty currently applies. Mr. Boyd noted anecdotal success stories from other agencies.

Action Taken

Board Member Hall moved to 1) Receive testimony, review, and comment on the implementation of California Vehicle Code (CVC) Section 24617 for MTS' bus fleet at a public hearing; and 2) Enact Resolution No. 24-18 to make CVC Section 24617 applicable to MTS and implement all the required actions of the code. Board Member McCann seconded the motion, and the vote was 14 to 0 in favor and Alternate Board Member Pepin absent.

OTHER ITEMS:

24. Chair, Board Member and Chief Executive Officer's (CEO's) Communications

Chair Whitburn prompted free rides on New Years free rides after 6pm both NCTD and MTS services.

Board Member Downey introduced Board Member Fleming as the Coronado alternate.

25. Remainder of Public Comments Not on The Agenda

There were no additional public comments.

CLOSED SESSION (ITEMS TAKEN OUT OF ORDER):

The Board convened to Closed Session at 10:19 a.m.

26. Public Comment

Nate Fairman - Representing the IBW Local 465 representing San Diego Utility Workers, provided a verbal statement to the Board during the meeting. Fairman advocated for the reinstatement of pension benefits for his constituents.

27. Closed Session - Conference with Labor Negotiators Pursuant to California Government Code Section 54957.6
Agencies: San Diego Transit Corporation ("SDTC"), San Diego Trolley, Inc. ("SDTI")
Employee Organization: Amalgamated Transit Union, Local 1309 ("ATU")
Employee Organization: International Brotherhood of Electrical Workers, Local 465 ("IBEW")
Employee Organization: International Association of Sheet Metal, Air, Rail, And Transportation Workers ("SMART")
Agency- Designated Representative: Jeffrey M. Stumbo, Chief Human Resources Officer (EEO Officer)

28. Closed Session - Conference with Labor Negotiators Pursuant to California Government Code Section 54957.6
Agencies: San Diego Trolley, Inc. ("SDTI")
Employee Organization: Transit Enforcement Officers Association ("TEOA")
Agency- Designated Representative: Jeffrey M. Stumbo, Chief Human Resources Officer (EEO Officer)

Closed Session Reconvening

The Board reconvened to Open Session at 10:41 a.m.

Ms. Landers, reported the following oral report of final actions taken in Closed Session:

27. The Board ratified the tentative agreements with each organization with 12 members in favor (Bush, Dillard, Elo-Rivera, Mendoza, Foster, Goble, Fernandez, Hall, McCann, Montgomery Steppe, Moreno and Whitburn) and 3 members absent (Downey, Leyva-Gonzalez, and Pepin)*

**note that the City of Poway board member position was incorrectly identified as "vacant" during the General Counsel's report out of the closed session vote. It was later confirmed that alternate Board Member Pepin was still officially a member of the MTS*

Board as of the December 19, 2024 meeting. The status was corrected to "absent" on the roll call vote sheet.

28. The Board received a report and gave negotiating instructions to staff.

ADJOURNMENT

29. Next Meeting Date

The next regularly scheduled Board meeting is January 16, 2025 at 9 a.m.

30. Adjournment

The meeting was adjourned at 10:41 a.m.

Chairperson
San Diego Metropolitan Transit System

Filed by:

Clerk of the Board
San Diego Metropolitan Transit System

Approved as to form:

General Counsel
San Diego Metropolitan Transit System

Attachment: A. Roll Call Sheet

SAN DIEGO METROPOLITAN TRANSIT SYSTEM
BOARD OF DIRECTORS
ROLL CALL

MEETING OF (DATE):	December 19, 2024	CALL TO ORDER (TIME):	9:03 a.m.
RECESS:		RECONVENE:	
CLOSED SESSION:	10:19 a.m.	RECONVENE:	10:41 a.m.
PUBLIC HEARING:	10:09 a.m.	RECONVENE:	10:14 a.m.
ORDINANCES ADOPTED:		ADJOURN:	10:41 a.m.

JURISDICTION	BOARD MEMBER		ALTERNATE		PRESENT (TIME ARRIVED)	ABSENT (TIME LEFT)
City of Chula Vista	Fernandez	☒	Preciado	☐	9:03 a.m.	10:41 a.m.
City of Chula Vista	McCann	☒	Preciado	☐	9:03 a.m.	10:41 a.m.
City of Coronado	Downey	☒	Fleming	☐	9:03 a.m.	10:14 a.m.
County of San Diego	Montgomery Steppe	☒	Vargas	☐	9:03 a.m.	10:41 a.m.
City of El Cajon	Goble (Vice-Chair)	☒	Ortiz	☐	9:03 a.m.	10:41 a.m.
City of Imperial Beach	Leyba-Gonzalez	☒	Aguirre	☐	9:03 a.m.	10:14 a.m.
City of La Mesa	Dillard	☒	Arapostathis	☐	9:13 a.m.	10:41 a.m.
City of Lemon Grove	VACANT	☐	Mendoza	☒	9:03 a.m.	10:41 a.m.
City of National City	Bush	☒	Rodriguez	☐	9:03 a.m.	10:41 a.m.
City of Poway	VACANT	☐	VACANT	☐	VACANT	VACANT
City of San Diego	Moreno	☒	Campbell	☐	9:03 a.m.	10:41 a.m.
City of San Diego	Elo-Rivera	☒	LaCava	☐	9:12 a.m.	10:41 a.m.
City of San Diego	Gloria	☐	Foster	☒	9:03 a.m.	10:41 a.m.
City of San Diego	Whitburn (Chair)	☒	Lee	☐	9:03 a.m.	10:41 a.m.
City of Santee	Hall	☒	Koval Minto	☐ ☐	9:03 a.m.	10:41 a.m.

SIGNED BY THE CLERK OF THE BOARD: /S/ Dalia Gonzalez

Metropolitan Transit System

Agenda Item No. 4

MEETING OF THE SAN DIEGO METROPOLITAN TRANSIT SYSTEM
BOARD OF DIRECTORS

January 16, 2025

SUBJECT:

Chief Executive Officer's (CEO) Report

INFORMATIONAL

In accordance with Board Policy No. 52, "Procurement of Goods and Services", attached are listings of contracts, purchase orders, and work orders that have been approved within the CEO's authority (up to and including $150,000) for the period December 12, 2024 – January 8, 2025.

Also attached is a report of a non-competitive contract award under "immediate remedial measures" exception.

CEO TRAVEL REPORT (since last Board meeting)

N/A

BOARD MEMBER TRAVEL REPORT (since last Board meeting)

N/A

Purchase Orders							
PO Number	PO Date	Name	Prime Business Certification	Material Group	PO Value	DBE Subcontracted Amount	Non DBE Subcontracted Amount
4400003177	12/13/2024	W.W. Grainger Inc		G140-SHOP SUPPLIES	$722.88	$ -	$ -
4400003178	12/13/2024	W.W. Grainger Inc		G130-SHOP TOOLS	$2,884.12	$ -	$ -
4400003179	12/16/2024	ODP Business Solutions, LLC		G200-OFFICE SUPPLIES	$212.48	$ -	$ -
4400003180	12/16/2024	ODP Business Solutions, LLC		G200-OFFICE SUPPLIES	$669.40	$ -	$ -
4400003181	12/17/2024	W.W. Grainger Inc		G200-OFFICE SUPPLIES	$429.04	$ -	$ -
4400003182	12/17/2024	ODP Business Solutions, LLC		G200-OFFICE SUPPLIES	$176.92	$ -	$ -
4400003183	12/17/2024	ODP Business Solutions, LLC		G200-OFFICE SUPPLIES	$84.30	$ -	$ -
4400003184	12/18/2024	W.W. Grainger Inc		G130-SHOP TOOLS	$1,869.20	$ -	$ -
4400003185	12/19/2024	W.W. Grainger Inc		G150-FASTENERS	$234.94	$ -	$ -
4400003186	12/19/2024	W.W. Grainger Inc		G140-SHOP SUPPLIES	$191.52	$ -	$ -
4400003187	12/20/2024	W.W. Grainger Inc		G130-SHOP TOOLS	$138.85	$ -	$ -
4400003188	12/20/2024	ODP Business Solutions, LLC		G200-OFFICE SUPPLIES	$169.39	$ -	$ -
4400003189	12/20/2024	ODP Business Solutions, LLC		G200-OFFICE SUPPLIES	$1,509.37	$ -	$ -
4400003190	12/26/2024	ODP Business Solutions, LLC		G200-OFFICE SUPPLIES	$384.32	$ -	$ -
4400003191	12/26/2024	Mcmaster-Carr Supply Co		G150-FASTENERS	$112.96	$ -	$ -
4400003192	12/30/2024	ODP Business Solutions, LLC		G200-OFFICE SUPPLIES	$322.57	$ -	$ -
4400003193	12/30/2024	Mcmaster-Carr Supply Co		F230-METALS/FERROUS	$159.13	$ -	$ -
4400003194	1/2/2025	ODP Business Solutions, LLC		G200-OFFICE SUPPLIES	$177.75	$ -	$ -
4400003195	1/2/2025	ODP Business Solutions, LLC		G200-OFFICE SUPPLIES	$165.92	$ -	$ -
4400003196	1/2/2025	W.W. Grainger Inc		G130-SHOP TOOLS	$185.99	$ -	$ -
4400003197	1/3/2025	W.W. Grainger Inc		G200-OFFICE SUPPLIES	$14.83	$ -	$ -
4400003198	1/3/2025	ODP Business Solutions, LLC		G200-OFFICE SUPPLIES	$192.75	$ -	$ -
4400003199	1/3/2025	ODP Business Solutions, LLC		G200-OFFICE SUPPLIES	$513.36	$ -	$ -
4400003200	1/6/2025	ODP Business Solutions, LLC		G200-OFFICE SUPPLIES	$1,912.41	$ -	$ -
4400003201	1/6/2025	W.W. Grainger Inc		F140-SHELVING AND RACK	$536.45	$ -	$ -
4400003202	1/7/2025	W.W. Grainger Inc		M110-SUB STATION	$1,189.88	$ -	$ -
4400003203	1/7/2025	W.W. Grainger Inc		G130-SHOP TOOLS	$439.73	$ -	$ -
4400003204	1/7/2025	ODP Business Solutions, LLC		G200-OFFICE SUPPLIES	$668.85	$ -	$ -
4400003205	1/7/2025	ODP Business Solutions, LLC		G200-OFFICE SUPPLIES	$509.42	$ -	$ -
4500065203	12/12/2024	Transit Holdings Inc		B200-BUS PWR TRAIN EQUIP	$67.89	$ -	$ -
4500065204	12/12/2024	Cummins Inc		B200-BUS PWR TRAIN EQUIP	$211.94	$ -	$ -
4500065205	12/12/2024	Cummins Inc		B120-BUS MECHANICAL PARTS	$317.89	$ -	$ -
4500065206	12/12/2024	Mohawk Mfg & Supply Co		B140-BUS CHASSIS	$19.18	$ -	$ -
4500065207	12/12/2024	Waxie's Enterprises, LLC		G180-JANITORIAL SUPPLIES	$2,152.58	$ -	$ -
4500065208	12/12/2024	Transit Holdings Inc		B200-BUS PWR TRAIN EQUIP	$176.17	$ -	$ -
4500065209	12/12/2024	Transit Holdings Inc		B200-BUS PWR TRAIN EQUIP	$1,634.17	$ -	$ -
4500065210	12/12/2024	Siemens Mobility, Inc.		R160-RAIL/LRV ELECTRICAL	$2,384.87	$ -	$ -
4500065211	12/12/2024	D's Kustom Sales & Services, LLC		T110-TRACK, RAIL	$1,242.90	$ -	$ -
4500065212	12/12/2024	VCA Animal Hospitals, Inc.		G120-SECURITY	$218.10	$ -	$ -
4500065213	12/12/2024	Dimensional Silk Screen Inc		G230-PRINTED MATERIALS	$4,133.29	$ -	$ -
4500065214	12/12/2024	San Diego Bowl Game Association		P310-ADVERTISING SERVICES	$3,500.00	$ -	$ -
4500065215	12/12/2024	San Diego Friction Products, Inc.		B120-BUS MECHANICAL PARTS	$4,176.60	$ -	$ -
4500065216	12/13/2024	Waxie's Enterprises, LLC		G180-JANITORIAL SUPPLIES	$288.08	$ -	$ -
4500065217	12/13/2024	Waxie's Enterprises, LLC		G180-JANITORIAL SUPPLIES	$775.80	$ -	$ -
4500065218	12/13/2024	Waxie's Enterprises, LLC		G180-JANITORIAL SUPPLIES	$240.29	$ -	$ -
4500065219	12/13/2024	Cummins Inc		B200-BUS PWR TRAIN EQUIP	$1,127.97	$ -	$ -
4500065220	12/13/2024	Mohawk Mfg & Supply Co		B140-BUS CHASSIS	$49.60	$ -	$ -
4500065221	12/13/2024	Waxie's Enterprises, LLC		G180-JANITORIAL SUPPLIES	$171.21	$ -	$ -
4500065222	12/13/2024	Transit Holdings Inc		B140-BUS CHASSIS	$2,658.59	$ -	$ -
4500065223	12/13/2024	Cummins Inc		B200-BUS PWR TRAIN EQUIP	$2,100.43	$ -	$ -

Purchase Orders							
PO Number	PO Date	Name	Prime Business Certification	Material Group	PO Value	DBE Subcontracted Amount	Non DBE Subcontracted Amount
4500065224	12/13/2024	Transit Holdings Inc		B200-BUS PWR TRAIN EQUIP	$260.49	$ -	$ -
4500065225	12/13/2024	AVPM CA 7 LP		G120-SECURITY	$137.04	$ -	$ -
4500065226	12/13/2024	ColorID LLC	Small Business	G200-OFFICE SUPPLIES	$223.92	$ -	$ -
4500065227	12/13/2024	Clarran Inc.	DBE	B250-BUS REPAIR PARTS	$139.00	$ -	$ -
4500065228	12/13/2024	Clarran Inc.	DBE	G150-FASTENERS	$58.19	$ -	$ -
4500065229	12/13/2024	Sacramento Computer Power, Inc.	Small Business	I130-IT CAPITAL HARDWARE	$4,987.00	$ -	$ -
4500065230	12/13/2024	ATI Restoration LLC		P120-BLDG/FACILITY REPRS	$415,631.11	$ -	$ -
4500065231	12/16/2024	Transit Holdings Inc		B140-BUS CHASSIS	$2,888.69	$ -	$ -
4500065232	12/16/2024	Transit Holdings Inc		B160-BUS ELECTRICAL	$869.02	$ -	$ -
4500065233	12/16/2024	Cummins Inc		B200-BUS PWR TRAIN EQUIP	$3,014.42	$ -	$ -
4500065234	12/16/2024	Cummins Inc		B200-BUS PWR TRAIN EQUIP	$7,972.27	$ -	$ -
4500065235	12/16/2024	Transit Holdings Inc		B200-BUS PWR TRAIN EQUIP	$15.13	$ -	$ -
4500065236	12/16/2024	Transit Holdings Inc		B140-BUS CHASSIS	$7,186.20	$ -	$ -
4500065237	12/16/2024	Mody Entrepreneurs Inc.	DBE	G230-PRINTED MATERIALS	$26,256.89	$ -	$ -
4500065238	12/16/2024	Cummins Inc		B200-BUS PWR TRAIN EQUIP	$9,334.86	$ -	$ -
4500065239	12/16/2024	Muncie Reclamation and Supply Co		B200-BUS PWR TRAIN EQUIP	$79.99	$ -	$ -
4500065240	12/16/2024	Transit Holdings Inc		B200-BUS PWR TRAIN EQUIP	$43.42	$ -	$ -
4500065241	12/16/2024	Ralphs Grocery Company		P440-CATERING SERVICES	$1,154.65	$ -	$ -
4500065242	12/16/2024	Transit Holdings Inc		B250-BUS REPAIR PARTS	$2,103.00	$ -	$ -
4500065243	12/16/2024	RA Automotive Software Solutions In		B250-BUS REPAIR PARTS	$1,200.00	$ -	$ -
4500065244	12/16/2024	OrgVision Solutions Inc		P480-EE MAINTENANCE	$32,462.00	$ -	$ -
4500065245	12/16/2024	Nth Generation Computing Inc		I110-INFORMATION TECH	$130,277.61	$ -	$ -
4500065246	12/16/2024	Supreme Oil Co.		A120-AUTO/TRUCK GASOLINE	$10,939.79	$ -	$ -
4500065247	12/16/2024	Waxie's Enterprises, LLC		G140-SHOP SUPPLIES	$527.44	$ -	$ -
4500065248	12/16/2024	Gillig LLC		B250-BUS REPAIR PARTS	$411.55	$ -	$ -
4500065249	12/16/2024	W.W. Grainger Inc		G140-SHOP SUPPLIES	$64.11	$ -	$ -
4500065250	12/16/2024	Prochem Specialty Products Inc	Small Business	G180-JANITORIAL SUPPLIES	$1,718.62	$ -	$ -
4500065251	12/16/2024	SC Commercial, LLC		A120-AUTO/TRUCK GASOLINE	$2,737.26	$ -	$ -
4500065252	12/17/2024	Transit Holdings Inc		B200-BUS PWR TRAIN EQUIP	$69.56	$ -	$ -
4500065253	12/17/2024	Transit Holdings Inc		B130-BUS BODY	$1,520.08	$ -	$ -
4500065254	12/17/2024	Cummins Inc		B200-BUS PWR TRAIN EQUIP	$303.86	$ -	$ -
4500065255	12/17/2024	S&A Systems Inc		B250-BUS REPAIR PARTS	$871.62	$ -	$ -
4500065256	12/17/2024	Siemens Mobility, Inc.		R120-RAIL/LRV CAR BODY	$1,064.57	$ -	$ -
4500065257	12/17/2024	MCI Carrillo Inc	Small Business	P210-NON-REV VEH REPAIRS	$109.00	$ -	$ -
4500065258	12/17/2024	Don Oleson Inc	Small Business	B120-BUS MECHANICAL PARTS	$3,216.82	$ -	$ -
4500065259	12/17/2024	Transit Holdings Inc		B120-BUS MECHANICAL PARTS	$8,507.76	$ -	$ -
4500065260	12/17/2024	Altec Inc		P210-NON-REV VEH REPAIRS	$2,716.03	$ -	$ -
4500065261	12/17/2024	San Diego Friction Products, Inc.		G140-SHOP SUPPLIES	$783.40	$ -	$ -
4500065262	12/17/2024	W.W. Grainger Inc		F110-SHOP/BLDG MACHINERY	$793.47	$ -	$ -
4500065263	12/17/2024	Reg-A-Car Inc		B250-BUS REPAIR PARTS	$657.00	$ -	$ -
4500065264	12/17/2024	AirSupply Tools, Inc		G150-FASTENERS	$175.86	$ -	$ -
4500065265	12/17/2024	Uline Inc		G200-OFFICE SUPPLIES	$380.80	$ -	$ -
4500065266	12/17/2024	Clarran Inc.	DBE	G150-FASTENERS	$69.24	$ -	$ -
4500065267	12/17/2024	RJ International LLC	DBE	G190-SAFETY/MED SUPPLIES	$247.29	$ -	$ -
4500065269	12/17/2024	Facility Solutions Group, Inc.		M140-WAYSIDE SIGNALS	$323.25	$ -	$ -
4500065270	12/17/2024	Fastenal Company		G150-FASTENERS	$66.81	$ -	$ -
4500065271	12/17/2024	Siemens Mobility, Inc.		R160-RAIL/LRV ELECTRICAL	$220.89	$ -	$ -
4500065272	12/17/2024	B and H Photo and Electronics		R160-RAIL/LRV ELECTRICAL	$2,606.20	$ -	$ -
4500065273	12/17/2024	Winzer Franchise Company		G150-FASTENERS	$420.23	$ -	$ -
4500065274	12/17/2024	Robcar Corporation	Woman Owned Business	G190-SAFETY/MED SUPPLIES	$646.50	$ -	$ -

Purchase Orders							
PO Number	PO Date	Name	Prime Business Certification	Material Group	PO Value	DBE Subcontracted Amount	Non DBE Subcontracted Amount
4500065275	12/17/2024	Professional Contractors Supplies		G140-SHOP SUPPLIES	$2,261.95	$ -	$ -
4500065276	12/17/2024	San Diego Friction Products, Inc.		B120-BUS MECHANICAL PARTS	$4,176.60	$ -	$ -
4500065277	12/17/2024	Kurt Morgan		G200-OFFICE SUPPLIES	$296.10	$ -	$ -
4500065278	12/17/2024	Cummins Inc		B250-BUS REPAIR PARTS	$2,113.70	$ -	$ -
4500065279	12/18/2024	Transit Holdings Inc		B120-BUS MECHANICAL PARTS	$174.43	$ -	$ -
4500065280	12/18/2024	Cummins Inc		B200-BUS PWR TRAIN EQUIP	$403.90	$ -	$ -
4500065281	12/18/2024	Transit Holdings Inc		B200-BUS PWR TRAIN EQUIP	$225.50	$ -	$ -
4500065282	12/18/2024	Transit Holdings Inc		B160-BUS ELECTRICAL	$1,237.90	$ -	$ -
4500065283	12/18/2024	Thompson Fetter		P280-GENERAL SVC AGRMNTS	$15,220.68	$ -	$ -
4500065284	12/18/2024	American Power Systems, LLC		B150-BUS COMM EQUIP.	$4,236.74	$ -	$ -
4500065285	12/18/2024	Cummins Inc		B200-BUS PWR TRAIN EQUIP	$487.46	$ -	$ -
4500065286	12/18/2024	Transit Holdings Inc		B120-BUS MECHANICAL PARTS	$2,309.65	$ -	$ -
4500065287	12/18/2024	CDW LLC		G200-OFFICE SUPPLIES	$6.38	$ -	$ -
4500065288	12/18/2024	CDW LLC		G200-OFFICE SUPPLIES	$12.70	$ -	$ -
4500065289	12/18/2024	San Diego Community		P490-MANAGEMENT TRAINING	$138.00	$ -	$ -
4500065290	12/18/2024	Waxie's Enterprises, LLC		G180-JANITORIAL SUPPLIES	$271.53	$ -	$ -
4500065291	12/18/2024	Gillig LLC		B250-BUS REPAIR PARTS	$817.77	$ -	$ -
4500065292	12/18/2024	W.W. Grainger Inc		B130-BUS BODY	$63.62	$ -	$ -
4500065293	12/18/2024	Adios Pest Control, Inc.		P280-GENERAL SVC AGRMNTS	$150.00	$ -	$ -
4500065294	12/18/2024	Muncie Reclamation and Supply Co		B120-BUS MECHANICAL PARTS	$559.24	$ -	$ -
4500065296	12/18/2024	Transit Innovations LLC		M120-OVRHEAD CATENARY SYS	$3,663.50	$ -	$ -
4500065297	12/18/2024	Transit Holdings Inc		B200-BUS PWR TRAIN EQUIP	$2,740.49	$ -	$ -
4500065298	12/18/2024	Cummins Inc		B200-BUS PWR TRAIN EQUIP	$49.48	$ -	$ -
4500065299	12/18/2024	Mohawk Mfg & Supply Co		B140-BUS CHASSIS	$785.85	$ -	$ -
4500065300	12/18/2024	Neopart Transit LLC		B130-BUS BODY	$1,136.57	$ -	$ -
4500065301	12/18/2024	Muncie Reclamation and Supply Co		B110-BUS HVAC SYSTEMS	$11,070.65	$ -	$ -
4500065302	12/18/2024	Transit Holdings Inc		B140-BUS CHASSIS	$8,569.04	$ -	$ -
4500065303	12/18/2024	Siemens Mobility, Inc.		P190-REV VEHICLE REPAIRS	$34,161.00	$ -	$ -
4500065304	12/19/2024	Mohawk Mfg & Supply Co		B140-BUS CHASSIS	$34.30	$ -	$ -
4500065305	12/19/2024	Transit Holdings Inc		B200-BUS PWR TRAIN EQUIP	$15.84	$ -	$ -
4500065306	12/19/2024	Transit Holdings Inc		B200-BUS PWR TRAIN EQUIP	$70.62	$ -	$ -
4500065307	12/19/2024	Transit Holdings Inc		B140-BUS CHASSIS	$2,146.39	$ -	$ -
4500065308	12/19/2024	Siemens Mobility, Inc.		R160-RAIL/LRV ELECTRICAL	$262.55	$ -	$ -
4500065309	12/19/2024	Home Depot USA Inc		G140-SHOP SUPPLIES	$116.80	$ -	$ -
4500065310	12/19/2024	Cummins Inc		B120-BUS MECHANICAL PARTS	$136.58	$ -	$ -
4500065311	12/19/2024	Transit Holdings Inc		B120-BUS MECHANICAL PARTS	$36.90	$ -	$ -
4500065312	12/19/2024	Transit Holdings Inc		B130-BUS BODY	$2,732.78	$ -	$ -
4500065313	12/19/2024	Ace Uniforms LLC	Small Business	G120-SECURITY	$76.47	$ -	$ -
4500065314	12/19/2024	TVEyes, Inc.		G260-MEDIA	$2,760.00	$ -	$ -
4500065315	12/19/2024	Steven R Timme		G230-PRINTED MATERIALS	$2,271.98	$ -	$ -
4500065317	12/19/2024	Transit Holdings Inc		B140-BUS CHASSIS	$923.21	$ -	$ -
4500065318	12/19/2024	Hulcher Services Inc.		INSURANCE-Insurance Stock	$33,780.00	$ -	$ -
4500065319	12/19/2024	TK Services Inc		B250-BUS REPAIR PARTS	$23,874.98	$ -	$ -
4500065320	12/19/2024	Transit Holdings Inc		B140-BUS CHASSIS	$461.60	$ -	$ -
4500065321	12/19/2024	VGP Holdings LLC		B120-BUS MECHANICAL PARTS	$7,977.81	$ -	$ -
4500065322	12/20/2024	Transit Holdings Inc		B140-BUS CHASSIS	$2,521.55	$ -	$ -
4500065323	12/20/2024	Waxie's Enterprises, LLC		G180-JANITORIAL SUPPLIES	$292.54	$ -	$ -
4500065324	12/20/2024	Transit Holdings Inc		B120-BUS MECHANICAL PARTS	$753.50	$ -	$ -
4500065325	12/20/2024	Transit Holdings Inc		B160-BUS ELECTRICAL	$1,760.27	$ -	$ -
4500065326	12/20/2024	Interboro Packaging Corporation		G180-JANITORIAL SUPPLIES	$127.79	$ -	$ -

Purchase Orders							
PO Number	PO Date	Name	Prime Business Certification	Material Group	PO Value	DBE Subcontracted Amount	Non DBE Subcontracted Amount
4500065327	12/20/2024	White Cap, LP		G130-SHOP TOOLS	$1,172.32	$ -	$ -
4500065329	12/20/2024	United Fastener Inc		G150-FASTENERS	$32.33	$ -	$ -
4500065330	12/20/2024	M Power Truck & Diesel		A140-AUTO/TRUCK REPAIR	$125.00	$ -	$ -
4500065331	12/20/2024	Robcar Corporation	Woman Owned Business	G110-BUS/TROLLEY SIGNAGE	$570.01	$ -	$ -
4500065332	12/20/2024	Railroad Tools & Solutions LLC		G130-SHOP TOOLS	$3,546.61	$ -	$ -
4500065333	12/20/2024	Home Depot USA Inc		G140-SHOP SUPPLIES	$409.12	$ -	$ -
4500065334	12/20/2024	Daniels Tire Service, Inc		A110-AUTO/TRUCK TIRES	$684.78	$ -	$ -
4500065335	12/20/2024	Resa Power LLC		M110-SUB STATION	$2,108.32	$ -	$ -
4500065336	12/20/2024	Shilpark Paint Corporation		F180-BUILDING MATERIALS	$151.70	$ -	$ -
4500065337	12/20/2024	Staples Contract & Commercial LLC		G200-OFFICE SUPPLIES	$668.59	$ -	$ -
4500065338	12/20/2024	Norman Industrial Materials Inc.		G140-SHOP SUPPLIES	$75.15	$ -	$ -
4500065339	12/20/2024	Cummins Inc		B250-BUS REPAIR PARTS	$144.45	$ -	$ -
4500065340	12/20/2024	Init Innovations in Transportation		G290-FARE REVENUE EQUIP	$10,221.19	$ -	$ -
4500065341	12/20/2024	Gillig LLC		B250-BUS REPAIR PARTS	$584.93	$ -	$ -
4500065342	12/20/2024	APTA		G260-MEDIA	$125.00	$ -	$ -
4500065343	12/20/2024	Init Innovations in Transportation		G290-FARE REVENUE EQUIP	$625.00	$ -	$ -
4500065344	12/20/2024	W.W. Grainger Inc		F110-SHOP/BLDG MACHINERY	$254.62	$ -	$ -
4500065345	12/20/2024	Mcmaster-Carr Supply Co		G150-FASTENERS	$154.52	$ -	$ -
4500065346	12/20/2024	W.W. Grainger Inc		F180-BUILDING MATERIALS	$935.40	$ -	$ -
4500065347	12/20/2024	Mid-Eastern Partners		G230-PRINTED MATERIALS	$1,229.87	$ -	$ -
4500065348	12/23/2024	Cummins Inc		B200-BUS PWR TRAIN EQUIP	$2,148.80	$ -	$ -
4500065349	12/23/2024	Mohawk Mfg & Supply Co		B140-BUS CHASSIS	$34.30	$ -	$ -
4500065350	12/23/2024	Clarran Inc.	DBE	G150-FASTENERS	$984.65	$ -	$ -
4500065351	12/23/2024	RJ International LLC	DBE	G190-SAFETY/MED SUPPLIES	$945.71	$ -	$ -
4500065352	12/23/2024	Gillig LLC		B140-BUS CHASSIS	$2,724.64	$ -	$ -
4500065353	12/23/2024	Gillig LLC		B120-BUS MECHANICAL PARTS	$3,923.35	$ -	$ -
4500065354	12/23/2024	Wesco Distribution Inc		F110-SHOP/BLDG MACHINERY	$577.54	$ -	$ -
4500065355	12/23/2024	Signal Hill Auto Enterprises, Inc.		G180-JANITORIAL SUPPLIES	$4,092.35	$ -	$ -
4500065356	12/23/2024	Transit Holdings Inc		B140-BUS CHASSIS	$3,888.96	$ -	$ -
4500065357	12/23/2024	Transit Holdings Inc		B130-BUS BODY	$4,011.02	$ -	$ -
4500065358	12/23/2024	Cummins Inc		B200-BUS PWR TRAIN EQUIP	$6,398.07	$ -	$ -
4500065360	12/23/2024	Transit Holdings Inc		B160-BUS ELECTRICAL	$128.59	$ -	$ -
4500065361	12/23/2024	Mcmaster-Carr Supply Co		P190-REV VEHICLE REPAIRS	$132.60	$ -	$ -
4500065362	12/23/2024	Staples Contract & Commercial LLC		G200-OFFICE SUPPLIES	$176.83	$ -	$ -
4500065363	12/23/2024	R.S. Hughes Co Inc		G160-PAINTS & CHEMICALS	$2,564.56	$ -	$ -
4500065364	12/23/2024	CDW LLC		B150-BUS COMM EQUIP.	$1,348.17	$ -	$ -
4500065365	12/23/2024	Fastenal Company		G140-SHOP SUPPLIES	$693.86	$ -	$ -
4500065366	12/23/2024	Waxie's Enterprises, LLC		G140-SHOP SUPPLIES	$208.97	$ -	$ -
4500065367	12/23/2024	Mohawk Mfg & Supply Co		B110-BUS HVAC SYSTEMS	$1,589.59	$ -	$ -
4500065368	12/23/2024	Home Depot USA Inc		G140-SHOP SUPPLIES	$1,096.80	$ -	$ -
4500065369	12/23/2024	Motion Industries, Inc.		G140-SHOP SUPPLIES	$501.59	$ -	$ -
4500065370	12/23/2024	Muncie Reclamation and Supply Co		B110-BUS HVAC SYSTEMS	$939.41	$ -	$ -
4500065371	12/23/2024	Cummins Inc		B250-BUS REPAIR PARTS	$3,473.90	$ -	$ -
4500065372	12/23/2024	Siemens Mobility, Inc.		R160-RAIL/LRV ELECTRICAL	$4,969.10	$ -	$ -
4500065373	12/23/2024	Gillig LLC		B250-BUS REPAIR PARTS	$5,572.45	$ -	$ -
4500065374	12/23/2024	Midwest Bus Corporation		B130-BUS BODY	$791.98	$ -	$ -
4500065375	12/23/2024	Cummins Inc		B250-BUS REPAIR PARTS	$28,439.24	$ -	$ -
4500065376	12/23/2024	Clarran Inc.	DBE	G150-FASTENERS	$246.00	$ -	$ -
4500065377	12/23/2024	Gillig LLC		B250-BUS REPAIR PARTS	$3,702.01	$ -	$ -
4500065378	12/23/2024	Home Depot USA Inc		F110-SHOP/BLDG MACHINERY	$43.01	$ -	$ -

Purchase Orders							
PO Number	PO Date	Name	Prime Business Certification	Material Group	PO Value	DBE Subcontracted Amount	Non DBE Subcontracted Amount
4500065379	12/23/2024	Siemens Mobility, Inc.		I120-INFO TECH, SVCS	$14,988.00	$ -	$ -
4500065380	12/23/2024	CDW LLC		I110-INFORMATION TECH	$4,449.11	$ -	$ -
4500065381	12/23/2024	Magaldi & Magaldi Inc		B250-BUS REPAIR PARTS	$235.22	$ -	$ -
4500065382	12/23/2024	Cummins Inc		B200-BUS PWR TRAIN EQUIP	$10,197.16	$ -	$ -
4500065383	12/23/2024	Bordova Innovations Inc		G250-NOVELTIES & AWARDS	$2,188.79	$ -	$ -
4500065384	12/23/2024	Cummins Inc		B250-BUS REPAIR PARTS	$575.06	$ -	$ -
4500065385	12/23/2024	B and H Photo and Electronics		G220-OFFICE EQUIPMENT	$560.58	$ -	$ -
4500065386	12/23/2024	Brand Makers LLC		G230-PRINTED MATERIALS	$901.90	$ -	$ -
4500065387	12/23/2024	Init Innovations in Transportation		G290-FARE REVENUE EQUIP	$4,245.35	$ -	$ -
4500065388	12/23/2024	W.W. Grainger Inc		B250-BUS REPAIR PARTS	$256.25	$ -	$ -
4500065389	12/23/2024	Muncie Reclamation and Supply Co		B130-BUS BODY	$3,145.88	$ -	$ -
4500065390	12/23/2024	AirSupply Tools, Inc		G140-SHOP SUPPLIES	$524.32	$ -	$ -
4500065391	12/23/2024	Freeby Signs		B130-BUS BODY	$79.76	$ -	$ -
4500065392	12/23/2024	Mouser Electronics Inc		B250-BUS REPAIR PARTS	$36.66	$ -	$ -
4500065393	12/23/2024	The Sherwin-Williams Company		F120-BUS/LRV PAINT BOOTHS	$1,186.33	$ -	$ -
4500065394	12/23/2024	Supreme Oil Co.		A120-AUTO/TRUCK GASOLINE	$11,684.24	$ -	$ -
4500065395	12/23/2024	Charter Industrial Supply Inc	Small Business	G150-FASTENERS	$209.04	$ -	$ -
4500065396	12/23/2024	Kurt Morgan		G200-OFFICE SUPPLIES	$1,036.35	$ -	$ -
4500065397	12/23/2024	Cummins Inc		B120-BUS MECHANICAL PARTS	$7,112.93	$ -	$ -
4500065398	12/23/2024	Prochem Specialty Products Inc	Small Business	G180-JANITORIAL SUPPLIES	$859.31	$ -	$ -
4500065399	12/23/2024	Madden Construction Inc		P280-GENERAL SVC AGRMNTS	$982.25	$ -	$ -
4500065400	12/23/2024	SC Commercial, LLC		A120-AUTO/TRUCK GASOLINE	$2,817.41	$ -	$ -
4500065401	12/23/2024	Robcar Corporation	Woman Owned Business	P160-EQUIPMENT RENTALS	$479.00	$ -	$ -
4500065402	12/23/2024	Madden Construction Inc		P280-GENERAL SVC AGRMNTS	$992.90	$ -	$ -
4500065403	12/23/2024	Gillig LLC		B250-BUS REPAIR PARTS	$3,207.87	$ -	$ -
4500065404	12/23/2024	Vehicle Maintenance Program, Inc.	Woman Owned Business	B140-BUS CHASSIS	$5,037.32	$ -	$ -
4500065405	12/24/2024	Transit Holdings Inc		B150-BUS COMM EQUIP.	$3,291.64	$ -	$ -
4500065406	12/24/2024	Harbor Diesel & Equipment, Inc		B120-BUS MECHANICAL PARTS	$750.17	$ -	$ -
4500065407	12/24/2024	Motion Industries, Inc.		G140-SHOP SUPPLIES	$63.03	$ -	$ -
4500065408	12/24/2024	Cummins Inc		B200-BUS PWR TRAIN EQUIP	$1,719.05	$ -	$ -
4500065409	12/24/2024	Transit Holdings Inc		B200-BUS PWR TRAIN EQUIP	$32.54	$ -	$ -
4500065410	12/24/2024	Fastenal Company		G140-SHOP SUPPLIES	$2,259.66	$ -	$ -
4500065411	12/24/2024	Gillig LLC		B250-BUS REPAIR PARTS	$162.92	$ -	$ -
4500065413	12/24/2024	Transit Holdings Inc		B200-BUS PWR TRAIN EQUIP	$3,450.53	$ -	$ -
4500065414	12/24/2024	Cummins Inc		B200-BUS PWR TRAIN EQUIP	$3,322.64	$ -	$ -
4500065415	12/24/2024	Transit Holdings Inc		B140-BUS CHASSIS	$1,007.75	$ -	$ -
4500065416	12/24/2024	OneSource Distributors, LLC		G140-SHOP SUPPLIES	$353.25	$ -	$ -
4500065417	12/24/2024	Magaldi & Magaldi Inc		B250-BUS REPAIR PARTS	$352.83	$ -	$ -
4500065418	12/24/2024	Madden Construction Inc		P280-GENERAL SVC AGRMNTS	$988.00	$ -	$ -
4500065419	12/24/2024	Prudential Overall Supply		G140-SHOP SUPPLIES	$530.13	$ -	$ -
4500065420	12/24/2024	Waxie's Enterprises, LLC		G180-JANITORIAL SUPPLIES	$42.56	$ -	$ -
4500065421	12/24/2024	San Diego Compressed Air Power LLC		F110-SHOP/BLDG MACHINERY	$4,577.76	$ -	$ -
4500065422	12/24/2024	Madden Construction Inc		P280-GENERAL SVC AGRMNTS	$994.25	$ -	$ -
4500065423	12/24/2024	Midwest Motor Supply Co. Inc		G180-JANITORIAL SUPPLIES	$1,034.40	$ -	$ -
4500065424	12/24/2024	Prudential Overall Supply		G140-SHOP SUPPLIES	$513.71	$ -	$ -
4500065425	12/24/2024	Cummins Inc		B200-BUS PWR TRAIN EQUIP	$3,065.04	$ -	$ -
4500065426	12/24/2024	Siemens Mobility, Inc.		R120-RAIL/LRV CAR BODY	$1,648.58	$ -	$ -
4500065427	12/24/2024	Mohawk Mfg & Supply Co		B250-BUS REPAIR PARTS	$615.41	$ -	$ -
4500065428	12/24/2024	Gillig LLC		B250-BUS REPAIR PARTS	$3,702.01	$ -	$ -
4500065429	12/24/2024	Waxie's Enterprises, LLC		G140-SHOP SUPPLIES	$958.98	$ -	$ -

Purchase Orders							
PO Number	PO Date	Name	Prime Business Certification	Material Group	PO Value	DBE Subcontracted Amount	Non DBE Subcontracted Amount
4500065431	12/24/2024	Vern Rose Inc		G140-SHOP SUPPLIES	$182.01	$ -	$ -
4500065432	12/24/2024	W.W. Grainger Inc		G140-SHOP SUPPLIES	$625.58	$ -	$ -
4500065434	12/26/2024	Cummins Inc		B200-BUS PWR TRAIN EQUIP	$1,801.42	$ -	$ -
4500065435	12/26/2024	Transit Holdings Inc		B200-BUS PWR TRAIN EQUIP	$616.02	$ -	$ -
4500065436	12/26/2024	Cummins Inc		B200-BUS PWR TRAIN EQUIP	$5,404.52	$ -	$ -
4500065437	12/26/2024	Transit Holdings Inc		B140-BUS CHASSIS	$3,663.90	$ -	$ -
4500065438	12/26/2024	RJ International LLC	DBE	G140-SHOP SUPPLIES	$1,444.93	$ -	$ -
4500065439	12/26/2024	vCloud Tech Inc.	DBE	I110-INFORMATION TECH	$116,079.88	$ -	$ -
4500065440	12/26/2024	Transit Innovations LLC		M120-OVRHEAD CATENARY SYS	$484.88	$ -	$ -
4500065441	12/26/2024	Siemens Mobility, Inc.		R160-RAIL/LRV ELECTRICAL	$554.92	$ -	$ -
4500065442	12/26/2024	Virginia Electronic & Lighting LLC		M140-WAYSIDE SIGNALS	$2,020.32	$ -	$ -
4500065443	12/26/2024	Annex Warehouse Company, Inc		R240-RAIL/LRV REPR PARTS	$1,351.44	$ -	$ -
4500065444	12/26/2024	Annex Warehouse Company, Inc		F120-BUS/LRV PAINT BOOTHS	$1,084.05	$ -	$ -
4500065445	12/26/2024	Siemens Mobility, Inc.		R230-RAIL/LRV MECHANICAL	$2,909.25	$ -	$ -
4500065446	12/26/2024	Penn Machine Company LLC		G170-LUBRICANTS	$1,077.50	$ -	$ -
4500065447	12/26/2024	Willy's Electronic Supply Co Inc		G140-SHOP SUPPLIES	$95.90	$ -	$ -
4500065448	12/26/2024	National Sign and Signal Co.		M140-WAYSIDE SIGNALS	$10,052.86	$ -	$ -
4500065449	12/26/2024	IDSC Holdings LLC		B250-BUS REPAIR PARTS	$276.81	$ -	$ -
4500065450	12/26/2024	Professional Contractors Supplies		G160-PAINTS & CHEMICALS	$293.08	$ -	$ -
4500065451	12/26/2024	Annex Warehouse Company, Inc		F120-BUS/LRV PAINT BOOTHS	$4,458.91	$ -	$ -
4500065452	12/26/2024	Annex Warehouse Company, Inc		R240-RAIL/LRV REPR PARTS	$867.41	$ -	$ -
4500065453	12/26/2024	All The King's Flags		M200-YARD FACILITIES	$673.44	$ -	$ -
4500065454	12/26/2024	Airgas Inc		G190-SAFETY/MED SUPPLIES	$221.43	$ -	$ -
4500065455	12/26/2024	Winzer Franchise Company		G140-SHOP SUPPLIES	$1,392.94	$ -	$ -
4500065456	12/26/2024	SC Commercial, LLC		A120-AUTO/TRUCK GASOLINE	$2,348.31	$ -	$ -
4500065457	12/26/2024	OneSource Distributors, LLC		M130-CROSSING MECHANISM	$1,197.75	$ -	$ -
4500065458	12/26/2024	Gillig LLC		B250-BUS REPAIR PARTS	$3,984.83	$ -	$ -
4500065459	12/26/2024	Sway Collective		G260-MEDIA	$4,047.18	$ -	$ -
4500065460	12/26/2024	Steven R Timme		G230-PRINTED MATERIALS	$548.25	$ -	$ -
4500065461	12/26/2024	Steven R Timme		G230-PRINTED MATERIALS	$2,905.01	$ -	$ -
4500065462	12/26/2024	Nexstar Media Inc		P310-ADVERTISING SERVICES	$4,995.00	$ -	$ -
4500065463	12/26/2024	BriceHouse Outdoor Inc.		G230-PRINTED MATERIALS	$1,500.00	$ -	$ -
4500065464	12/26/2024	Steven R Timme		G230-PRINTED MATERIALS	$127.75	$ -	$ -
4500065465	12/26/2024	Magaldi & Magaldi Inc		B250-BUS REPAIR PARTS	$352.83	$ -	$ -
4500065466	12/26/2024	Keystone Automotive Industries		F120-BUS/LRV PAINT BOOTHS	$1,435.23	$ -	$ -
4500065467	12/27/2024	Transit Holdings Inc		B140-BUS CHASSIS	$388.52	$ -	$ -
4500065468	12/27/2024	Waxie's Enterprises, LLC		G180-JANITORIAL SUPPLIES	$26.94	$ -	$ -
4500065469	12/27/2024	Muncie Reclamation and Supply Co		B200-BUS PWR TRAIN EQUIP	$58.31	$ -	$ -
4500065470	12/27/2024	Transit Holdings Inc		B200-BUS PWR TRAIN EQUIP	$542.03	$ -	$ -
4500065471	12/27/2024	Transit Holdings Inc		B200-BUS PWR TRAIN EQUIP	$15.19	$ -	$ -
4500065472	12/27/2024	Transit Holdings Inc		B160-BUS ELECTRICAL	$4,797.46	$ -	$ -
4500065473	12/27/2024	Fastenal Company		G150-FASTENERS	$43.10	$ -	$ -
4500065474	12/27/2024	Professional Contractors Supplies		G140-SHOP SUPPLIES	$292.07	$ -	$ -
4500065475	12/27/2024	Winzer Franchise Company		G130-SHOP TOOLS	$86.40	$ -	$ -
4500065476	12/27/2024	Western-Cullen-Hayes Inc		M130-CROSSING MECHANISM	$310.32	$ -	$ -
4500065477	12/27/2024	Siemens Mobility, Inc.		M130-CROSSING MECHANISM	$929.02	$ -	$ -
4500065478	12/27/2024	San Diego Friction Products, Inc.		B140-BUS CHASSIS	$428.63	$ -	$ -
4500065479	12/27/2024	San Diego Friction Products, Inc.		R180-RAIL/LRV LIGHTING	$3,999.17	$ -	$ -
4500065480	12/27/2024	Western-Cullen-Hayes Inc		M130-CROSSING MECHANISM	$177.79	$ -	$ -
4500065481	12/27/2024	Airgas Inc		R160-RAIL/LRV ELECTRICAL	$1,947.26	$ -	$ -

Purchase Orders							
PO Number	PO Date	Name	Prime Business Certification	Material Group	PO Value	DBE Subcontracted Amount	Non DBE Subcontracted Amount
4500065482	12/27/2024	General Signals Inc		M130-CROSSING MECHANISM	$4,992.06	$ -	$ -
4500065483	12/27/2024	Dokken Engineering		C130-CONSTRUCTION SVCS	$99,849.02	$ -	$ 61,986.27
4500065484	12/27/2024	Muncie Reclamation and Supply Co		B120-BUS MECHANICAL PARTS	$3,695.85	$ -	$ -
4500065485	12/27/2024	TK Services Inc		B110-BUS HVAC SYSTEMS	$2,537.51	$ -	$ -
4500065486	12/27/2024	Vehicle Maintenance Program, Inc.	Woman Owned Business	B140-BUS CHASSIS	$3,663.50	$ -	$ -
4500065487	12/27/2024	Clarran Inc.	DBE	G150-FASTENERS	$31.27	$ -	$ -
4500065488	12/27/2024	AirSupply Tools, Inc		G140-SHOP SUPPLIES	$93.78	$ -	$ -
4500065490	12/30/2024	Jamison Professional Services, LLC	DBE	G170-LUBRICANTS	$1,039.05	$ -	$ -
4500065491	12/30/2024	Cummins Inc		B200-BUS PWR TRAIN EQUIP	$2,710.41	$ -	$ -
4500065492	12/30/2024	Cummins Inc		B200-BUS PWR TRAIN EQUIP	$241.36	$ -	$ -
4500065493	12/30/2024	Transit Holdings Inc		B200-BUS PWR TRAIN EQUIP	$69.56	$ -	$ -
4500065494	12/30/2024	Transit Holdings Inc		B140-BUS CHASSIS	$5,135.11	$ -	$ -
4500065495	12/30/2024	Transit Holdings Inc		B160-BUS ELECTRICAL	$3,229.36	$ -	$ -
4500065496	12/30/2024	Alyson Corporation	DBE	T110-TRACK, RAIL	$140,000.00	$ -	$ -
4500065497	12/30/2024	Waxie's Enterprises, LLC		G180-JANITORIAL SUPPLIES	$3,607.47	$ -	$ -
4500065498	12/30/2024	San Diego Friction Products, Inc.		G140-SHOP SUPPLIES	$522.28	$ -	$ -
4500065499	12/30/2024	CDW LLC		B150-BUS COMM EQUIP.	$337.04	$ -	$ -
4500065500	12/30/2024	CDW LLC		B150-BUS COMM EQUIP.	$337.04	$ -	$ -
4500065501	12/30/2024	RJ International LLC	DBE	G190-SAFETY/MED SUPPLIES	$452.55	$ -	$ -
4500065502	12/30/2024	D's Kustom Sales & Services, LLC		M150-PWR SWITCHES/LOCKS	$1,088.28	$ -	$ -
4500065503	12/30/2024	IPD Packaging		G140-SHOP SUPPLIES	$1,508.50	$ -	$ -
4500065504	12/30/2024	Louis Sardo Upholstery Inc		R200-RAIL/LRV SEATING	$3,040.21	$ -	$ -
4500065505	12/30/2024	Reid and Clark Screen Arts Co		G140-SHOP SUPPLIES	$2,262.97	$ -	$ -
4500065506	12/30/2024	RS Americas, Inc.		G170-LUBRICANTS	$2,272.06	$ -	$ -
4500065507	12/30/2024	B and H Photo and Electronics		R160-RAIL/LRV ELECTRICAL	$1,667.97	$ -	$ -
4500065508	12/30/2024	W.W. Grainger Inc		G170-LUBRICANTS	$2,166.02	$ -	$ -
4500065509	12/30/2024	Home Depot USA Inc		G220-OFFICE EQUIPMENT	$423.25	$ -	$ -
4500065510	12/30/2024	Cart Mart Inc		F110-SHOP/BLDG MACHINERY	$382.52	$ -	$ -
4500065511	12/30/2024	Gillig LLC		B160-BUS ELECTRICAL	$1,453.42	$ -	$ -
4500065512	12/30/2024	Midwest Bus Corporation		B130-BUS BODY	$1,072.12	$ -	$ -
4500065513	12/30/2024	Transit Holdings Inc		B140-BUS CHASSIS	$2,460.69	$ -	$ -
4500065514	12/30/2024	Brown & Bigelow Inc		G200-OFFICE SUPPLIES	$934.55	$ -	$ -
4500065515	12/30/2024	Allied Refrigeration Inc		B250-BUS REPAIR PARTS	$154.52	$ -	$ -
4500065516	12/30/2024	Romaine Electric Corporation		B160-BUS ELECTRICAL	$3,608.55	$ -	$ -
4500065517	12/30/2024	Airgas Inc		G190-SAFETY/MED SUPPLIES	$403.23	$ -	$ -
4500065518	12/30/2024	Mcmaster-Carr Supply Co		G140-SHOP SUPPLIES	$264.44	$ -	$ -
4500065519	12/30/2024	Mohawk Mfg & Supply Co		B140-BUS CHASSIS	$2,028.45	$ -	$ -
4500065520	12/30/2024	Southern Counties Lubricants LLC		G170-LUBRICANTS	$2,311.24	$ -	$ -
4500065521	12/30/2024	Staples Contract & Commercial LLC		G200-OFFICE SUPPLIES	$2,425.37	$ -	$ -
4500065522	12/30/2024	Clarran Inc.	DBE	G150-FASTENERS	$107.51	$ -	$ -
4500065523	12/30/2024	W.W. Grainger Inc		B250-BUS REPAIR PARTS	$24.09	$ -	$ -
4500065524	12/30/2024	R.S. Hughes Co Inc		G140-SHOP SUPPLIES	$221.07	$ -	$ -
4500065525	12/30/2024	Vern Rose Inc		G140-SHOP SUPPLIES	$846.48	$ -	$ -
4500065526	12/30/2024	Canada Ticket Inc.		G280-FARE MATERIALS	$7,467.08	$ -	$ -
4500065527	12/30/2024	RJ International LLC	DBE	G190-SAFETY/MED SUPPLIES	$888.62	$ -	$ -
4500065528	12/30/2024	KLI Midco LLC		G170-LUBRICANTS	$805.54	$ -	$ -
4500065529	12/30/2024	W.W. Grainger Inc		G140-SHOP SUPPLIES	$546.83	$ -	$ -
4500065530	12/30/2024	Supreme Oil Co.		A120-AUTO/TRUCK GASOLINE	$11,716.58	$ -	$ -
4500065531	12/30/2024	SC Commercial, LLC		A120-AUTO/TRUCK GASOLINE	$2,829.74	$ -	$ -
4500065532	12/30/2024	Network Industries, Inc.		P130-EQUIP MAINT REPR SVC	$460.50	$ -	$ -

Purchase Orders							
PO Number	PO Date	Name	Prime Business Certification	Material Group	PO Value	DBE Subcontracted Amount	Non DBE Subcontracted Amount
4500065533	12/30/2024	Transit Holdings Inc		B120-BUS MECHANICAL PARTS	$4,868.19	$ -	$ -
4500065534	12/30/2024	Network Industries, Inc.		P130-EQUIP MAINT REPR SVC	$561.20	$ -	$ -
4500065535	12/30/2024	Network Industries, Inc.		P130-EQUIP MAINT REPR SVC	$504.47	$ -	$ -
4500065536	12/30/2024	Gillig LLC		B140-BUS CHASSIS	$5,449.29	$ -	$ -
4500065537	12/30/2024	Freeby Signs		B130-BUS BODY	$180.18	$ -	$ -
4500065538	12/30/2024	Network Industries, Inc.		G130-SHOP TOOLS	$1,074.09	$ -	$ -
4500065539	12/30/2024	Network Industries, Inc.		F180-BUILDING MATERIALS	$1,131.05	$ -	$ -
4500065540	12/30/2024	Network Industries, Inc.		P130-EQUIP MAINT REPR SVC	$739.88	$ -	$ -
4500065541	12/30/2024	Compressed Air Systems		F110-SHOP/BLDG MACHINERY	$349.11	$ -	$ -
4500065542	12/30/2024	Network Industries, Inc.		F180-BUILDING MATERIALS	$1,322.30	$ -	$ -
4500065543	12/30/2024	Genfare, LLC		G290-FARE REVENUE EQUIP	$451.48	$ -	$ -
4500065544	12/30/2024	Motion Industries, Inc.		G140-SHOP SUPPLIES	$21.01	$ -	$ -
4500065545	12/30/2024	Network Industries, Inc.		P130-EQUIP MAINT REPR SVC	$388.00	$ -	$ -
4500065546	12/30/2024	The Sherwin-Williams Company		B130-BUS BODY	$2,989.45	$ -	$ -
4500065547	12/30/2024	Network Industries, Inc.		P130-EQUIP MAINT REPR SVC	$394.74	$ -	$ -
4500065550	12/30/2024	Network Industries, Inc.		F200-TANK EQUIPMENT	$448.01	$ -	$ -
4500065551	12/30/2024	Network Industries, Inc.		F170-MATL HANDLING EQUIP	$1,462.74	$ -	$ -
4500065552	12/30/2024	Staples Contract & Commercial LLC		P280-GENERAL SVC AGRMNTS	$390.67	$ -	$ -
4500065553	12/30/2024	Network Industries, Inc.		P120-BLDG/FACILITY REPRS	$241.80	$ -	$ -
4500065554	12/30/2024	Muncie Reclamation and Supply Co		B140-BUS CHASSIS	$2,277.53	$ -	$ -
4500065555	12/30/2024	Cummins Inc		B200-BUS PWR TRAIN EQUIP	$20,394.32	$ -	$ -
4500065556	12/30/2024	Cummins Inc		B120-BUS MECHANICAL PARTS	$762.41	$ -	$ -
4500065557	12/30/2024	Harbor Diesel & Equipment, Inc		B120-BUS MECHANICAL PARTS	$160.87	$ -	$ -
4500065558	12/30/2024	San Diego Friction Products, Inc.		B120-BUS MECHANICAL PARTS	$933.40	$ -	$ -
4500065559	12/30/2024	Prochem Specialty Products Inc	Small Business	G180-JANITORIAL SUPPLIES	$2,577.93	$ -	$ -
4500065560	12/30/2024	Gillig LLC		B120-BUS MECHANICAL PARTS	$1,701.99	$ -	$ -
4500065561	12/30/2024	Waxie's Enterprises, LLC		G180-JANITORIAL SUPPLIES	$711.15	$ -	$ -
4500065562	12/30/2024	Home Depot USA Inc		F110-SHOP/BLDG MACHINERY	$229.66	$ -	$ -
4500065563	12/30/2024	Professional Contractors Supplies		G140-SHOP SUPPLIES	$166.21	$ -	$ -
4500065564	12/30/2024	Home Depot USA Inc		F190-LANDSCAPING MAT'LS	$262.53	$ -	$ -
4500065565	12/30/2024	SiteOne Landscape Supply Holding		F190-LANDSCAPING MAT'LS	$2,207.10	$ -	$ -
4500065566	12/30/2024	OneSource Distributors, LLC		G140-SHOP SUPPLIES	$1,283.58	$ -	$ -
4500065567	12/30/2024	Westair Gases & Equipment Inc	Small Business	G140-SHOP SUPPLIES	$779.55	$ -	$ -
4500065568	12/30/2024	ODP Business Solutions, LLC		G200-OFFICE SUPPLIES	$159.46	$ -	$ -
4500065569	12/31/2024	Transit Holdings Inc		B160-BUS ELECTRICAL	$2,775.03	$ -	$ -
4500065570	12/31/2024	Cummins Inc		B200-BUS PWR TRAIN EQUIP	$1,278.67	$ -	$ -
4500065571	12/31/2024	Waxie's Enterprises, LLC		G180-JANITORIAL SUPPLIES	$6,723.60	$ -	$ -
4500065572	12/31/2024	Transit Holdings Inc		B140-BUS CHASSIS	$1,978.59	$ -	$ -
4500065573	12/31/2024	Network Industries, Inc.		G140-SHOP SUPPLIES	$1,061.85	$ -	$ -
4500065574	12/31/2024	Network Industries, Inc.		G160-PAINTS & CHEMICALS	$234.98	$ -	$ -
4500065575	12/31/2024	Network Industries, Inc.		G140-SHOP SUPPLIES	$205.62	$ -	$ -
4500065576	12/31/2024	Network Industries, Inc.		G140-SHOP SUPPLIES	$350.16	$ -	$ -
4500065577	12/31/2024	W.W. Grainger Inc		G140-SHOP SUPPLIES	$22.13	$ -	$ -
4500065578	12/31/2024	Annex Warehouse Company, Inc		G160-PAINTS & CHEMICALS	$8,849.56	$ -	$ -
4500065579	12/31/2024	Vern Rose Inc		G140-SHOP SUPPLIES	$257.96	$ -	$ -
4500065580	12/31/2024	Southern Counties Lubricants LLC		G170-LUBRICANTS	$9,289.95	$ -	$ -
4500065581	1/2/2025	Transit Holdings Inc		B130-BUS BODY	$3.01	$ -	$ -
4500065582	1/2/2025	Transit Holdings Inc		B160-BUS ELECTRICAL	$7.93	$ -	$ -
4500065583	1/2/2025	Transit Holdings Inc		B140-BUS CHASSIS	$98.27	$ -	$ -
4500065584	1/2/2025	Mohawk Mfg & Supply Co		B140-BUS CHASSIS	$7.68	$ -	$ -

Purchase Orders							
PO Number	PO Date	Name	Prime Business Certification	Material Group	PO Value	DBE Subcontracted Amount	Non DBE Subcontracted Amount
4500065585	1/2/2025	Transit Holdings Inc		B140-BUS CHASSIS	$3,010.19	$ -	$ -
4500065586	1/2/2025	Signal Hill Auto Enterprises, Inc.		G180-JANITORIAL SUPPLIES	$814.30	$ -	$ -
4500065587	1/2/2025	Waxie's Enterprises, LLC		G180-JANITORIAL SUPPLIES	$535.47	$ -	$ -
4500065590	1/2/2025	Aymar Industries, LLC.		R140-RAIL/LRV DOORS/RAMP	$4,032.54	$ -	$ -
4500065591	1/2/2025	RJ International LLC	DBE	G140-SHOP SUPPLIES	$1,108.10	$ -	$ -
4500065592	1/2/2025	Linkedin Corporation		P450-PERSONNEL SVCS	$18,000.00	$ -	$ -
4500065593	1/2/2025	Fastenal Company		G180-JANITORIAL SUPPLIES	$771.28	$ -	$ -
4500065594	1/2/2025	RJ International LLC	DBE	G140-SHOP SUPPLIES	$1,121.69	$ -	$ -
4500065595	1/2/2025	Johnson Controls Fire Protection LP		P280-GENERAL SVC AGRMNTS	$1,900.00	$ -	$ -
4500065596	1/2/2025	Laird Plastics, Inc		M180-STATION ELECTRICAL	$1,123.18	$ -	$ -
4500065597	1/2/2025	Waxie's Enterprises, LLC		G180-JANITORIAL SUPPLIES	$4,363.88	$ -	$ -
4500065598	1/2/2025	Tom Malloy Corporation		M200-YARD FACILITIES	$1,555.18	$ -	$ -
4500065599	1/2/2025	Arts Lawnmower and Repairs LLC		P130-EQUIP MAINT REPR SVC	$1,166.20	$ -	$ -
4500065600	1/3/2025	Cummins Inc		B200-BUS PWR TRAIN EQUIP	$2,148.80	$ -	$ -
4500065601	1/3/2025	Waxie's Enterprises, LLC		G180-JANITORIAL SUPPLIES	$3,289.39	$ -	$ -
4500065602	1/3/2025	Transit Holdings Inc		B250-BUS REPAIR PARTS	$374.22	$ -	$ -
4500065603	1/3/2025	Cummins Inc		B200-BUS PWR TRAIN EQUIP	$2,710.41	$ -	$ -
4500065604	1/3/2025	Transit Holdings Inc		B140-BUS CHASSIS	$3,669.75	$ -	$ -
4500065605	1/3/2025	Cummins Inc		B200-BUS PWR TRAIN EQUIP	$397.94	$ -	$ -
4500065606	1/3/2025	Waxie's Enterprises, LLC		G180-JANITORIAL SUPPLIES	$1,508.93	$ -	$ -
4500065607	1/3/2025	Waxie's Enterprises, LLC		G180-JANITORIAL SUPPLIES	$77.77	$ -	$ -
4500065608	1/3/2025	Transit Holdings Inc		B140-BUS CHASSIS	$4,200.58	$ -	$ -
4500065609	1/3/2025	Jamison Professional Services, LLC	DBE	G170-LUBRICANTS	$1,661.76	$ -	$ -
4500065610	1/3/2025	Signal Hill Auto Enterprises, Inc.		G180-JANITORIAL SUPPLIES	$753.98	$ -	$ -
4500065611	1/3/2025	ODP Business Solutions, LLC		P400-FINANCIAL & AUDIT	$269.27	$ -	$ -
4500065612	1/3/2025	W.W. Grainger Inc		C120-SPECIALTY CONTRACTOR	$69.63	$ -	$ -
4500065613	1/3/2025	W.W. Grainger Inc		C120-SPECIALTY CONTRACTOR	$137.61	$ -	$ -
4500065614	1/3/2025	Maestronic USA Inc		G110-BUS/TROLLEY SIGNAGE	$97,114.25	$ -	$ -
4500065615	1/3/2025	Hulcher Services Inc.		INSURANCE-Insurance Stock	$33,780.00	$ -	$ -
4500065616	1/6/2025	Cummins Inc		B250-BUS REPAIR PARTS	$58.83	$ -	$ -
4500065617	1/6/2025	Waxie's Enterprises, LLC		G180-JANITORIAL SUPPLIES	$1,343.17	$ -	$ -
4500065618	1/6/2025	Transit Holdings Inc		B200-BUS PWR TRAIN EQUIP	$12.07	$ -	$ -
4500065619	1/6/2025	Transit Holdings Inc		B200-BUS PWR TRAIN EQUIP	$2.91	$ -	$ -
4500065620	1/6/2025	Transit Holdings Inc		B130-BUS BODY	$1,413.78	$ -	$ -
4500065621	1/6/2025	Gillig LLC		B250-BUS REPAIR PARTS	$968.93	$ -	$ -
4500065622	1/6/2025	Transit Holdings Inc		B140-BUS CHASSIS	$2,804.75	$ -	$ -
4500065623	1/6/2025	Transit Holdings Inc		B130-BUS BODY	$4,412.14	$ -	$ -
4500065625	1/6/2025	Leonardo Fernando Cruz		G250-NOVELTIES & AWARDS	$840.00	$ -	$ -
4500065626	1/6/2025	Inland Kenworth (US) Inc		B250-BUS REPAIR PARTS	$2,143.08	$ -	$ -
4500065627	1/6/2025	American Battery Corporation	Small Business	P280-GENERAL SVC AGRMNTS	$4,776.56	$ -	$ -
4500065628	1/6/2025	AirSupply Tools, Inc		G130-SHOP TOOLS	$93.90	$ -	$ -
4500065629	1/6/2025	B and H Photo and Electronics		G200-OFFICE SUPPLIES	$2,624.15	$ -	$ -
4500065630	1/6/2025	Waxie's Enterprises, LLC		G180-JANITORIAL SUPPLIES	$4,363.88	$ -	$ -
4500065631	1/6/2025	Winzer Franchise Company		G150-FASTENERS	$269.22	$ -	$ -
4500065632	1/6/2025	Supreme Oil Co.		A120-AUTO/TRUCK GASOLINE	$11,878.43	$ -	$ -
4500065633	1/6/2025	SC Commercial, LLC		A120-AUTO/TRUCK GASOLINE	$2,879.06	$ -	$ -
4500065634	1/6/2025	Day Management Corp		B150-BUS COMM EQUIP.	$2,745.00	$ -	$ -
4500065635	1/6/2025	Transit Holdings Inc		B130-BUS BODY	$564.10	$ -	$ -
4500065636	1/6/2025	Don Oleson Inc	Small Business	B120-BUS MECHANICAL PARTS	$3,216.82	$ -	$ -
4500065637	1/6/2025	Clarran Inc.	DBE	G150-FASTENERS	$172.55	$ -	$ -

Purchase Orders							
PO Number	PO Date	Name	Prime Business Certification	Material Group	PO Value	DBE Subcontracted Amount	Non DBE Subcontracted Amount
4500065638	1/6/2025	Transit Holdings Inc		B130-BUS BODY	$647.71	$ -	$ -
4500065639	1/6/2025	Cummins Inc		B200-BUS PWR TRAIN EQUIP	$718.64	$ -	$ -
4500065640	1/6/2025	Neopart Transit LLC		B250-BUS REPAIR PARTS	$847.36	$ -	$ -
4500065641	1/6/2025	Gillig LLC		B250-BUS REPAIR PARTS	$2,598.07	$ -	$ -
4500065642	1/6/2025	Radwell International LLC		M110-SUB STATION	$2,429.82	$ -	$ -
4500065643	1/6/2025	Fastenal Company		R230-RAIL/LRV MECHANICAL	$3,585.92	$ -	$ -
4500065644	1/6/2025	Magaldi & Magaldi Inc		B200-BUS PWR TRAIN EQUIP	$855.65	$ -	$ -
4500065645	1/6/2025	Muncie Reclamation and Supply Co		B130-BUS BODY	$973.13	$ -	$ -
4500065646	1/6/2025	Charter Industrial Supply Inc	Small Business	G140-SHOP SUPPLIES	$165.87	$ -	$ -
4500065647	1/6/2025	Balfour Beatty Infrastructure, Inc		M140-WAYSIDE SIGNALS	$366,245.28	$ -	$ -
4500065648	1/7/2025	Transit Holdings Inc		B250-BUS REPAIR PARTS	$111.20	$ -	$ -
4500065649	1/7/2025	Cummins Inc		G150-FASTENERS	$94.18	$ -	$ -
4500065650	1/7/2025	Uline Inc		G200-OFFICE SUPPLIES	$102.80	$ -	$ -
4500065651	1/7/2025	Cummins Inc		B250-BUS REPAIR PARTS	$1,806.15	$ -	$ -
4500065652	1/7/2025	Transit Holdings Inc		B200-BUS PWR TRAIN EQUIP	$69.56	$ -	$ -
4500065653	1/7/2025	Transit Holdings Inc		B120-BUS MECHANICAL PARTS	$399.21	$ -	$ -
4500065654	1/7/2025	Cummins Inc		B200-BUS PWR TRAIN EQUIP	$798.28	$ -	$ -
4500065655	1/7/2025	Mohawk Mfg & Supply Co		B140-BUS CHASSIS	$7.68	$ -	$ -
4500065656	1/7/2025	Waxie's Enterprises, LLC		G180-JANITORIAL SUPPLIES	$747.57	$ -	$ -
4500065657	1/7/2025	Gillig LLC		B250-BUS REPAIR PARTS	$3,702.01	$ -	$ -
4500065658	1/7/2025	Mohawk Mfg & Supply Co		B120-BUS MECHANICAL PARTS	$961.55	$ -	$ -
4500065659	1/7/2025	W.W. Grainger Inc		G120-SECURITY	$6,207.58	$ -	$ -
4500065660	1/7/2025	Home Depot USA Inc		F110-SHOP/BLDG MACHINERY	$138.46	$ -	$ -
4500065661	1/7/2025	Home Depot USA Inc		G250-NOVELTIES & AWARDS	$221.32	$ -	$ -
4500065662	1/7/2025	Maxwell Industries R&D, Inc.		R130-RAIL/LRV COUPLER	$28,549.44	$ -	$ -
4500065663	1/7/2025	National Carwash Solutions Inc		G160-PAINTS & CHEMICALS	$1,614.37	$ -	$ -
4500065664	1/7/2025	Cummins Inc		B250-BUS REPAIR PARTS	$32,343.05	$ -	$ -
4500065665	1/7/2025	Allied Refrigeration Inc		B250-BUS REPAIR PARTS	$77.26	$ -	$ -
4500065666	1/7/2025	Freeby Signs		B130-BUS BODY	$311.29	$ -	$ -
4500065667	1/7/2025	B & S Graphics Inc		B130-BUS BODY	$324.33	$ -	$ -
4500065668	1/7/2025	Enterprise FM Trust		P180-LEASES, OTHER	$8,228,514.00	$ -	$ -
4500065669	1/7/2025	Motion Industries, Inc.		G140-SHOP SUPPLIES	$1,629.26	$ -	$ -
4500065670	1/7/2025	Fastenal Company		G140-SHOP SUPPLIES	$2,259.66	$ -	$ -
4500065671	1/7/2025	Motion Industries, Inc.		G140-SHOP SUPPLIES	$343.74	$ -	$ -

EXPENSE CONTRACTS				
Doc #	**Organization**	**Subject**	**Amount**	**Day**
PWL312.0-20JOC-12.2-4	HMS	SWITCHGEAR AND SCADA MOD CCO 04	$34,290.96	12/12/2024
PWL337.8-21	IMT	IMT DOUBLE TRACK CCOS 36-40	$38,737.95	12/13/2024
PWL358.0-22WOA-AE-49	CL	RE CAD GIS TEST CASE	$18,107.00	12/16/2024
PWG348.0-22JOC-13.02	VETERANS	EL CAJON PLATFORM DEMO & REC CCO 02	$70,929.55	12/17/2024
PWB380.1-24	HAZARD	VARIOUS CCOS FOR IRIS TC	$79,917.89	12/20/2024
PWG347.0-22JOC-20	ABCGC	TRANSIT CENTER CONCRETE REPAIRS	$59,447.24	12/24/2024
PWG347.0-22JOC-35	ABCGC	62ND ST STATION REPAIR	$69,726.84	12/24/2024
G2981.0-25	VCLOUD TECH INC	SOLARWINDS MAINTENANCE RENEWALS	$116,079.88	12/24/2024
G2541.0-22	SANDAG	S895137 RE SVCS AMD 2 ASSIGN 1	$145,000.00	12/24/2024
PWG383.3-24	ARI	ADD FUNDS AND LOCATION	$54,967.70	12/27/2024
PWL425.0-25	ALYSON	69TH ST SURVEY EMERGENCY SURVEYING	$140,000.00	12/27/2024
PWL393.1-24	BALFOUR	VMS INSTALLATION ON COPPER LINE CCO 01	$54,006.73	01/03/2025
PWB414.0-25	FORDYCE	ECBMF STORAGE PROJECT	$143,016.00	01/07/2025

REVENUE CONTRACTS AND MOUs				
Doc #	**Organization**	**Subject**	**Amount**	**Day**
L5867.0-25	SD AIRPORT	JROE PERMIT FOR GRAPE ST AND PALM	$750.00	12/24/2024
L6871.1-24	OHLA	255.45 255.50 JROE TIME EXT	$750.00	12/31/2024
L5296.0-25	CITY OF SANTEE	RACEWALK 2025 JAN WALK ROE	$750.00	01/06/2025
M6809.0-25	OHLA	OHLA - SD ALVARADO PIPELINE EXT PROJ ROE	$1,056.12	01/07/2025

Purchase Order No.	Estimated Cost	Actual Cost	Contract or	Description of Work	Contractor Selection Justification	Projected Competitive Procurement Timeline	Projected	Location
4500060487	$2,500,000	$2,500,000.00	DRS Contracting	Track reconstruction and drainage repair	DRS Contracting Inc. was selected because their sister company Veteran's Engineering Inc. had an	Construction IFB, process of 6 months	Ability to immediately commence	Orange Line: Massachusetts to Euclid
4500060475	$2,500,000	$2,500,000.00	Balfour Beatty	Track reconstruction and drainage repair	MTS turned to Balfour Beatty to authorize them to perform this work on 1/24/24, this was the earliest possible time. They had an existing contract in place with MTS for trackwork in other areas, therefore, they had crews and equipment available for immediate mobilization.	Construction IFB, process of 6 months	Ability to immediately commence services	Orange Line: Massachusetts to Euclid
4500061454	$65,251.97	$86,724.28	PGH Wong	Inspection and construction management for track reconstruction	Firm currently under contract as an on-call consultant for Construction Management (CM) Services	Mini RFP through on-call construction management services agreements, process of 4 months	Ability to immediately commence services	Orange Line: Massachusetts to Euclid
4500060499	$1,500,000	$1,500,000.00	Blue Iron	Shoring	MTS met with 3 shoring contractors. Blue Iron was the only firm that had materials on-hand and could start right away. The other two contractors had a 3- month lead time.	Construction IFB, process of 6 months	Ability to immediately commence services	Orange Line: Near 65th crossing
4500060986	$120,000	$120,000.00	HMS	Overhead catenary system repairs	Firm currently under contract as an on-call consultant for JOC Overhead Catenary System (OCS)	Construction IFB process of 6 months	Ability to immediately commence services	Orange Line: Near 65th
4500060094	$140,570.00	$140,570.00	AECOM	Inspection and construction management for shoring and system/signals	Firm currently under contract as an on-call consultant for CM Services	Mini RFP through on-call CM services agreements, process of 4 months	Ability to immediately commence services	Orange Line: Near 65th
4500059857	$5,961	$5,961.00	Overhead Door Company of Southern	Purchase and install roll up door	Firm specializes in providing roll up door products and services	RFQ process of 1-2 months	Services scheduled to	Pyramid Building, Bay 3
4500060232	$58,800	$58,800.00	National Electrical Testing and Engineeri ng, LLC (NETE)	Testing and repairs prior to regeneration of substations	Previous experience on testing and commissioning of substations for both the Mid Coast and Blue/Green lines.	RFQ process of 1-2 months	Ability to immediately start repairs	Green Line: San Altos Substation
4500062947	$250,000	$257,537.40	Clean Harbor	Trolley Building Pump-out	Personnel availability, immediate mobilization, and past work performance.	Formal IFB, process of 4-6 months	Ability to immediately commence services	LRV Maintenance Facility (Building C)
4500059608	$27,093	$27,093.10	Badger Day Lighting	Clean-out LRV Maintenance pits	Prompt mobilization and prior work performance	RFQ process of 1-2 months	Ability to immediately start repairs	LRV Maintenance Facility (Building C)
4500060233	$19,668.53	$19,668.53	NMS Management, Inc.	Strip and waxing of Building C Shop Floors for proper sanitation of shop floors	Janitorial expertise, personnel availability, immediate mobilization, and past work performance	RFQ process of 1-2 months	Ability to immediately start repairs	LRV Maintenance Facility (Building C)
4500059669	$14,484.17	$14,484.17	National Business Furniture (NBF)	Replace office furniture for SDTI staff (manager, project coordinator and shop supervisor)	Staff attempted to receive quotes from National Business Furniture, Madison Liquidators and Office Depot, Items are readily available for shipment and assembled, MTS chose NBF	RFQ process of 1-2 months	Ability to immediately ship furniture	LRV Maintenance Facility (Building C)
4500059667	$5,039.04	$5,384.46	National Business Furniture	Replace office furniture for SDTI LRV Director	Staff attempted to receive quotes from National business Furniture, Madison Liquidators and Office Depot, Items are readily available for shipment and assembled, MTS chose NBF	RFQ process of 1-2 months	Ability to immediately ship furniture	LRV Maintenance Facility (Building C)

Purchase Order No.	Estimated Cost	Actual Cost	Contract or	Description of Work	Contractor Selection Justification	Projected Competitive Procurement Timeline	Projected	Location
4500059748	$14,769.07	$14,769.08	Gillig LLC	Purchase exterior mirrors (inventory item) for LRVs that were ripped off/damaged during storm	Staff attempted to attain quotes, received two from Gillig and Siemens. Gillig was the lowest bidder.	RFQ for inventory item, process of 7 days	Ability to immediately ship	LRV Maintenance Facility (Building C)
4500061162	$160,000	$127,697.32	ABCGC	Building A Interior Clean up, Building C Exterior Pressure Washing and Clean up, San Altos Substation Clean up, 65th & Imperial Slope SWPPP and BMP installation to support the shoring contractor at this location, 65th & Imperial fence that was replaced to support the shoring contractor at this location, 54th & Market fence installation near the pedestrian crossing	Personnel availability, immediate mobilization, and past work performance.	Construction IFB, process of 6 months	Ability to immediately commence services.	Building A, Building C. San Altos Substation, 65th & Imperial Slope,65th & Imperial fence, 54th & Market fence.
4500060050	$7,176.00	~~Not yet Finalized~~ $7,176.00	World Oil	Perform C2 Clarifier Clean Out due to flood	MTS turned to World Oil to perform this work based on their expertise of normal disposal, past purchase history with MTS, and previous work performance.	RFQ process of 30-60 days	Ability to immediately commence services	LRV Department
4500060078	$12,200.00	$12,200.00	Josephson Werdowatz	Structural analysis of the collapsed section of the roof on the Pyramid building, as well as designs on required repairs are necessary in order to ensure the building is safe for further crews to enter the building for additional repairs and to return the building to full	Based on previous work with MTS, specifically its previous work with MTS on structural improvements to this building in particulate.	RFQ process of 30-60 days	Ability to immediately commence services.	Pyramid Building
4500041657	$12,865.00	$12,865.00	NSH USA Corp.	Wheel truing machine evaluation.	NSH had drawings, technical support, knowledge of operation and past work performance.	RFQ process of 30-60 days	Ability to immediately commence services	LRV Department – Building C
4500060310	$11,801.44	$11,804.44	NMS Management	Cleaning, waxing and sealing of New Vinal floors in A Building, C Building and Yard Tower	NMS Management was identified due to its janitorial expertise, personnel availability, immediate mobilization, and past work performance.	RFQ process of 30-60 days	Ability to immediately commence services	Buildings A and C, and Yard Tower
4500060985	$1,360,874.00	Not yet Finalized	Carlos Guzman	Above-ground Wheel Truing Machine Replacement for LRV Department	Staff learned Carlos Guzman hasd purchased a wheel truing machine that has only been in service for 4 ½ years and offered to sell it to MTS. Delivery of unit is 8-10 weeks compared to purchasing a brand new machine that would cost more and take longer to arrive with a lead time of 18 months from NTP.	IFB 4-6 months plus Lead time of 18 months	Availability of machine with a very short lead time.	LRV maintenance – Building C
4500061382	$109,548.85	$109,548.85	Legend to Kings Fence, Inc	Fencing Repair at Euclid Ave Station to Lemon Grove Station	MTS turned to LTK Fence to authorize them to perform this work. LTK Fence was identified due to its fencing expertise, personnel availability, and immediate mobilization.	Construction IFB, process of 6 months	Ability to immediately commence services	Euclid Ave Station to Lemon Grove Station
4500061099	$1,500,000	$1,408,455.91	DRS Contracting	Grade crossing on Euclid and Euclid Bridge repair	DRS was selected because they are currently mobilized on another project and have crews, equipment and long-lead time materials available for immediate mobilization.	Construction IFB, process of 6 months	Ability to immediately commence services	Euclid and Euclid Bridge

Purchase Order No.	Estimated Cost	Actual Cost	Contract or	Description of Work	Contractor Selection Justification	Projected Competitive Procurement Timeline	Projected	Location
4500060538	$67,500	$67,500.00	Atlas	Trees were damaged during flood	Contractor has an existing on call tree trimming contract in place, personnel availability, immediate mobilization, and past work performance. Delays mean that track and OCS could have been damaged.	RFQ process of 30-60 days	Ability to immediately commence services	Orange Line - Intersection of Massachusetts and 69th
4500059776	$6,854	$8,527.00	Hitachi	Part replacement	Existing MTS contractor for replacement services	RFQ process of 1-2 months	Ability to immediately commence services	Wayside
4500060161	$8,105.29	$8,105.29	Otay Mesa Sales, Inc.	MTS Track department used this equipment for (1) one month to help restore tracks and clean up trash	Identified due to large inventory, machine availability and ability for immediate mobilization	RFQ process of 1-2 months	Ability to immediately commence services	Orange Line – Massachusetts Station
4500061003	$187,680	$158,859.00	BBM Railway Innovations	Lifting Equipment	Sole Source – MACTON provided the lifts that were damaged. BBM bought out MACTON around 2018. BBM supplied similar replacement lifts	Formal IFB, process of 4-6 months	Availability to provide good with a very short lead time.	Trolley – LRV Maintenance
4500063310	$269,012.80	Not yet Finalized	BBM Railway Innovations	Lifting Equipment	Sole Source – MACTON provided the lifts that were damaged. BBM bought out MACTON around 2018. BBM supplied similar replacement lifts	Formal IFB, process of 4-6 months	Availability to provide good with a very short lead time.	Trolley – LRV Maintenance
4500060764	$58,600	Not yet Finalized	Kleinfelder	AE eval of sheet pile shoring	familiarity on the soil vicinity due to the past projects	Mini A&E RFP of 4 month	Ability to immediately commence services	Orange Line - Shoring Wall at 65th Street
4500063115	$1,857,000	Not yet Finalized	Siemens	Repair damaged drive units	Existing MTS contractor for repair services	Formal IFB, process of 4-6 months	Ability to immediately commence services	LRV Department
4500061162	$145,000	$127,697.32	ABGGC	Emergency cleanup and repairs	Existing MTS contractor for JOC services	Formal IFB, process of 4-6 months	Ability to immediately commence services and mobilize equipment and crews	Various locations
4500060841	$5,071.50	~~Not yet Finalized~~ $9,561.36	Asbury Environmental Services	Removal of oil from C4/5 In-Floor Hoist Pits	Existing MTS contractor for services	RFQ process of 1-2 months	Ability to immediately commence services	LRV Maintenance – Bldg C
This is an amendment to PO 4500061454	$21,508.31	$21,508.31	PGH Wong	Inspection and construction management for track reconstruction	CM Services	Mini RFP through on-call construction management services agreements, process of 4 months	Ability to immediately commence services	Orange Line: Massachusetts to Euclid
TBD	$166,133.27	$166,133.27	Jacobs Project Management Co.	CM services for Las Chollas Bridge emergency repair related to the January 2024 flood.	Jacobs is MTS' bridge inspector	Mini RFP through on-call CM services agreements, process of 4 months	Ability to immediately commence services	Las Chollas Bridge
4500062668	$75,900.00	$75,900.00	Baker Electric and Renewables, LLC	Electrical Utility Setup for new Wheeltrue machine	Past work performance, expertise and availability.	Formal IFB, process of 4-6 months	Ability to immediately commence services	LRV Maintenance – Bldg C
4500062733	$25,000.00	$21,151.75	Urban Corps of San Diego	Flood Emergency - Debris cleanup	Existing MTS contractor for debris clean-up services, personnel availability, and quick mobilization.	RFQ process of 1-2 months	Ability to immediately commence services	Various locations

Purchase Order No.	Estimated Cost	Actual Cost	Contract or	Description of Work	Contractor Selection Justification	Projected Competitive Procurement Timeline	Projected	Location
4500063680	$7,800.00	~~Not yet finalized~~ $49,197.14	HJR Equipment Rental, Inc.	Engineering Service Site Visit for Hold Downs	Sole Source - Contractor is original equiment manufacturer (OEM) possess proprietary drawings and specifications needed to engineer hold downs.	RFQ process of 1-2 months	Ability to immediately commence services	LRV Maintenance – Bldg C
PR #10130086	$439,973.60	Not yet Finalized	ATI Restoration	Emergency Flood Services for Bldg A	Flood restoration expertise, personnel availability, immediate mobilization, and past work performance.	Formal IFB, process of 4-6 months	Ability to immediately commence services	SDTI Bldg. A
PR: 10132309	$900,002.49	$910,405.76	Balfour Beatty	Las Chollas Bridge Repairs Construction	Knowledge and expertise, personnel availability, immediate mobilization.	Formal IFB, process of 4-6 months	Formal IFB, process of 4-6 months	Las Chollas Bridge
4500064912	$658,028.79	$639,405.34	Belfor Property Restoration	Flood Services in Building C, Yard Tower, Paint Booth and Boogie Room	Flood restoration expertise, personnel availability, immediate mobilization, and past work performance.	Formal IFB, process of 4-6 months	Formal IFB, process of 4-6 months	Building C, Yard Tower, Paint Booth and Boogie Room
4500064056	$15,126.70	$15,126.70	JR Bardin	Structural inspection and ongoing construction support during the inspection and repair phases of the Pyramid building.	Was identified due to its previous work with MTS, specifically its previous work with MTS on structural improvements to this building in particular.	Informal would take 30-60 days	Informal would take 30-60 days	Pyramid Building
PR # 10131933	$210,000.00	Not yet Finalized	Mott MacDonald	AE Service Las Chollas Bridge Repair	Contractor is already under contract with MTS to prepare engineering plans in response to annual bridge reports so they have familiarity with the bridge.	Mini RFP through on-call construction management services agreements, process of 4 months	Ability to immediately commence services	Las Chollas Bridge
PR:10129472 (Line 3)	$617,055.31	Not yet Finalized	Belfor Property Restoration	Reconstruction of Building C, Bogie Building, Paint Booth and Yard Tower after the January 22nd Flood.	Flood restoration expertise, personnel availability, immediate mobilization, and past work performance.	Formal IFB, process of 4-6 months	Formal IFB, process of 4-6 months	Building C, Yard Tower, Paint Booth, and Boogie Room
PR:10129472 (Line 4)	$72,610.55	Not yet Finalized	Belfor Property Restoration	Inspections, remediations, restorations of Pyramid Building after the January 22nd Flood.	Flood restoration expertise, personnel availability, immediate mobilization, and past work performance.	Formal IFB, process of 4-6 months	Formal IFB, process of 4-6 months	Pyramid Building
PR:10129472 (Line 5)	$88,025.08	Not yet Finalized	Belfor Property Restoration	Reconstruction of Pyramid Building after the January 22nd Flood.	Flood restoration expertise, personnel availability, immediate mobilization, and past work performance.	Formal IFB, process of 4-6 months	Formal IFB, process of 4-6 months	Pyramid Building
	$16,298,089.76	$11,219,817.78	Total (as of 01/08/2025)					

Metropolitan Transit System

Agenda Item No. 5

MEETING OF THE SAN DIEGO METROPOLITAN TRANSIT SYSTEM
BOARD OF DIRECTORS

January 16, 2025

SUBJECT:

RuBAN Software Maintenance and Development – Contract Amendment

RECOMMENDATION:

That the San Diego Metropolitan Transit System (MTS) Board of Directors authorize the Chief Executive Officer (CEO) to:

1) Ratify Amendment No. 1 to MTS Doc. No. G2795.0-24 (Attachment A), with Davra Networks USA (Davra), for Copper Line Estimated Time of Arrival (ETA) development services in the amount of $88,200.00; and

2) Execute Amendment No. 2 to MTS Doc. No. G2795.0-24 (in substantially the same format as Attachment B), with Davra, for trolley Public Address (PA) system Spanish language support development services in the amount of $176,400.00.

Budget Impact

The total cost of these amendments are estimated to be $264,600.00, and the total contract cost of the services is estimated to be $1,553,400.00. These services will be funded by the Information Technology (IT) Operations Budget account 661010-571250.

Document	Description	Authorization	Board Authorized Amount	Exercised Contract Value
Original	RuBAN Software Support and Development – *Base Period*	Board authorized on 7/17/2014, AI #30	$830,400.00	$830,400.00
	Option Years (not yet exercised)		$458,400.00	Not yet exercised
		Total	**$1,288.800.0**	
AM 1	Copper Line ETA	Today's Board Action - Ratify (approved under CEO's authority)	$88,200.00	$88,200.00
AM 2	Budget Module Licenses and Integration	Today's Board Action - Execute	$176,400.00	$176,400.00
		Total	**$ 1,553,400.00**	**$1,095,000**

DISCUSSION:

In 2023, MTS renewed the sole source RuBAN software support and development contract with Davra that displays next train arrival information on Variable Message Systems located at each trolley station. Since the project was originally implemented in 2015, various improvements and enhancements have been deployed. Davra's RuBAN software systems provide this software solution for next train arrivals, PA system announcements integration, Automated Passenger Counting (APC), smart train sign programing, General Transit Feed Specification (GTFS) data, reports, and as an analytical tool for Light Rail Vehicle (LRV) operations and LRV maintenance staff. These information systems are a key communication link between transit operations and the traveling public.

Today's proposed actions relate to the ratification of Amendment No. 1, as well as the approval to execute Amendment No. 2. Per MTS Board Policy No. 41 "Signature Authority", CEO executed Amendment No. 1 relating to development services for the Copper Line ETA information display to riders. Amendment No. 2, if approved, will add Spanish language translation to PA system announcements.

Currently, announcements can only be written and translated in English. This project will introduce Spanish translation, enabling MTS operations to create messages in either English or Spanish. The text-to-speech system will automatically translate these messages between both languages, allowing them to be displayed on signs and played through speakers in sync with the displayed English and Spanish versions.

Therefore, staff recommends that the MTS Board of Directors authorize the CEO to:

1) Ratify Amendment No. 1 to MTS Doc. No. G2795.0-24 (Attachment A), with Davra, for Copper Line ETA development services in the amount of $88,200.00; and

2) Execute Amendment No. 2 to MTS Doc. No. G2795.0-24 (in substantially the same format as Attachment B), with Davra, for trolley PA system Spanish language support development services in the amount of $176,400.00.

/S/ Sharon Cooney
Sharon Cooney
Chief Executive Officer

Key Staff Contact: Mark Olson, 619.557.4588, mark.olson@sdmts.com

Attachments: A. Executed Amendment, MTS Doc. No. G2795.1-24
B. Draft Amendment, MTS Doc. No. G2795.2-24

Metropolitan Transit System

Amendment 1

August 6, 2024 MTS Doc. No. G2795.1-24

RUBAN SOFTWARE MAINTENANCE AND DEVELOPMENT

Davra Networks USA Inc.
Paul Glynn
Chief Executive Officer
440 North Wolfe Road
Sunnyvale, CA 94085

This shall serve as Amendment No. 1 to the original agreement G2795.0-24 as further described below.

SCOPE

Pursuant to the Scope of Work, contractor shall provide RuBAN software development services for the Copper Line transition (Attachment A).

SCHEDULE

There shall be no change to the contract term due to this amendment.

PAYMENT

This contract amendment shall authorize additional costs not to exceed $88,200.00. The total value of this contract including this amendment shall be in the amount of $918,600.00. This amount shall not be exceeded without prior written approval from MTS.

Please sign and return a copy to the Contract Specialist at MTS. All other terms and conditions shall remain the same and in effect. Retain a copy for your records.

Sincerely,

Sharon Cooney, Chief Executive Officer

Agreed:

DocuSigned by:
Paul Glynn
4F5B64A599C04A1...

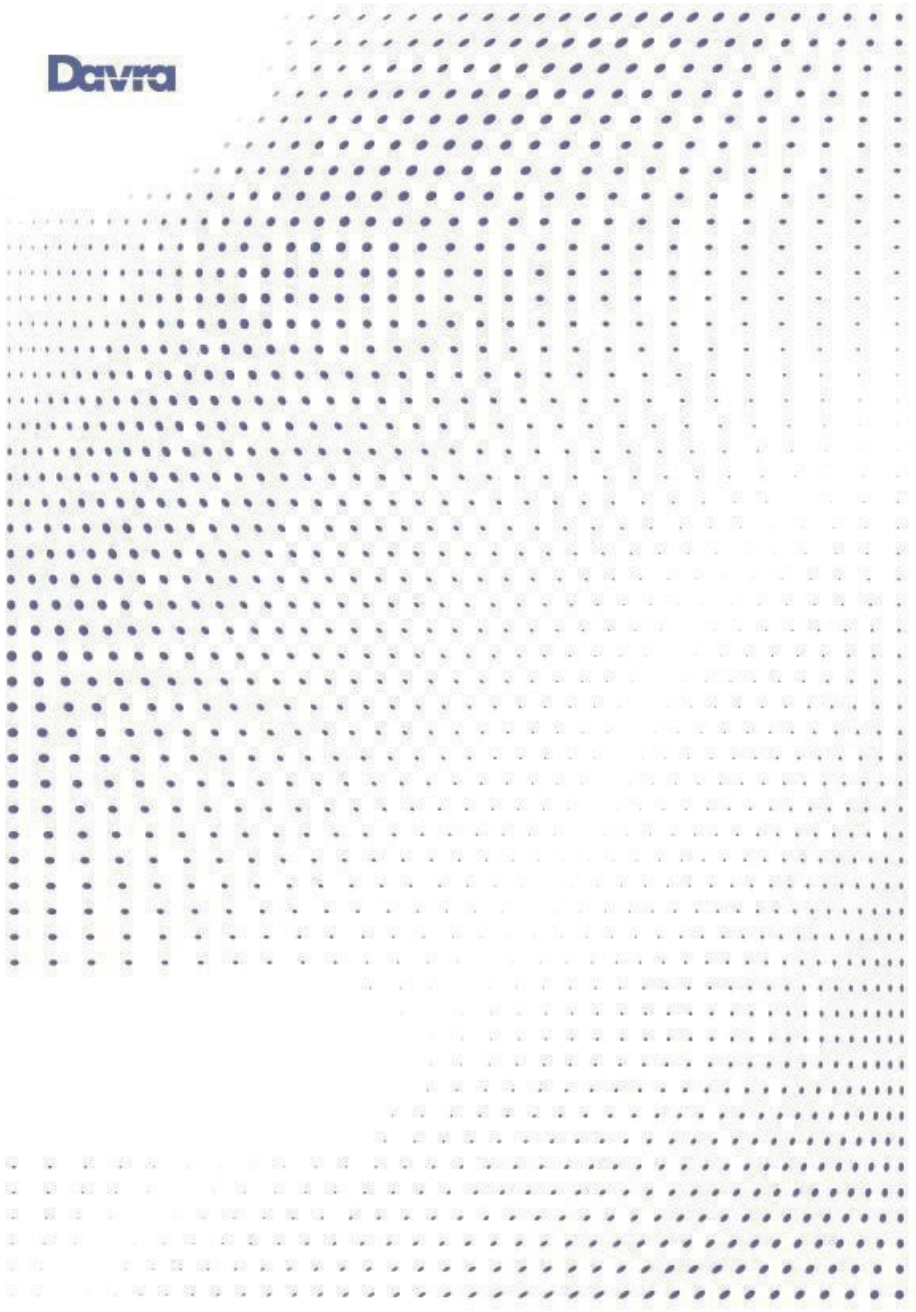
Paul Glynn, Chief Executive Officer
Davra Networks USA Inc

Date: 8/15/2024

Attachment: A. Copper Line – Statement of Work Rev1.0

ATTACHMENT A

(Copper Line – Statement of Work Rev1.0)



SDMTS

Copper Line - Statement of Work
Rev 1.0

May 2024

SDMTS-2024: Copper Line

Customer Details

Company name: SDMTS
Contact name: Jason McNeil
Email address: jason.mcneil@sdmts.com
Mobile Number: 619-744-5940
Time Zone: PST

Summary

To address issues with the furthest eastern reaches of the Green and Orange lines introducing delays to those routes, SDMTS are now terminating those lines at El Cajon and running a new Copper Line from El Cajon to Santee.

Davra will support this new line across all its applications & services.

Business Objectives

The Copper Line runs on some single line sections of track and across busy road intersections that can introduce delays to services that ripple down the whole network. By terminating Green & Orange services at El Cajon, they remove this less predictable section of track and can ensure better on-time service for Green & Orange line users.

Assumptions

- SDMTS will supply a new GTFS that will implement the Copper Line services as a new GTFS route_id, running a distinct set of train numbers (block_ids).
- SDMTS will provide the CCU route codes that will be used for this new route.
- Copper Line services will start/end from a new stop at El Cajon which:
  - Will be a new stop_id in the GTFS
  - Will have a distinct Daktronics service for digital signs, named consistent with existing conventions.
  - Will have a distinct RecipientGroup for audio announcements via SingleWire for digital signs, named consistent with existing conventions.

- Davra will provide a dedicated Development resource and a Project Manager to this project.
- SDMTS will provide a dedicated Project Manager to his project.
- SDMTS will provide all documentation and reports to Davra as required.
- Both parties will commit to weekly update and progress meetings.
- SDMTS will conduct UAT within the timeframe detailed below.

Dependencies

- *None*

Acceptance Criteria

- ETAs are no longer produced for arrival of Green & Orange lines at El Cajon. Departures on those lines show estimated time of departure based on the schedule (from GTFS).
- Trips on the new Copper Line show estimated times of departure from their originating stops, again based on the schedule. ETAs at intervening stops (Arnele & Gillespie Field) are accurate.
- All Davra applications identify the Copper Line as a distinct route.

Architectural Overview

Whilst these changes can seem fairly basic, they touch every single aspect of Davra's systems within SDMTS.

1. Technical Debt

- Move some key services to a new Docker-based deployment, including an updated GTFS Service.
- Deploy a new LRV Emulator service to facilitate testing of the new Copper Line and for use in future test scenarios.

2. Third-Party Integrations

- Daktronics - Create new endpoint service for new El Cajon Copper Line stop
- SingleWire - Create new RecipientGroup for new El Cajon Copper Line stop

3. Applications

The following applications will require updating:

- Train Mgt App
  - Add new route & stop to map
  - Update Trip Tracker view to include Copper Line
- ETA Viewer
  - New Copper Line & El Cajon stop
- PA Viewer
  - New Copper Line & El Cajon stop
- Reporter
  - New config of regions
  - Sched Acc Report - filter & breakdown into lines plus new El Cajon stop
  - Slow Con Heatmap - display new Copper Line & El Cajon stop on map
  - Slow Con Report - filter & breakdown into regions plus new El Cajon stop
  - LRV Ops Report - filter & breakdown into lines
- PA App
  - Add new Select Stations/Station Groups column for Copper Line. Edit Orange & Green stations.
  - Update East County Group to include new El Cajon stop
  - Update Station Status/Current Sign Text
  - Add new Stations Group "Copper Line"
  - PA App Service

4. Services

The following services will require updating:

- ETA Service
  - ETA Publisher - Support for new line & stop
  - ETA Baselines - Support for new line & stop
- RNS Handler
  - Trip Tracker - Support for Copper Line trips

Scope

In Scope

- Build features and functionality as per Architectural Overview section
- Deploy to Staging & Production platforms

Out of Scope

- *Nothing*

Change Requests

- Requests for changes beyond those defined in this SoW will require a Change Order Request. No additional services will be provided unless and until the Change Order Request is signed by both parties.

- Change Order Requests may affect the project schedule and project cost.

- Delays by third party vendors may impact the project schedule and may create applicable additional charges that will require a Change Order Request.

If the above defined project responsibilities are not met, additional fees may apply.

Training

- PA App & Train Management App User Guides will have minimal updates to reflect new screen layouts.
- Hand over to SDMTS users.

User Acceptance Testing

- SDMTS will conduct UAT within 2 weeks for final delivery. After which defects will resolved as part of the Davra Support Agreement.

Timeline & Milestones

The below table contains a summary of the expected Milestones, Deliverables and Schedule of the project.

Milestone & Deliverables	Planned Phase Conclusion Date
Initiation Project charter signoff Agree on resourcing plan Agree on UAT acceptance criteria Agree on milestones / high level timeline Schedule regular project meetings	June 2024
Definition Requirements Review Analysis & Design Design signoff by steering committee	June 2024
Execution Tech debt tasks Update third-party configs Update Applications Update Services Generate Baselines Update documentation Sign-off by steering committee	August 2024
Assessment Execution of UAT plan Documentation & Knowledge Transfer Trigger CRs as needed UAT completion signoff by steering committee	August 2024
Live Support handover	September 2024

Pricing for Professional Services

For the Services provided under this SoW, Davra estimated a total of **63** days at the standard SDMTS Rate of **$1,400** per day, a total of **$88,200.**

Payment Milestones

Payments will be made in **4** tranches based on Davra IDEAL process, as agreed with San Diego PM, Jason McNeil.:

- 30% upon completion of Initiation
- 30% upon completion of Definition
- 30% upon completion of Execution
- 10% upon completion of Assessment

Project shall commence as soon as PO has been received.

Locations

Davra will complete the platform development at the locations listed below:

- Davra R&D HQ in Dublin, Ireland

Contacts

Davra – Paul Glynn, paul.glynn@davra.com
SDMTS - Jason McNeil, Phone: 619-744-5940, Jason.McNeil@sdmts.com

Authorization

IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the date written below.

Sharon Cooney _____ August 12, 2024

San Diego Metropolitan Transit System Date

DocuSigned by:
Paul Glynn
4F5B64A599C04A1...

8/15/2024

Davra Date

Metropolitan Transit System

Amendment 2

January 16, 2025 MTS Doc No. G2795.2-24

RUBAN SOFTWARE MAINTENANCE AND DEVELOPMENT

Davra Networks USA Inc
Paul Glynn
Chief Executive Officer
440 North Wolfe Road
Sunnyvale, CA 94085

This shall serve as Amendment No.2 to the original agreement G2795.0-24 as further described below.

SCOPE

Pursuant to the Scope of Work, contractor shall provide RuBAN software development services for the trolley public address system Spanish language translation (Attachment A).

SCHEDULE

There shall be no change to the contract term due to this amendment.

PAYMENT

This contract amendment shall authorize additional costs not to exceed $176,400.00. The total value of this contract including this amendment shall be in the amount of $1,095,000.00. This amount shall not be exceeded without prior written approval from MTS.

Please sign and return a copy to the Contract Specialist at MTS. All other terms and conditions shall remain the same and in effect. Retain a copy for your records.

Sincerely,

Sharon Cooney, Chief Executive Officer

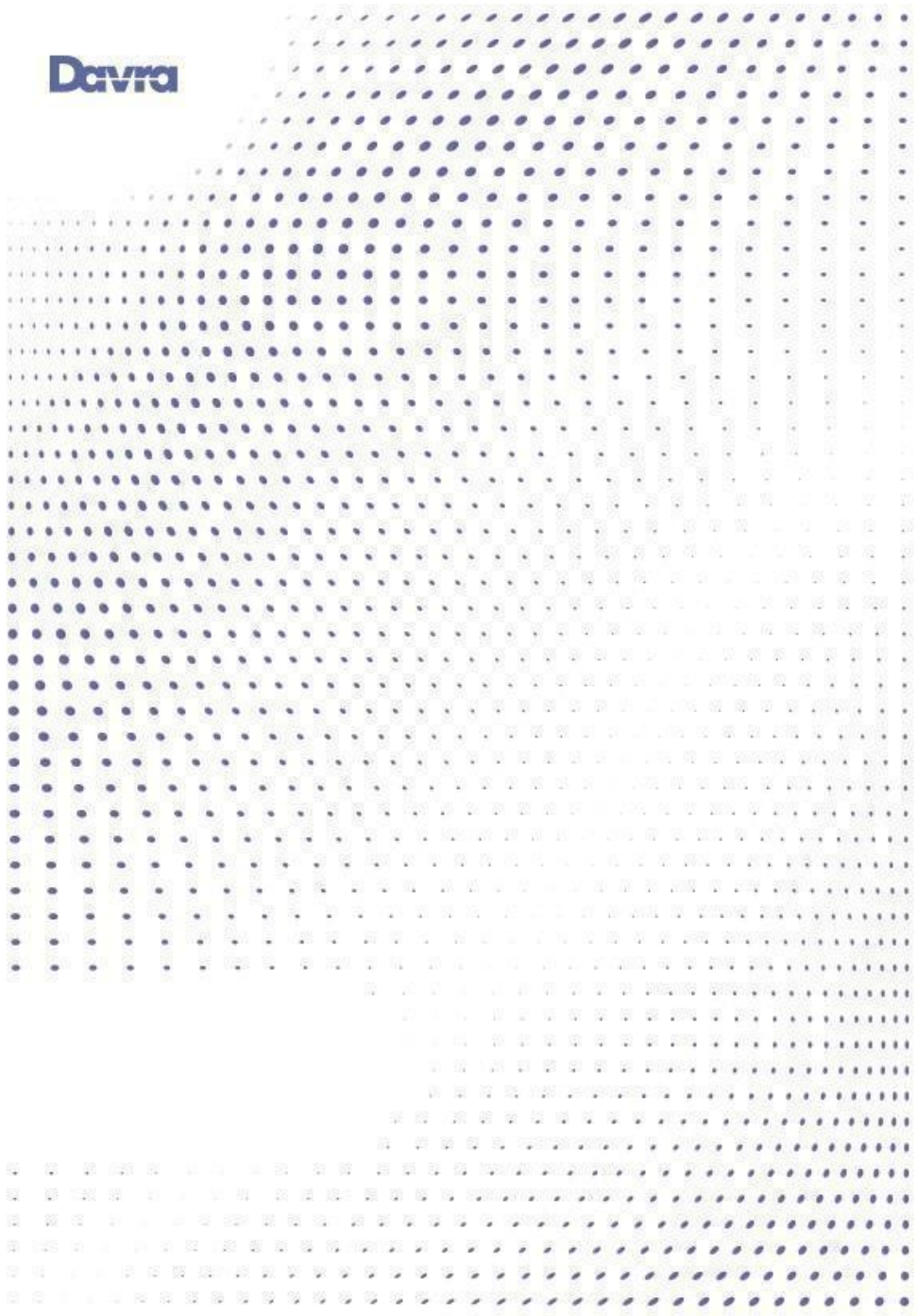
Agreed:

Paul Glynn, Chief Executive Officer
Davra Networks USA Inc

Date: _____

Attachment:

A. PA Spanish Support – Statement of Work Rev 1.6



SDMTS

PA Spanish Support - Statement of Work
Rev 1.6

December 2024

SDMTS-2024: PA Spanish Support

Customer Details

Company name: SDMTS
Contact name: Jason McNeil
Email address: jason.mcneil@sdmts.com
Mobile Number: 619-744-5940
Time Zone: PST

Summary

This SoW is for the addition of Spanish language support to the Davra SDMTS PA App.

This revision to the SoW considers the work required to support SingleWire InformaCast Fusion rather than using PlayHT. It includes the impact on the existing Davra PA App when SDMTS migrate from InformaCast Advanced [ICAdvanced] to InformaCast Fusion [ICFusion].

Business Objectives

Announcements can be specified in English and automatically translated to Spanish which will then be display on signs or converted to speech and played on speakers in tandem with the English language message.

Significantly better text-to-speech audio quality can be attained by moving from Cepstral (InformaCast Advanced's text-to-speech engine) to InformaCast Fusion. The additional features offered by ICFusion complement SDMTS' expanding communication requirements beyond the scope of this particular project.

Dependencies

- SDMTS will migrate their systems from ICAdvanced to ICFusion before any audio/TTS work undertaken by Davra.

Acceptance Criteria

- SDMTS users are able to send audio and/or text announcements using the PA App in English and, optionally, Spanish.

- Where more than one language is specified, messages will be relayed with sufficient gaps between each for SDMTS customers to comprehend announcements in either language.

Assumptions

- SDMTS will move away from the existing ICAdvanced which supports the Cepstral text-to-speech (TTS) system (English language TTS only) to ICFusion, for generation of both English & Spanish speech.
- SDMTS will be responsible for setting up & maintaining accounts with Google Translate and ICFusion including all associated costs.
- SDMTS will migrate to SingleWire ICFusion (and Davra will update PA App) prior to any work by Davra on Spanish audio support, the naming convention for RecipientGroups will be retained when moving to DeviceGroups.
- SDMTS are responsible for liasing with any third-party consumer of GTFS-realtime Alert data (for example AppSpace for Mid-Coast signs) to ensure they can handle multiple languages.
- Davra will provide a dedicated Development resource and a Project Manager to this project.
- SDMTS will provide a dedicated Project Manager to his project.
- SDMTS will provide all documentation and reports to Davra as required.
- Both parties will commit to weekly update and progress meetings.
- SDMTS will conduct UAT within the timeframe detailed below.

Application Requirements

- When making an announcement, have an option to ‘Include Spanish’:
    - *Ad-Hoc Announcements* - English text can then be translated to Spanish. The user will be shown both languages with an option to edit/correct the Spanish.
    - *Canned Announcements* - will have new predefined Spanish text with the same placeholders as English text for station name substitutions.
- Text messages:
    - *Scrolling* - will display a single scrolling string of English followed by Spanish. Repeat until message schedule ends.
    - *Full Page* - will display full page of English for fixed period followed by Spanish for fixed period. Repeat until message schedule ends.
- Audio messages:
    - Play English message and, once complete and after a short pause, play Spanish message. Once only.

Proposal

Currently audio announcements use ICAdvanced’s built-in third party tools from Cepstral. These can only handle English language text-to-speech conversion.

We propose migrating to ICFusion which SingleWire market as the successor to ICAdvanced: https://www.singlewire.com/blog/informacast-advanced-to-fusion

ICFusion also offers much improved text to speech conversion and can handle multiple languages. There is a clearly documented migration path from ICAdvanced to ICFusion and Davra already have experience of working with ICFusion.

Translation from English to Spanish will use Google Translate (cloud.google.com/translate) which provides reliable translation, even for longer messages. Generally, if translation errors do occur, the messages are still understandable and, in addition, we allow a user to correct the text before the message is sent.

Third Party Costs

We will use Google Translate for translation, SDMTS already has a Google account allowing them to avail of these services. SDMTS is a low volume user of audio messaging, so operational costs should stay low.

Costs for Basic API use (https://cloud.google.com/translate?hl=en#pricing):

- First 500,000 character per month, free
- For 500,000 to 1 billion characters, $20 per million characters per month

Two options have been proposed for English to Spanish translation:

1. Provide a “Translate” button that the user will hit once they have entered the English text, the text is then sent to Google for translation, minimising translation costs.
2. “Real-time” translation whereby every time a user enters a new word, the text is sent for translation, which incurs a cumulative character cost in Google translation.

The second option was chosen and the examples below give an indication of that Google Translate costs by detailing the number of characters in the example message (that is, number of characters that would be sent for translation using option #1) together with the cumulative number of characters that would be sent for tranlsation using option #2.

Example Messages & Costs (Google Translate)

Consider the following typical message:

“No trolleys between 12th & Imperial Transit Center and Beyer Boulevard. Refer to MTS staff or in-station signage for alternatives.”

This message has 131 characters, 20 words and 1317 cumulative characters in translation option #2. Under option #2, if sent 100 times it would consume 131,700 of the 500,000 characters per month allowance.

Here is an example of a longer message:

“Please have Trolley fares ready to show to MTS security at bottom of ramp. If you do not have a fare, please purchase one at ticket vending machine on platform. Avoid long lines after the game and add enough value to PRONTO cards/app now for return trip. Last return trip towards Old Town and downtown San Diego is 12:37am; last return trip to SDSU is 12:07; last return trip to Santee, El Cajon, and other stations east of SDSU will be 45 minutes after event ends”

This message has 464 characters, 87 words and around 19,600 cumulative characters in translation option #2. Under option #2, if sent 25 times it would consume nearly all (490,000 of 500,000) of the characters per month allowance.

NOTE: Due to restrictions within the current PA system, a message will be translated only once but TTS conversion will be applied every time the message is played. To prevent those multiple TTS conversions would significantly increase the scope of this proposal.

Architectural Overview

The solution will work within the existing Davra SDMTS PA System and will consists of:

- Updated PA App Client UI
- Updated PA App Service
- Updated generic *announceAPI* for audio & text messaging
- Updated Daktronics Handler for *announceAPI*
- New SingleWire ICFusion Handler, based on the existing ICAdvanced handler but interacting with the new API/object model and handling concurrent multiple language announcements.

1. PA App Client

- Create Announcements:
  When creating an announcement, add new checkbox 'Include Spanish' next to 'Visual Only' radio button. New layout beneath:
  - For Canned Messages:
    - 'Message Text' section will move left, underneath 'Canned Messages' selection.
    - A second Sign Preview will appear underneath the current English sign, the second showing Spanish preview.

  - For Ad-Hoc Messages:
    - A second text box will be displayed under the English language box. Any English text entered will be automatically translated to Spanish in the second box when a new word has been entered or there is any pause in typing.
    - A second Sign Preview will appear underneath the current English sign, the second showing Spanish preview.
    - User can correct the Spanish translation but if any changes are made to the English text after translation, the Spanish text box will revert to the translation provided by Google and may need correcting again.

  - Manage Announcements, Current Sign Text & Logs Panels: Display all languages

2. PA App Service

- New API for calling out to Google Translate
- Update calls to *announceAPI*

3. *announceAPI* Service

- Migrate *announceAPI* Services to new Docker-based Davra Services
- Improved API to handlers
- Generic 'message duration' to estimate playback/read time based on message length (configurable)

4. *announceAPI* Daktronics Handler Service

- Generic solution to display multiple languages (for both Scrolling & Full Page message types)
  - Convert to hybrid synchronous/asynchronous, timer-based approach
  - Trigger upon ‘send’
  - Improved ‘clear’ processing to cancel related timers

5. New *announceAPI* SingleWire ICFusion Handler Service

- Migration of existing Davra system to support ICFusion.
- A new service that will support ICFusion integration.
- Update config format to support multiple languages & delivery mechanisms
- Play each language with a suitable pause between each:
  - Create pre-defined Notification to use for all messages
  - Allow length of audio file plus a configurable pause between successive announcements in each language

6. GTFS-rt Service

- Ensure Alerts filled for each language
- Ensure ‘clear’ processed for each language

Scope

In Scope

- Build features and functionality as per Application Requirements section
- Deploy to Staging & Production platforms

Out of Scope

- SDMTS will be responsible for setting up & maintaining accounts with Google Translate.

Change Requests

- Requests for changes beyond those defined in this SoW will require a Change Order Request. No additional services will be provided unless and until the Change Order Request is signed by both parties.

- Change Order Requests may affect the project schedule and project cost.

- Delays by third party vendors may impact the project schedule and may create applicable additional charges that will require a Change Order Request.

If the above defined project responsibilities are not met, additional fees may apply.

Training

- PA App User Guide will be updated describing the new multi-language support.
- Hand over to SDMTS users.

User Acceptance Testing

- SDMTS will conduct UAT within 2 weeks for final delivery. After which defects will resolved as part of the Davra Support Agreement.

Timeline & Milestones

The below table contains a summary of the expected Milestones, Deliverables and Schedule of the project.

NOTE: Dates here are indicative and will be clarified once SoW has been accepted and planned.

Milestone & Deliverables	Planned Phase Conclusion Date
Initiation Project charter signoff Agree on resourcing plan Agree on UAT acceptance criteria Agree on milestones / high level timeline Schedule regular project meetings	February 2025
Definition Requirements Review Analysis & Design Design signoff by steering committee	March 2025
Execution PA App Client Updates PA App Service Updates announceAPI Service Updates New SingleWire ICFusion Handler Daktronics Handler Updates GTFS-rt Service Updates Sign-off by steering committee	April 2025
Assessment Execution of UAT plan Documentation & Knowledge Transfer Trigger CRs as needed UAT completion signoff by steering committee	May 2025
Live Support handover	June 2025

Pricing for Professional Services

For the Services provided under this SoW, Davra estimated a total of **126** days at the standard SDMTS Rate of **$1,400** per day, a total of **$176,400.**

Payment Milestones

Payments will be made in **4** tranches based on Davra IDEAL process, as agreed with San Diego PM, Jason McNeil.:

- 30% upon completion of Initiation
- 30% upon completion of Definition
- 30% upon completion of Execution
- 10% upon completion of Assessment

Locations

Davra will complete the platform development at the locations listed below:

- Davra R&D HQ in Dublin, Ireland

Contacts

Davra – Paul Glynn, paul.glynn@davra.com
SDMTS - Jason McNeil, Phone: 619-744-5940, Jason.McNeil@sdmts.com

Authorization

IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the date written below.

_____ _____
SDMTS Date

_____ _____
Davra Date

Metropolitan Transit System

Agenda Item No. 6

MEETING OF THE SAN DIEGO METROPOLITAN TRANSIT SYSTEM
BOARD OF DIRECTORS

January 16, 2025

SUBJECT:

Dissolution of Security and Passenger Safety Community Advisory Group

RECOMMENDATION:

That the San Diego Metropolitan Transit System (MTS) Board of Directors approve the dissolution of the Security and Passenger Safety Community Advisory Group.

Budget Impact

None.

DISCUSSION:

In July 2021, the MTS Board of Directors approved the guidelines of the Security and Passenger Safety Community Advisory Group (CAG). The CAG was created as an advisory group to the Public Security Committee to provide feedback related to security and passenger safety practices throughout the MTS system. The CAG membership includes sixteen (16) voting members, comprised of the following representatives: transit riders, youth/young adults, a senior community advocate, educators with a primary study focus on public safety, a business/tourism professional, a social service professional, a public safety professional, a disabled community advocate, community advocacy group members, and a representative from the Regional Task Force on the Homeless. CAG guidelines noted that regular meetings shall take place at least three times per year and would be subject to the provisions of the Ralph M. Brown Act, California Government Code, Section 54950, et. seq.

During the past three years, the CAG has met a total of six times (four meetings in 2022, two meetings in 2023, and no meetings in 2024). Staff have consistently experienced challenges with establishing a quorum of CAG members to host meetings. Due to impacted schedules and the requirements to follow Brown Act rules (e.g. attending meetings in-person at MTS headquarters), members have often expressed their inability to attend and participate. Due to low participation and interest, staff is recommending the dissolution of the CAG.

As an alternative to the formalized CAG, staff would integrate the CAG discussions and topics into the established Community Advisory Committee (CAC) meetings. The CAC was established during MTS's Elevate SD 2020 initiative and includes a broad membership of public participants and community groups. The CAC is an ad-hoc committee and is not required to

follow Brown Act provisions, which results in more flexibility and participation in meetings. This includes the ability to host virtual meetings to discuss and accept feedback on various MTS projects and initiatives.

Staff consulted with and obtained approval from the Chair of the MTS Public Security Committee to recommend this alternative approach to the MTS Board of Directors for consideration. If approved, the CAG will be formally dissolved, and the discussion topics of the CAG will be integrated into future CAC meetings to allow for more inclusive and flexible opportunities for the public to participate in discussing MTS security and passenger safety-related issues.

Therefore, staff recommends the MTS Board of Directors approve the dissolution of the Security and Passenger Safety Community Advisory Group.

/S/ Sharon Cooney
Sharon Cooney
Chief Executive Officer

Key Staff Contact: Mark Olson, 619.557.4588, mark.olson@sdmts.com

Metropolitan Transit System

Agenda Item No. 7

MEETING OF THE SAN DIEGO METROPOLITAN TRANSIT SYSTEM
BOARD OF DIRECTORS

January 16, 2025

SUBJECT:

Operations Budget Status Report for November 2024

INFORMATIONAL ONLY

Budget Impact

None.

DISCUSSION:

This report summarizes the year-to-date operating results for November 2024 compared to the Fiscal Year (FY) 2025 budget for the San Diego Metropolitan Transit System (MTS). Attachment A-1 combines the operations', administrations', and other activities' results for November 2024. Attachment A-2 details the November 2024 combined operations' results and Attachments A-3 to A-7 present budget comparisons for each MTS operation. Attachment A-8 details budget comparisons for MTS Administration, and Attachment A-9 provides November 2024 results for MTS's other activities (For Hire Vehicle Administration (FHV)/San Diego and Arizona Eastern Railway Company (SD&AE)).

MTS NET-OPERATING SUBSIDY RESULTS

As indicated within Attachment A-1, for the year-to-date period ending November 2024, MTS's net-operating income favorable variance totaled $2,707,000 (2.0%). Operations produced a $2,395,000 (1.8%) favorable variance and the administrative/other activities areas were favorable by $312,000.

MTS COMBINED RESULTS

Operating Revenues Year-to-date combined revenues through November 2024 were $45,281,000, compared to the year-to-date budget of $45,483,000, representing a $202,000 (-0.4%) unfavorable variance. Year-to-date passenger revenue was unfavorable by $284,000 (-0.9%) through November. Passenger revenue is up by $2,096,000 (7.0%) versus the prior year. Ridership is up by 3,354,000 (13.6%) passengers versus the prior year.

Other operating revenue was favorable by $83,000 (0.6%), primarily due to favorable interest income and energy credit revenue.

Operating Expenses Year-to-date combined expenses through November 2024 were $180,863,000, compared to the budget of $183,771,000, representing a $2,909,000 (1.6%) favorable variance.

Personnel Costs Year-to-date personnel-related costs totaled $79,387,000, compared to a budgetary figure of $81,341,000, producing a favorable variance of $1,954,000 (2.4%). This is primarily due to favorable health and welfare costs and defined contribution pension plan costs for represented Bus employees. Security wages within Administration and Flag-person wages within Trolley are favorable as well.

Outside Services and Purchased Transportation Total outside services through five months of the fiscal year totaled $65,669,000, compared to a budget of $64,780,000, resulting in an unfavorable variance of $890,000 (-1.4%). This is primarily due to unfavorable purchased transportation costs and engine/transmission repairs within Fixed Route Operations.

Materials and Supplies Total year-to-date materials and supplies expenses were $8,280,000, compared to a budgetary figure of $8,337,000, resulting in a favorable variance of $57,000 (0.7%). This is primarily due to favorable revenue vehicle parts and maintenance supplies within Bus Operations.

Energy Total year-to-date energy costs were $19,619,000, compared to the budget of $21,604,000, resulting in a favorable variance of $1,985,000 (9.2%). This is primarily due to favorable commodity rates for both compressed natural gas (CNG) and electricity.

Risk Management Total year-to-date expenses for Risk Management were $4,049,000 compared to the budget of $4,207,000, resulting in a favorable variance totaling $158,000 (3.8%). This is primarily favorable due to claims payouts and recoveries within Administrative, Bus and Rail Operations.

General and Administrative The year-to-date general and administrative costs were $2,899,000 through November 2024, compared to a budget of $2,606,000, resulting in an unfavorable variance of $293,000 (-11.2%). This is primarily due to unfavorable office equipment due to handheld unit purchases for Security within Administration.

Vehicle and Facility Leases The year-to-date vehicle and facilities leases costs were $959,000 compared to the budget of $896,000, resulting in a $63,000 (-7.0%) unfavorable variance. This is primarily due to radio tower leases within Rail Operations.

YEAR-TO-DATE SUMMARY

The November 2024, year-to-date net-operating income totaled a favorable variance of $2,707,000 (2.0%). These factors include favorable variances in other revenue, personnel, materials and supplies, energy, and risk management; partially offset by unfavorable variances in passenger revenue, outside services, general and administrative costs, and vehicle/facility lease costs.

/S/ Sharon Cooney
Sharon Cooney
Chief Executive Officer

Key Staff Contact: Mark Olson, 619.557.4588, mark.olson@sdmts.com

Attachment: A. Comparison to Budget

SAN DIEGO METROPOLITAN TRANSIT SYSTEM

MTS
CONSOLIDATED

COMPARISON TO BUDGET - FISCAL YEAR 2025
NOVEMBER 30, 2024
(in $000's)

	YEAR TO DATE			
	ACTUAL	**BUDGET**	**VARIANCE**	**VAR. %**
Passenger Revenue	$ 32,110	$ 32,394	$ (284)	-0.9%
Other Revenue	13,171	13,089	83	0.6%
Total Operating Revenue	**$ 45,281**	**$ 45,483**	**$ (202)**	**-0.4%**
Personnel costs	$ 79,387	$ 81,341	$ 1,954	2.4%
Outside services	65,669	64,780	(890)	-1.4%
Materials and supplies	8,280	8,337	57	0.7%
Energy	19,619	21,604	1,985	9.2%
Risk management	4,049	4,207	158	3.8%
General & administrative	2,899	2,606	(293)	-11.2%
Vehicle/facility leases	959	896	(63)	-7.0%
Administrative Allocation	(0)	0	0	0.0%
Total Operating Expenses	**$ 180,863**	**$ 183,771**	**$ 2,909**	**1.6%**
Operating Income (Loss)	**$ (135,582)**	**$ (138,289)**	**$ 2,707**	**2.0%**
Total Non-Operating Activities	**133**	**373**	**(240)**	**-64.3%**
Income (Loss) before Capital Contributions	**$ (135,448)**	**$ (137,915)**	**$ 2,467**	**-1.8%**

SAN DIEGO METROPOLITAN TRANSIT SYSTEM

OPERATIONS
CONSOLIDATED

COMPARISON TO BUDGET - FISCAL YEAR 2025
NOVEMBER 30, 2024
(in $000's)

	YEAR TO DATE			
	ACTUAL	**BUDGET**	**VARIANCE**	**VAR. %**
Passenger Revenue	$ 32,110	$ 32,394	$ (284)	-0.9%
Other Revenue	769	758	11	1.5%
Total Operating Revenue	**$ 32,879**	**$ 33,152**	**$ (273)**	**-0.8%**
Personnel costs	$ 65,271	$ 66,525	$ 1,253	1.9%
Outside services	53,887	53,282	(605)	-1.1%
Materials and supplies	8,267	8,312	45	0.5%
Energy	19,063	21,051	1,989	9.4%
Risk management	3,656	3,702	46	1.2%
General & administrative	485	484	(1)	-0.1%
Vehicle/facility leases	781	722	(60)	-8.3%
Administrative Allocation	15,793	15,793	(0)	0.0%
Total Operating Expenses	**$ 167,203**	**$ 169,871**	**$ 2,668**	**1.6%**
Operating Income (Loss)	**$ (134,324)**	**$ (136,719)**	**$ 2,395**	**1.8%**
Total Non-Operating Activities	**133**	**373**	**(240)**	**-64.3%**
Income (Loss) before Capital Contributions	**$ (134,191)**	**$ (136,345)**	**$ 2,155**	**-1.6%**

SAN DIEGO METROPOLITAN TRANSIT SYSTEM

OPERATIONS
BUS - DIRECTLY OPERATED (SAN DIEGO TRANSIT CORP.)
COMPARISON TO BUDGET - FISCAL YEAR 2025
NOVEMBER 30, 2024
(in $000's)

	YEAR TO DATE			
	ACTUAL	**BUDGET**	**VARIANCE**	**VAR. %**
Passenger Revenue	$ 8,339	$ 8,419	$ (80)	-1.0%
Other Revenue	16	21	(5)	-25.4%
Total Operating Revenue	**$ 8,355**	**$ 8,440**	**$ (86)**	**-1.0%**
Personnel costs	$ 40,281	$ 41,156	$ 876	2.1%
Outside services	800	938	138	14.7%
Materials and supplies	3,097	3,218	121	3.8%
Energy	3,083	3,646	563	15.4%
Risk management	1,401	1,495	94	6.3%
General & administrative	219	251	32	12.8%
Vehicle/facility leases	255	238	(17)	-7.3%
Administrative Allocation	2,437	2,437	0	0.0%
Total Operating Expenses	**$ 51,573**	**$ 53,380**	**$ 1,808**	**3.4%**
Operating Income (Loss)	**$ (43,218)**	**$ (44,940)**	**$ 1,722**	**3.8%**
Total Non-Operating Activities	**-**	**115**	**(115)**	**-**
Income (Loss) before Capital Contributions	**$ (43,218)**	**$ (44,825)**	**$ 1,607**	**-3.6%**

SAN DIEGO METROPOLITAN TRANSIT SYSTEM

OPERATIONS
RAIL (SAN DIEGO TROLLEY INC.)

COMPARISON TO BUDGET - FISCAL YEAR 2025
NOVEMBER 30, 2024
(in $000's)

	YEAR TO DATE			
	ACTUAL	**BUDGET**	**VARIANCE**	**VAR. %**
Passenger Revenue	$ 13,271	$ 13,626	$ (355)	-2.6%
Other Revenue	753	737	16	2.2%
Total Operating Revenue	**$ 14,024**	**$ 14,363**	**$ (339)**	**-2.4%**
Personnel costs	$ 24,592	$ 25,020	$ 428	1.7%
Outside services	5,327	5,115	(212)	-4.1%
Materials and supplies	5,094	5,070	(24)	-0.5%
Energy	12,206	12,949	743	5.7%
Risk management	2,240	2,191	(48)	-2.2%
General & administrative	262	223	(39)	-17.6%
Vehicle/facility leases	373	332	(41)	-12.3%
Administrative Allocation	12,104	12,104	0	0.0%
Total Operating Expenses	**$ 62,199**	**$ 63,006**	**$ 807**	**1.3%**
Operating Income (Loss)	**$ (48,175)**	**$ (48,643)**	**$ 468**	**1.0%**
Total Non-Operating Activities	**-**	**125**	**(125)**	**-**
Income (Loss) before Capital Contributions	**$ (48,175)**	**$ (48,518)**	**$ 343**	**-0.7%**

SAN DIEGO METROPOLITAN TRANSIT SYSTEM

OPERATIONS
BUS - CONTRACTED SERVICES (FIXED ROUTE)
COMPARISON TO BUDGET - FISCAL YEAR 2025
NOVEMBER 30, 2024
(in $000's)

	YEAR TO DATE			
	ACTUAL	**BUDGET**	**VARIANCE**	**VAR. %**
Passenger Revenue	$ 9,854	$ 9,712	$ 142	1.5%
Other Revenue	-	-	-	-
Total Operating Revenue	**$ 9,854**	**$ 9,712**	**$ 142**	**1.5%**
Personnel costs	$ 304	$ 270	$ (34)	-12.8%
Outside services	39,645	39,107	(538)	-1.4%
Materials and supplies	76	23	(52)	-223.7%
Energy	3,324	3,919	595	15.2%
Risk management	-	-	-	-
General & administrative	3	5	2	33.4%
Vehicle/facility leases	11	9	(2)	-21.8%
Administrative Allocation	1,024	1,024	(0)	0.0%
Total Operating Expenses	**$ 44,388**	**$ 44,357**	**$ (30)**	**-0.1%**
Operating Income (Loss)	**$ (34,533)**	**$ (34,645)**	**$ 112**	**0.3%**
Total Non-Operating Activities	**-**	**-**	**-**	**-**
Income (Loss) before Capital Contributions	**$ (34,533)**	**$ (34,645)**	**$ 112**	**-0.3%**

SAN DIEGO METROPOLITAN TRANSIT SYSTEM

OPERATIONS
BUS - CONTRACTED SERVICES (PARATRANSIT)
COMPARISON TO BUDGET - FISCAL YEAR 2025
NOVEMBER 30, 2024
(in $000's)

	YEAR TO DATE			
	ACTUAL	**BUDGET**	**VARIANCE**	**VAR. %**
Passenger Revenue	$ 645	$ 636	$ 9	1.5%
Other Revenue	-	-	-	-
Total Operating Revenue	**$ 645**	**$ 636**	**$ 9**	**1.5%**
Personnel costs	$ 95	$ 78	$ (16)	-20.7%
Outside services	7,981	7,989	7	0.1%
Materials and supplies	-	-	-	-
Energy	449	536	88	16.3%
Risk management	15	15	0	0.3%
General & administrative	0	5	5	96.7%
Vehicle/facility leases	143	143	0	0.1%
Administrative Allocation	227	227	(0)	0.0%
Total Operating Expenses	**$ 8,910**	**$ 8,994**	**$ 84**	**0.9%**
Operating Income (Loss)	**$ (8,265)**	**$ (8,358)**	**$ 93**	**1.1%**
Total Non-Operating Activities	**-**	**-**	**-**	**-**
Income (Loss) before Capital Contributions	**$ (8,265)**	**$ (8,358)**	**$ 93**	**-1.1%**

SAN DIEGO METROPOLITAN TRANSIT SYSTEM

OPERATIONS
CORONADO FERRY

COMPARISON TO BUDGET - FISCAL YEAR 2025
NOVEMBER 30, 2024
(in $000's)

	YEAR TO DATE			
	ACTUAL	**BUDGET**	**VARIANCE**	**VAR. %**
Passenger Revenue	$ -	$ -	$ -	-
Other Revenue	-	-	-	-
Total Operating Revenue	**$ -**	**$ -**	**$ -**	**-**
Personnel costs	$ -	$ -	$ -	-
Outside services	133	133	-	0.0%
Materials and supplies	-	-	-	-
Energy	-	-	-	-
Risk management	-	-	-	-
General & administrative	-	-	-	-
Vehicle/facility leases	-	-	-	-
Administrative Allocation	-	-	-	0.0%
Total Operating Expenses	**$ 133**	**$ 133**	**$ -**	**0.0%**
Operating Income (Loss)	**$ (133)**	**$ (133)**	**$ -**	**0.0%**
Total Non-Operating Activities	**133**	**133**	**-**	**0.0%**
Income (Loss) before Capital Contributions	**$ -**	**$ -**	**$ -**	**-**

SAN DIEGO METROPOLITAN TRANSIT SYSTEM

ADMINISTRATION
CONSOLIDATED

COMPARISON TO BUDGET - FISCAL YEAR 2025
NOVEMBER 30, 2024
(in $000's)

	YEAR TO DATE			
	ACTUAL	**BUDGET**	**VARIANCE**	**VAR. %**
Passenger Revenue	$ -	$ -	$ -	-
Other Revenue	12,241	12,156	85	0.7%
Total Operating Revenue	**$ 12,241**	**$ 12,156**	**$ 85**	**0.7%**
Personnel costs	$ 13,874	$ 14,536	$ 662	4.6%
Outside services	11,777	11,471	(306)	-2.7%
Materials and supplies	13	25	12	47.6%
Energy	555	549	(6)	-1.1%
Risk management	363	458	95	20.7%
General & administrative	2,370	2,075	(295)	-14.2%
Vehicle/facility leases	169	172	3	1.8%
Administrative Allocation	(15,800)	(15,800)	0	0.0%
Total Operating Expenses	**$ 13,322**	**$ 13,486**	**$ 164**	**1.2%**
Operating Income (Loss)	**$ (1,081)**	**$ (1,330)**	**$ 249**	**18.7%**
Total Non-Operating Activities	**-**	**-**	**-**	**-**
Income (Loss) before Capital Contributions	**$ (1,081)**	**$ (1,330)**	**$ 249**	**-18.7%**

SAN DIEGO METROPOLITAN TRANSIT SYSTEM

OTHER ACTIVITIES
CONSOLIDATED

COMPARISON TO BUDGET - FISCAL YEAR 2025
NOVEMBER 30, 2024
(in $000's)

	YEAR TO DATE			
	ACTUAL	**BUDGET**	**VARIANCE**	**VAR. %**
Passenger Revenue	$ -	$ -	$ -	-
Other Revenue	162	175	(13)	-7.4%
Total Operating Revenue	**$ 162**	**$ 175**	**$ (13)**	**-7.4%**
Personnel costs	$ 242	$ 281	$ 39	13.9%
Outside services	5	26	21	79.7%
Materials and supplies	-	0	0	-
Energy	2	4	2	51.0%
Risk management	30	47	17	36.0%
General & administrative	44	47	4	7.5%
Vehicle/facility leases	9	3	(6)	-243.3%
Administrative Allocation	7	7	(0)	0.0%
Total Operating Expenses	**$ 339**	**$ 415**	**$ 76**	**18.4%**
Operating Income (Loss)	**$ (177)**	**$ (240)**	**$ 64**	**26.4%**
Total Non-Operating Activities	**-**	**-**	**-**	**-**
Income (Loss) before Capital Contributions	**$ (177)**	**$ (240)**	**$ 64**	**-26.4%**

Agenda Item No. 8

MEETING OF THE SAN DIEGO METROPOLITAN TRANSIT SYSTEM
BOARD OF DIRECTORS

January 16, 2025

SUBJECT:

Additional Staffing – One (1) Accounting Supervisor and One (1) Staff Accountant II

RECOMMENDATION:

That the San Diego Metropolitan Transit System (MTS) Board of Directors authorize the Chief Executive Officer (CEO) to add one (1) Accounting Supervisor and one (1) additional Staff Accountant II to the position tables previously approved in the Fiscal Year 2025 operating budget.

Budget Impact

The Accounting Supervisor will be in Salary Grade #9 ($72,303 - $102,671), and the Staff Accountant II will be in Salary Grade #8 ($66,333 - $94,193).

DISCUSSION:

The primary functions of the Finance department are accounting, accounts receivable, accounts payable, payroll, cash receipts, and cash management. The department is also responsible for budget preparation, capital assets, all external audits and all financial reporting.

Over the past several years, MTS has expanded its service operations to include several Bus Rapid Transit (BRT) routes as well as the Mid-Coast Trolley extension. Given these routes are funded with TransNet funding, special accounting requirements are necessary for this funding source.

With these service expansions, and the continued modernization of our bus and trolley vehicles, including the transition to a fully electric fleet, MTS' inventory has ratably increased over the past five years. This increase in inventory has a direct impact on the accounting department including vendor management within MTS's accounting system and an increase in the volume of payment processing.

In addition, with the mandated implementation of Governmental Accounting Standard Board (GASB) 87 for Leases and GASB 96 for Software Based Information Technology Arrangements (SBITAs), MTS had to purchase a standalone niche leasing / accounting system to track these

assets, liabilities, receivables and deferred inflows each month, as well as compiling the necessary information to disclose in the notes to the financial statements at year end.

Further, with the launch of the PRONTO fare collection system in 2021, MTS had to purchase an additional accounting system to directly integrate with the INIT system. Lastly, with the implementation of additional PRONTO functional enhancements for our customers, including fare capping, open payment, and institutional portal opportunities, daily accounting processes are required.

With these changes and enhancements, MTS is recommending hiring an Accounting Supervisor that will supervise both accounts payable and accounts receivable, allowing the Accounting Manager to focus more time on general ledger accounting. MTS is also proposing to hire an additional Staff Accountant II. This will allow the accounting department to have more cross training, meet all mandated deadlines and continue to support other departments for project collaboration.

Therefore, Staff recommends that the MTS Board of Directors authorize the CEO to add one (1) Accounting Supervisor and one (1) additional Staff accountant II to the position tables previously approved in the FY 2025 Operating Budget.

/S/ Sharon Cooney
Sharon Cooney
Chief Executive Officer

Key Staff Contact: Julia Tuer, 619.557.4515, Julia.Tuer@sdmts.com

Metropolitan Transit System

Agenda Item No. 9

MEETING OF THE SAN DIEGO METROPOLITAN TRANSIT SYSTEM
BOARD OF DIRECTORS

January 16, 2025

SUBJECT:

Board Policy No. 9: Relocation Assistance Program – Policy Revisions

RECOMMENDATION:

That the San Diego Metropolitan Transit System (MTS) Board of Directors approve revisions to Board Policy No. 9 (Relocation Assistance Program) shown in Attachment A and B.

Budget Impact

None. Relocation benefits owed are determined by state and federal law. Today's action simply updates the applicable Board Policy to comply with current law.

DISCUSSION:

Relocation assistance is a program established by federal and state law to provide help to individuals, families, businesses, farm operations, and nonprofit organizations required to relocate because of a public improvement project. The program's primary objective is to assist all project displaced so that they do not suffer disproportionate injury because of projects constructed for the benefit of the public as a whole.

MTS Board Policy No. 9 summarizes MTS's Relocation Assistance Program. A recent review of the policy showed that it had not been revised for twenty-one (21) years – since January 2004. The policy is therefore outdated and contains monetary limits of relocation benefits that are not consistent with state and federal law. Today's proposed action would revise Board Policy No. 9 to more generally describe the types of benefits available and to cross-reference the applicable statutes and regulations instead of including specific dollar limits. A clean copy of the proposed new policy is shown in Attachment A. A redline version showing the changes from the 2004 policy to the proposed new policy is shown in Attachment B.

Therefore, staff recommend that the MTS Board of Directors approve revisions to Board Policy No. 9 (Relocation Assistance Program) shown in Attachment A and B.

/S/ Sharon Cooney
Sharon Cooney
Chief Executive Officer

Key Staff Contact: Mark Olson, 619.557.4588, mark.olson@sdmts.com

Attachment: A. Proposed New Board Policy No. 9 (Relocation Assistance Program)
B. Redline Version comparing 1/29/2004 version to Attachment A

Metropolitan Transit System

Policies and Procedures No. 9

Board Approval: 1/16/2025

SUBJECT:

RELOCATION ASSISTANCE PROGRAM

PURPOSE:

To provide relocation assistance to individuals, families, businesses, farm operations, and nonprofit organizations required to relocate as a result of San Diego Metropolitan Transit System (MTS) transit projects.

BACKGROUND:

Relocation assistance is a program established by federal and state law to provide help to individuals, families, businesses, farm operations, and nonprofit organizations required to relocate as a result of a public improvement project. The program's primary objective is to assist all project displacees so that they do not suffer disproportionate injury as a result of projects constructed for the benefit of the public as a whole.

POLICY:

1. Applicable Laws. Relocation assistance shall be in accordance with Sections 7260-7276 of the State Government Code (State Code) and the Federal Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended, 42 U.S.C. 4601 et seq. (Uniform Act), as applicable. The State Code and Uniform Act are collectively referred to as Regulations. To the extent applicable, MTS shall follow generally the procedures outlined in Chapter 10 (Relocation Assistance) of the Caltrans Right of Way Manual.

2. Entitlement to Relocation Benefits. No person will be required to relocate due to a proposed MTS construction project until:

   A. A replacement facility has been made available that meets the following standards:

      (1) Decent, safe, and sanitary.
      (2) Fair housing.
      (3) In areas not generally less desirable than the property to be acquired in regard to:

         a. Public utilities.
         b. Public and commercial facilities.

(4) Within the financial means of the displacee.
(5) Reasonably accessible to the displacee's place of employment, public services, and commercial facilities.
(6) Adequate to accommodate the displacee.
(7) In an equal or better neighborhood.
(8) Available on the market to the displacee.

B. In lieu of a replacement facility in subparagraph 2(A) above, the eligible owner or occupant agrees to accept a cash settlement as provided in the Regulations.

C. Moving Related Expenses. Moving and related payments will be paid as provided by the Regulations.

Individuals, businesses, and nonprofit organizations occupying the property to be acquired at the time of the first written offer to purchase and move as a result of the agency's acquisition will be eligible for reimbursement of moving expenses.

Residential occupants will receive either the actual reasonable costs involved in moving family and personal property up to a maximum of 50 miles or a payment based on a schedule relating to the size of their present dwelling based upon the Uniform Act's "Residential Moving Expense and Dislocation Allowance Payment Schedule" or other applicable law or regulation.

Businesses, farms, and nonprofit organizations will be entitled to reimbursement for: (1) actual reasonable costs involved in moving the operation and personal property up to a maximum of 50 miles; (2) actual reasonable expenses incurred in searching for a replacement property; and (3) actual direct losses of tangible property.

Payment in Lieu of Moving Expenses

Instead of accepting an actual moving expense payment, a business owner may be paid an amount equal to the average annual net earnings of the farm or business for the last two years prior to relocation subject to the limits set forth in the State Code or the Uniform Act, as applicable.

A business may qualify for an in-lieu payment if the agency determines that the business cannot be relocated without a substantial loss of the existing dollar volume of business, and it is not a part of a business having an additional establishment. A part-time individual or family occupation in the home that does not contribute materially to the income of the displaced owner is ineligible for an in-lieu payment.

D. Relocation Assistance Services. MTS may, pursuant to Government Code Section 7261.5, contract for the provisions of relocation assistance.

E. Appeal of MTS Determination of Relocation Eligibility and Payments.

If a displaced person (as defined in the Regulations) disagrees with MTS's decision as to their right to a relocation payment or the amount of payment, they may appeal the decision to MTS's Relocation Appeals Board that will be established by the Chief Executive Officer. The Appeals procedure will follow the appeals process set forth in the Regulations including 49 CFR Section 24.10. The displaced person shall file an appeal within sixty (60) days from the date they receive written notification of MTS's determination on their claim.

F. Reports to Board. All final relocation payments to owners or occupants for any purpose shall be formally reported to the Board as to amount, rationale, and applicable code or statute as part of the CEO Report.

3. Pre-Project Displacement Studies. Before any project may be undertaken that involves the displacement of people from residential housing, MTS or its agent shall complete a Replacement Housing Study to determine the needs of the relocatees and the availability of replacement housing. MTS studies shall serve to assure that orderly relocation can be accomplished and that realistic and adequate plans are developed for relocating all displaced persons. Comparable replacement dwellings shall be available or provided for each displaced person within a reasonable amount of time. Such assurance is a part of the MTS Relocation Assistance Program study process and must be specifically given on every project requiring displacement.

POLICY.9. RELOCATION ASSISTANCE PROGRAM

Original Policy approved on 9/11/78.
Policy revised on 4/16/79.
Policy revised on 8/27/79.
Policy revised on 7/28/80.
Policy revised on 9/8/80.
Policy revised on 2/7/85.
Policy revised/renumbered on 1/29/04.
Policy revised 1/16/2025.

Metropolitan Transit System

1255 Imperial Avenue, Suite 1000
San Diego, CA 92101-7490
619/231-1466
FAX 619/234-3407

Metropolitan Transit System

Policies and Procedures No. 9

SUBJECT: **Board Approval:** 1/29/0416/2025

SUBJECT:

RELOCATION ASSISTANCE PROGRAM

PURPOSE:

To provide relocation assistance to individuals, families, businesses, farm operations, and nonprofit organizations required to relocate as a result of San Diego Metropolitan Transit System (MTS) transit projects.

BACKGROUND:

Relocation assistance is a program that has been established by federal and state law to provide help to individuals, families, businesses, farm operations, and nonprofit organizations required to relocate as a result of a public improvement project. ItsThe program's primary objective is to assist all project displacees to the endso that they do not suffer disproportionate injury as a result of projects constructed for the benefit of the public as a whole.

POLICY:

1. Applicable Laws. Relocation assistance shall be in accordance with Sections 7260-7276 of the State Government Code (State Code) and the Federal Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended, 42 U.S.C. 4601 et seq. (Uniform Act), as applicable. The State Code and Uniform Act are collectively referred to as Regulations. To the extent applicable, MTS shall follow generally the procedures outlined in Chapter 10 (Relocation Assistance) of the Caltrans Right of Way Manual.

2. ~~That no~~Entitlement to Relocation Benefits. No person will be required to relocate due to a proposed MTS construction project until:

A. A replacement facility has been made available that meets the following standards:

(1) Decent, safe, and sanitary.
(2) Fair housing.
(3) In areas not generally less desirable than the property to be acquired in regard to:

a. Public utilities.
b. Public and commercial facilities.

(4) Within the financial means of the displacee.
(5) Reasonably accessible to the displacee's place of employment, public services, and commercial facilities.
(6) Adequate to accommodate the displacee.
(7) In an equal or better neighborhood.
(8) Available on the market to the displacee.

B. In lieu of a replacement facility in subparagraph 2(A) above, the eligible owner or occupant agrees to accept a cash settlement as provided ~~by state law~~in the Regulations.

C. Moving Related Expenses. Moving and related payments will be paid as provided by ~~state law~~the Regulations.

~~Moving-Related Expenses~~

Individuals, businesses, and nonprofit organizations occupying the property to be acquired at the time of the first written offer to purchase and move as a result of the agency's acquisition will be eligible for reimbursement of moving expenses.

Residential occupants will receive either the actual reasonable costs involved in moving family and personal property up to a maximum of 50 miles or a payment based on a schedule relating to the size of their present dwelling ~~not to exceed $500~~based upon the Uniform Act's "Residential Moving Expense and Dislocation Allowance Payment Schedule" or other applicable law or regulation.

Businesses, farms, and nonprofit organizations will be entitled to reimbursement for: (1) actual reasonable costs involved in moving the operation and personal property up to a maximum of 50 miles; (2) actual reasonable expenses incurred in searching for a replacement property; and (3) actual direct losses of tangible property.

Payment in Lieu of Moving Expenses

Instead of accepting an actual moving expense payment, a business owner may be paid an amount equal to the average annual net earnings of the farm or business for the last two years prior to relocation~~. The payment may not be less than $2,500 or more than $10,000.~~ subject to the limits set forth in the State Code or the Uniform Act, as applicable.

A business may qualify for an in-lieu payment if the agency determines that the business cannot be relocated without a substantial loss of the existing dollar volume of business, and it is not a part of a business having an additional establishment. A part-time individual or family occupation in the home that does not contribute materially to the income of the displaced owner is ineligible for an in-lieu payment.

~~D.~~ D. Relocation Assistance Services. MTS may, pursuant to Government Code Section 7261.5, contract for the provisions of relocation assistance ~~in connection with the San Diego Trolley system.~~.

E. Appeal of MTS ~~adopts the California Department of Transportation's (Caltrans') relocation assistance regulations set forth in Title 21, Chapter 2, Subchapter 2~~Determination of ~~the California Administrative Code, except as modified herein, as MTS's~~ Relocation ~~Assistance Program for all projects not covered by the Caltrans contract. The modifications to said program shall be as follows:~~

~~(1) The terms "Department of Transportation," "Department"~~Eligibility and ~~"State"~~ Payments.

If a displaced person (as ~~used~~defined in the ~~regulations shall mean the "San Diego Metropolitan Transit System (MTS)."~~

~~(2) The term "Director"~~Regulations) disagrees with MTS's decision as ~~used therein shall mean the "Chief Executive Officer (CEO)."~~

~~(3) The term "Highway Purposes" and provisions relating thereto shall be deleted.~~

~~(4) References~~ to ~~"State Highway System" shall be deleted.~~

~~(5) Section 1407.04(a) relating~~their right to ~~appeals shall be modified to read in its entirety as set forth below and shall apply to all MTS projects, including those for which a contractor has acted as the agent for conducting condemnation and relocation activities.~~

~~F. APPEAL PROCEDURE (REPLACING SECTION 1407.04(A))~~

~~(a) Appeals~~

~~(1) Any complainant, that is any person who believes himself aggrieved by the MTS CEO's determination as to~~

~~eligibility for~~ a relocation payment or the amount of ~~such~~ payment, ~~may have his application reviewed in accordance with the procedures set forth in Subsections (2) through (6).~~

~~(2) Any complainant may request MTS to provide him with a written explanation of its determination. MTS shall provide such an explanation to the complainant within three (3) weeks of its receipt of the request.~~

~~(3) All complainants shall be informed by MTS of their right to review.~~

~~(4) Any complainant desiring review pursuant to Subsections (5) and (6) shall make a request to MTS within six (6) months following the date specified in Subsection (d) of Section 1407.04 for applying for relocation payments.~~

~~(5) (a) Any complainant may request an informal oral presentation before seeking formal review. MTS shall afford any complainant the opportunity to make such presentation within fifteen (15) days of the request.~~

~~(b) The presentation shall be made to the CEO who shall have the authority to review the initial determination if he decides a revision is necessary. Within five (5) days of the oral presentation, the CEO shall notify the complainant of its decision.~~

~~(c) The right to formal review shall not be conditioned upon requesting an oral presentation.~~

~~(6) (a) Any complainant may make a written request for formal review by MTS. Such review shall be conducted by the Board of Directors of MTS (Board) who shall consider every request regardless of form.~~

~~(b) Notwithstanding the time limitations set forth in subsection (a)(4), a request for a formal review that follows an informal oral presentation shall be made either within the time limitations set forth in Subsection (a)(4) or within twenty (20) days of the oral presentation if the time for review has otherwise elapsed.~~

~~(c) The Board shall inform the complainant that~~ they ~~have the right to be represented by an attorney, to present his case by oral or documentary evidence, to submit rebuttal evidence, to conduct such cross-examination as may be required for a full and true disclosure of facts, and to seek judicial review once they have exhausted the review procedure set forth herein.~~

~~(d) The Board shall review and reconsider the initial determination of the complainant's case in light of:~~

~~(i) All material upon which the MTS CEO based his original determination, including all applicable rules and regulations, except that no evidence shall be relied upon where a complainant has been improperly denied an opportunity to controvert the evidence or cross-examine the witness.~~

~~(ii) The reasons given by the complainant for requesting review and reconsideration of the claim.~~

~~(iii) Any additional written or relevant documentary material submitted by the complainant.~~

~~(iv) Any further information that the Board in its discretion, obtains by request, investigation, or research, to ensure fair and full review of the claim.~~

~~(e) (i) The determination on review by the Board shall include, but is not limited to:~~

~~(a) the Board's~~ may appeal the decision ~~on reconsideration of the claim.~~

~~(b) the factual and legal basis upon which the decision rests, including any pertinent explanation or rationale.~~

~~(c) a statement to the~~ to MTS's Relocation Appeals Board that will be established by the Chief

Executive Officer. The Appeals procedure will follow the appeals process set forth in the Regulations including 49 CFR Section 24.10. The displaced person ~~that administrative remedies have been exhausted and judicial review may be sought.~~

~~(ii) The determination shall be in writing with a copy provided to the complainant.~~

~~(f) (i) The Board shall issue its determination of review as soon as possible but no later than six (6) weeks~~ shall file an appeal within sixty (60) days from ~~receipt of the last material submitted for consideration by the complainant or the date of hearing, whichever is greater~~the date they receive written notification of MTS's determination on their claim.

~~(ii) In the case of complaints dismissed for untimeliness or for any other reason not based on the merits of the claim, MTS shall furnish a written statement to the complainant stating the reason for the dismissal of the claim as soon as possible but no later than two (2) weeks from receipt of the last material submitted by the complainant or the date of the hearing, whichever is later.~~

~~(7) Except to the extent the confidentiality of material is protected by law or its disclosure is prohibited by law, the Board shall permit the complainant to inspect all files and records bearing upon his claim or the prosecution of the complainant's grievance. If a complainant is improperly denied access to any relevant material bearing on the claim, such material may not be relied upon in reviewing the initial determination.~~

~~(8) The principles established in all determinations by MTS shall be considered as precedent for all eligible persons in similar situations regardless of whether or not a person has filed a written request for review. All written determinations shall be kept on file and available for public review.~~

~~(9) Any aggrieved party has a right to representation by legal or other counsel at his expense at any and all stages of the proceedings set forth in these sections.~~

~~(10) If a complainant, other than the owner of a displaced advertising sign, seeks to prevent displacement, MTS shall~~

~~not require the complainant to move until at least twenty (20) days after it has made a determination and the complainant has had an opportunity to seek judicial review. In all cases, MTS shall notify the complainant in writing twenty (20) days prior to the proposed new date of displacement.~~

~~(11) Where more than one person is aggrieved by the failure of MTS to refer them to comparable permanent or adequate temporary replacement housing, the complainants may join in filing a single written request for review. A determination shall be made by MTS for each of the complainants.~~

~~(12) Nothing in this Subsection shall in any way preclude or limit a complainant from seeking judicial review of a claim upon exhaustion of such administrative remedies as are available under this Subsection.~~

~~3. That eligible owners and occupants will qualify for relocation assistance immediately after MTS adopts a "Resolution of Necessity." (Revised 8/27/79)~~

~~GUIDELINES:~~

~~A.~~ F. Reports to Board. All final relocation payments to owners or occupants for any purpose shall be formally reported to the Board as to amount, rationale, and applicable code or statute as part of the CEO Report.

3. Pre-Project Displacement Studies. Before any project may be undertaken that involves the displacement of people from residential housing, MTS or its agent shall complete a Replacement Housing Study to determine the needs of the relocatees and the availability of replacement housing. MTS studies shall serve to assure that orderly relocation can be accomplished and that realistic and adequate plans are developed for relocating all displaced persons.

~~B.~~ Comparable replacement dwellings ~~will~~shall be available or provided for each displaced person within a reasonable amount of time. Such assurance is a part of the MTS Relocation Assistance Program study process and must be specifically given on every project requiring displacement.

~~C. Relocation advisory services will be provided to assist persons in relocating into safe, decent, and sanitary housing that meets their needs and is within their financial means. The same will be provided for displaced business and farm operators to aid them in finding suitable replacement locations to continue operations. Assistance is required throughout the acquisition phase of the project and starts at the time MTS begins acquiring properties on a project.~~

~~D. No person lawfully occupying real property shall be required to move from a dwelling, assuming a decent, safe, and sanitary replacement dwelling is available, or to move a business or farm operation, without at least 90 days' written notice from MTS prior to the date the move is required.~~

~~E. MTS shall follow generally the procedures outlined in the following Caltrans guides.~~

~~1. Right-of-Way (Caltrans)~~
~~2. Relocation Assistance Handbook (Caltrans)~~
~~3. How to Make Relocation Studies and Plans (Caltrans)~~

~~F. All cash payments to owners or occupants for any purpose shall be formally reported to the Board as to amount, rationale, and applicable code or statute.~~

~~G. Real property acquisition and relocation assistance shall comply with guidelines issued by the California Department of Housing and Community Development. (Revised 4/16/79)~~

~~SGreen/JGarde~~

POLICY.9.RELOCATION ASSISTANCE PROGRAM
~~7/11/06~~

Original Policy approved on 9/11/78.
Policy revised on 4/16/79.
Policy revised on 8/27/79.
Policy revised on 7/28/80.
Policy revised on 9/8/80.
Policy revised on 2/7/85.
Policy revised/renumbered on 1/29/04.
Policy revised 1/16/2025.

Metropolitan Transit System

Agenda Item No. 10

MEETING OF THE SAN DIEGO METROPOLITAN TRANSIT SYSTEM
BOARD OF DIRECTORS

January 16, 2025

SUBJECT:

Semiannual Uniform Report of Disadvantaged Business Enterprise (DBE) Awards and Payments

INFORMATIONAL ONLY

Budget Impact

None.

DISCUSSION:

As a Federal Transit Administration (FTA) grantee, San Diego Metropolitan Transit System (MTS) complies with the federal regulations set forth in 49 CFR Part 26 regarding participation by DBEs in the U.S. Department of Transportation (DOT) Program.

I. Goals of MTS's DBE Program

The goals of MTS's race-neutral DBE program are:

1. to ensure nondiscrimination in the award and administration of DOT-assisted contracts;
2. to create a level playing field on which DBEs can compete fairly for DOT-assisted contracts;
3. to ensure that the DBE program is narrowly tailored in accordance with applicable law;
4. to ensure that only firms that fully meet 49 CFR Part 26 eligibility standards are permitted to participate as DBEs;
5. to help remove barriers to the participation of DBEs in DOT-assisted contracts;
6. to assist the development of firms that can compete successfully in the marketplace outside of the DBE program; and
7. to provide appropriate flexibility to recipients of federal financial assistance in establishing and providing opportunities for DBEs.

II. MTS's DBE Triennial Overall Goal for FFY 2022-2024

The DBE regulations require MTS to prepare a DBE Triennial Overall Goal. The DBE Triennial Overall Goal is established upon the number of ready, willing, and able DBE contractors within MTS's geographic market area that are available to bid on MTS's federally assisted procurements (excludes transit vehicle procurements). For FFY 2022-2024 (October 1, 2021 to September 30, 2024), MTS's aspirational DBE Overall Goal is **6.3%** on federally funded contracts. Please note, MTS recently adopted its aspirational DBE Overall Goal on federally funded contracts for FFY 2025-2027 (October 1, 2024 to September 30, 2027), of **5.6%,** which will be the goal used for future Semiannual DBE Reports (See MTS Board of Directors July 18, 2024 Meeting Agenda Item No. 5 for further information on MTS's FFY 2025-2027 DBE Overall Goal Methodology)**.**

III. Participation by certified DBEs

For purposes of reporting DBE participation to the FTA, MTS may only count participation by certified DBE contractors. In order to be certified as a DBE through the California Unified Certification Program, contractors must:

(1) have a majority owner who is **socially and economically disadvantaged** (Native Americans, Black Americans, Hispanic Americans, Asian-Pacific Americans, Subcontinent Asian Americans, Women and any additional groups whose members are designated as socially and economically disadvantaged by the U.S. Small Business Administration (SBA)) are currently presumed to be socially and economically disadvantaged by the DOT);

(2) the majority owner must have a personal net worth of less than **$2,047,000**; and

(3) the business must be a **small business** and, for *most* types of businesses, have average annual gross receipts less than **$30,720,000**.

Per DOT DBE Regulations, MTS *may not* count participation from certified minority owned businesses (MBE), disabled veteran owned businesses (DVBE), women owned businesses (WBE), small businesses (SB), lesbian gay bisexual transgender owned businesses (LGBTBE), or persons with disabilities businesses (PDBE) (collectively referred to as SBEs) toward meeting its DBE Triennial Overall Goal. Nonetheless, MTS encourages participation from, conducts outreach to, and tracks awards to SBEs.

IV. Race-Neutral Outreach Measures to Increase DBE and SBE Participation

A race-neutral DBE program means that there are no DBE contract specific goals and no advantages provided to interested DBE contractors when submitting bids or proposals. Successful bidders are chosen using race-neutral means, generally through a low-bid or best-value procurement process.

To increase DBE participation on MTS's federally assisted procurements, as well as SBE participation on all MTS's contracts, MTS conducts outreach to DBEs and SBEs in an effort to inform them of upcoming MTS procurements. The following are some of the race-neutral measures MTS has implemented:

1. outreach to new vendors to provide the benefits of DBE, MBE, DVBE, WBE, SB, PDBE and/or LGBTBE certification and what qualifications are necessary to become certified, as some may already qualify;

2. outreach to vendors requesting that they register on PlanetBids so they can receive automatic notification of upcoming MTS procurements;

3. for small purchase procurements in which MTS must seek out three (3) bids, MTS aims to advertise more of these procurement on PlanetBids so as to increase the potential of DBEs, and SBEs learning of the procurement, if such a contractor is available to perform the work;

4. for small purchase procurements in which MTS must seek out three (3) bids, seeking at least one (1) of those bids from a DBE or SBE, if available; and

5. attend and actively promote small business conferences and programs to alert DBEs and SBEs of upcoming MTS contracting opportunities and to educate about MTS's DBE program.

MTS also continued to attend San Diego Public Agency Consortium (PAC) bi-monthly meetings, as well as the Local Small Business Council bi-monthly meetings, virtually. At these meetings, public agencies discuss upcoming planned outreach events amongst the members and best practices regarding their agency's DBE and SB programs.

V. Federally Funded Procurements

Only contracts awarded and paid by MTS using federal funds (or a portion of federal funds) are reported to the FTA per DOT DBE Regulations. MTS generally reserves federal funds for transit vehicle procurements, transit facility improvements, state-of-good-repair vehicle or system preventative maintenance projects, and contracted fixed route and paratransit bus services. MTS generally uses local and state funds for administrative costs and other expenses (e.g. marketing, land management, office supplies).

VI. Summary of Semi-Annual DBE Report Achievement (Federal Funds Only)

The FTA Semi-Annual Report for April 1, 2024 to September 30, 2024 is the last of six reports in the triennial period of FFY 2022-2024.

a. Contracts Awarded

For this reporting period, MTS **did not achieve** its DBE Triennial Overall Goal of 6.3% for contracts awarded. MTS achieved **2.08%** DBE participation for contracts awarded, as shown below in Table 1.

Table 1: Federal Contracts Awarded

Federal Contract Awards/Commitments				**Goal**
REPORTING PERIOD	Total Federal $	DBE $	DBE %	vs 6.3%
Federal Funds: Apr 1, 2024 to Sept 30, 2024	$3,624,621.11	$75,249.65	**2.08%**	-4.22%

The main reason for why MTS was not able to meet its DBE Triennial Overall Goal for contracts awarded was due to awarding several large contracts to non-DBE firms. This included but is not limited to: Jacobs Project Management for bridge inspection services in the amount of $322,460.34 (federal portion only), San Diego Power Clean (SB certified) for parking lot sweeping services in the amount of $301,632.00 (federal portion only), A&K Railroad Materials for purchase of 115 RE head hardened steel rail in the amount of $285,890.42 (federal portion only), and Datel System Incorporated for VMS Media Converter and Cradlepoint services in the amount of $193,553.50 (federal portion only). These contract awards to a non-DBE substantially diluted the participation that was achieved through contract awards to DBE firms, such as a contract amendment to **NMS Management**, a **DBE firm**, relating to janitorial services in the amount of $55,467.30 (federal portion only).

b. Contracts Open

For this reporting period, MTS **did not achieve** its DBE Triennial Overall Goal of 6.3% for contracts opened. MTS achieved **2.69%** DBE participation for contracts open, as shown below in Table 2.

Table 2: Federal Contracts Open

Federal Contracts Open/Payments During Reporting Period				**Goal**
REPORTING PERIOD	Total Federal $	DBE $	DBE %	vs 6.3%
Federal Funds: Apr 1, 2024 to Sept 30, 2024	$30,384,591.63	$816,462.30	**2.69%**	-3.61%

The main reason why MTS was not able to meet its DBE Triennial Overall Goal for contracts opened was due to ongoing payments to **Transdev,** a **non-DBE firm**, for fixed route bus service, in the amount of $19,653,533.67 (federal portion only) paid between April 1, 2024 to September 30, 2024. These payments substantially diluted ongoing payments to contracts with DBE firms, such as a large contract to **NMS Management**, a **DBE firm**, for janitorial services, in the amount of $812,878.30 (federal portion only) paid between April 1, 2024 to September 30, 2024.

c. Contracts Completed

For this reporting period, MTS **did not achieve** its DBE Triennial Overall Goal of 6.3% for contracts completed. MTS achieved **0.26%** DBE participation for contracts completed, as shown below in Table 3.

Table 3: Federal Contracts Completed

Federal Contracts Completed/Total Payments				**Goal**
REPORTING PERIOD	Total Federal $	DBE $	DBE %	vs 6.3%
Federal Funds: Apr 1, 2024 to Sept 30, 2024	$7,670,058.64	$19,782.35	**0.26%**	--6.04%

The main reason for why MTS was not able to meet its DBE Triennial Overall Goal for contracts completed was due to closing out a grade crossing replacement project with **Balfour Beatty Infrastructure**, a **non-DBE firm**. Total payments made during the life of this contract totaled $5,888,910.83 (federal portion only). Please note, MTS decides contract performance periods based on MTS business and operational needs. Every reporting period will differ on the number, type and dollar amount of contracts closed out. No large contracts with a DBE firm were closed out during this reporting period.

VII. Summary of Achievement Toward Meeting MTS's DBE Triennial Overall Goal

While the specific DBE participation rate for each six (6) month reporting period may fluctuate, the goal of the MTS DBE program is to achieve the 6.3% DBE Triennial Overall Goal as an average for the FFY 2022-2024 triennial period. MTS has **achieved** its DBE Triennial Overall Goal of 6.3% for FFY 2022-2024. MTS achieved **18.94%** DBE participation for FFY 2022-2024, as shown below in Table 4.

Table 4: DBE Achievement for FFY 2022-2024

DBE Achievement for FFY 2022-2024				
FFY	**Reporting Period**	**Total Federal Awarded**	**Total DBE Awarded**	**DBE %**
FFY 2022	Oct 1 21 to Mar 31 22	$7,843,315.85	$234,599.40	**2.99%**
FFY 2022	April 1 22 to Sept 30 22	$6,977,851.08	$92,523.71	**1.33%**
FFY 2023	Oct 1 22 to Mar 31 23	$17,806,277.45	$7,965,351.88	**44.73%**
FFY 2023	April 1 23 to Sept 30 23	$9,630,377.28	$2,237,323.28	**23.23%**
FFY 2024	Oct 1 23 to Mar 31 24	$11,394,054.87	$240,626.03	**2.11%**
FFY 2024	April 1 24 to Sept 30 24	$3,624,621.11	$75,249.65	**2.08%**
TOTAL		**$57,276,497.64**	**$10,845,673.95**	**18.94%**
Achievement Toward Meeting FFY 2022-2024 DBE Triennial Overall Goal of 6.3% (FFY 2022-2024 Total DBE Awarded ÷ FFY 2022-2024 Total Fed Awarded)		**18.94%** Achieved 18.94% towards DBE Overall Triennial Goal of 6.3%		

VIII. Shortfall Analysis and Corrective Action Plan

Per DBE Regulations, whenever the last 2 reporting periods cumulatively show that MTS did not achieve its DBE Overall Goal, a Shortfall Analysis and Corrective Action Plan is required to be submitted to the FTA at the end of the FFY (by December 29 of any applicable year).

On December 26, 2024, MTS submitted to the FTA a Shortfall Analysis and Corrective Action Plan (Attachment A) that explains the reasons for the shortfall, as well as what steps MTS will be taking that are aimed to increase DBE participation in the future.

As discussed in more detail in the enclosed Shortfall Analysis and Corrective Action Plan (Attachment A), MTS plans to complete the following corrective actions in the coming FFY: updating MTS's e-procurement website, PlanetBids, to better capture how firms are learning to register on MTS's PlanetBids website to understand which MTS outreach measure is most successful, updating MTS's DBE website to include information on what financial and technical assistance resources are provided by the U.S. Chamber of Commerce to assist DBE and SB firms, adding a goal of evaluating at least 3 federally funded procurements to determine if a small business set aside would be appropriate, updating MTS's Project Labor Agreement website and its pre-bid meeting materials to better highlight all the benefits of DBE and SB subcontractors participating on MTS's larger construction projects and how to become certified as a DBE and SB firm, and identifying new strategies to better encourage prime contractors awarded master agreements for on-call work to identify DBE and SB certified subcontractors as appropriate for individual task orders.

IX. Summary of DBE, WBE, MBE, DVBE, PDBE, LGBTBE and SB Participation for all Contracts (Regardless of Funding Source)

Although MTS may not count participation of MBE, DVBE, WBE, SB, PDBE and LGBTBE (collectively referred to as SBEs) towards achievement of its DBE Overall Triennial Goal, MTS does record the participation of these businesses to gauge the success of its program to foster small business participation. MTS encourages the participation of DBEs and SBEs on all of its contracts, no matter the funding source.

MTS's DBE and SBE participation rates for the reporting period, *using both local and federal funds*, are included below in Table 5.

Table 5: All Contracts Awarded (All Funding Sources)

All Contract Awards/Commitments (All Funding Sources)					
REPORTING PERIOD	**Total $**	**DBE $**	**DBE %**	**SBE $ (MBE, DVBE, WBE, SB, PDBE and LGBTBE)**	**SBE %**
Total Funds: Apr 1, 2024 to Sept 30, 2024	$3,649,043.32	$6,949,059.93	9.44%	$4,564,695.97	6.20%

To compare MTS's current achievements with past reporting periods, enclosed is a History of Semi-Annual Reports (Attachment B).

/S/ Sharon Cooney
Sharon Cooney
Chief Executive Officer

Key Staff Contact: Mark Olson, 619.557.4588, mark.olson@sdmts.com

Attachment: A. Shortfall Analysis and Corrective Action Plan
B. History of Semi-Annual DBE Reports

Metropolitan Transit System

December 29, 2024

Federal Transit Administration (FTA)
FTAShortfallAnalyses@dot.gov

Re: SHORTFALL ANALYSIS AND CORRECTIVE ACTION PLAN - FEDERAL FISCAL YEAR (FFY) 2024

To whom it may concern:

As one of the nation's 50 largest transit agencies, San Diego Metropolitan Transit System (MTS) is required to submit a shortfall analysis and corrective action plan within 90 days of the end of the FFY (i.e. December 29, 2024) if the awards and commitments shown on MTS's Uniform Report at the end of any FFY are less than the overall goal applicable to that FFY.

I. Race-Neutral DBE Program

MTS operates a strictly race-neutral DBE program and only uses race-neutral measures to increase DBE participation. MTS's FTA Disadvantaged Business Enterprise (DBE) Triennial Overall Goal for FFY 2022 – 2024 (October 1, 2021 – September 30, 2024) is 6.3%. MTS's DBE Triennial Overall Goal of 6.3% includes a 100% race-neutral component and 0% race-conscious component.

II. Shortfall Percentage for FFY 2024

To determine the DBE percentage of awarded contracts for FFY 2024 (October 1, 2023 – September 30, 2024), MTS divided DBE Awards and Commitments by the total Awards and Commitments made to all contractors in FFY 2024 (using the June 1, 2024 and December 1, 2024 DBE Semi-Annual Uniform Reports).

Total federal dollars awarded to a DBE firm for FFY 2024 was $315,875.68. Total federal awards and commitments to all contractors for FFY 2024 was $15,018,678.98. As shown in Table 1, the difference between MTS's DBE Triennial Overall Goal of 6.3% and the DBE Awards and Commitments for FFY 2024 of 2.10% was a 4.20% shortfall.

Table 1: FFY 2024 Contract Awards/Commitments

Reporting Period	Total Federal $	Total DBE $	DBE %	Shortfall %
Oct 1, 2023 to Mar 31, 2024	$11,394,054.87	$240,626.03	2.11%	
Apr 1, 2024 to Sept 30, 2024	$3,624,624.11	$75,249.65	2.08%	
TOTAL FFY 2024	$15,018,678.98	$315,875.68	2.10%	-4.20%

III. Specific Reasons for the Shortfall in FFY 2024

The reasons for the shortfall between MTS's DBE Triennial Overall Goal and the Awards and Commitments obtained in FFY 2024 are described below.

A. Federal Funds Generally are Allocated Towards Paying for Unique, Specialized Services

MTS generally reserves federal funds for transit vehicle procurements (excluded from DBE Triennial Overall Goal and Semi-Annual Reports per FTA DBE Regulations), contracted bus services, and state-of-good-repair vehicle and system preventative maintenance activities. These procurements usually have very low DBE potential, as they involve specialized and unique goods and services.

In addition, San Diego Association of Governments (SANDAG), the Metropolitan Planning Organization for the San Diego region, is generally responsible for the large ,regional MTS-related construction projects. Construction projects have historically been one of the most effective ways to achieve DBE participation through the use of DBE subcontractors. For those small construction projects that MTS is responsible for, MTS typically uses local and state funds. Thus, how MTS generally allocates its federal funds makes it increasingly difficult to achieve our DBE Triennial Overall Goal.

B. Overall Goal is a Triennial Goal, Not an Annual Goal

MTS's DBE Triennial Overall Goal is an aspirational goal for DBE participation over a three (3) year period. Although FTA DBE Regulations requires a review of the annual goal to determine whether a shortfall analysis is required, it may be deceiving to only view one (1) FFY out of the entire three (3) year period. The timing of when MTS awards certain contracts, specifically large, unique or specialized contracts that have low DBE potential, has a significant effect on whether MTS meets its DBE Triennial Overall Goal in any given FFY. As shown in Table 2, the DBE utilization percentage for any given reporting period can swing greatly, depending on the size and type of contracts awarded at any given time. MTS was able to not only achieve, but exceed, its triennial goal. MTS achieved **18.94%** DBE Participation over the

entire three (3) year period, well exceeding its 6.3% DBE Overall Triennial DBE Goal, using 100% race-neutral DBE goals.

Table 2: DBE Achievement for FFY 2022 - 2024

DBE Achievement for FFY 2022-2024				
FFY	**Reporting Period**	**Total Federal Awarded**	**Total DBE Awarded**	**DBE %**
FFY 2022	Oct 1 21 to Mar 31 22	$7,843,315.85	$234,599.40	**2.99%**
FFY 2022	April 1 22 to Sept 30 22	$6,977,851.08	$92,523.71	**1.33%**
FFY 2023	Oct 1 22 to Mar 31 23	$17,806,277.45	$7,965,351.88	**44.73%**
FFY 2023	April 1 23 to Sept 30 23	$9,630,377.28	$2,237,323.28	**23.23%**
FFY 2024	Oct 1 23 to Mar 31 24	$11,394,054.87	$240,626.03	**2.11%**
FFY 2024	April 1 24 to Sept 30 24	$3,624,624.11	$75,249.65	**2.08%**
Achievement Toward Meeting FFY 2022-2024 DBE Triennial Overall Goal of 6.3% (FFY 2022-2024 Total DBE Awarded ÷ FFY 2022-2024 Total Fed Awarded)		**18.94%** Achieved 18.94% towards DBE Overall Triennial Goal of 6.3%		

C. Large Contract Award for Trolley Track Improvements

MTS awarded a large construction contract for trolley track improvements to **Balfour Beatty, a non-DBE**, in the amount of $5,888,910.84 (federal dollars only) in FFY 2024. This work includes replacement of vehicular crossings and track. Three (3) prime contractors submitted proposals on this procurement, all of which were non-DBE firms, and it was awarded to the firm providing the lowest bid, Balfour Beatty.

Balfour Beatty did designate two (2) subcontractors for this work: Traffic Management (a Minority Owned Business (MBE)); and Miramar General Engineering (a Small Business (SB)). Unfortunately, since none of the subcontractors were DBE specifically certified, none of these federal dollars paid to the subcontractors were able to be counted towards achievement of MTS's DBE Overall Goal.

Please note, this project was not included in MTS's DBE Overall Triennial Goal. At the time of developing the Overall Goal in 2021, it was not anticipated that MTS would use any federal funds on this contract, as generally MTS seeks to

minimize the use of federal funds on construction projects and to maximize the use of federal funds on preventive maintenance and vehicle replacement projects. This strategy allows MTS to expedite grant spending and close-out, while maximizing cash-flow. However, due to overall funding availability and CIP funding allocation requirements, federal funds were used for this construction project.

Since this resulted in substantially more federal dollars being awarded than anticipated when developing the Overall Goal, it made MTS's ability to meet its Overall Goal of 6.3% significantly more difficult. This large contract also substantially diluted achieved DBE participation.

IV. Procurements Awarded in FFY 2024 that were included within MTS's DBE Triennial Overall Goal

Table 3 shows the projects awarded during FFY 2024 that were used to establish the DBE Triennial Overall Goal for FFY 2022 - 2024. The majority of these projects are of a nature that are very specialized and which have little or no DBEs in San Diego County, MTS's geographic market area, that are available to perform.

Table 3: Overall DBE Goal Projects Awarded in FFY 2024

Project	Estimated Federal $ to be Awarded in FFY 2022 - 2024, as used in Overall Goal	Per NAICS, Estimated DBE% Weighted Ratio, as used in Overall Goal	If Contract Awarded to DBE	Actual Federal $ Awarded in FFY 2024	Notes
HVAC Preventative Maintenance & Repairs	$152,458	0.14%	No. Request for Proposal (RFP) process was used. One (1) proposal was received. Awarded to the firm with the best value proposal, **Comfort Mechanical**.	$316,314	Three (3) year base period, with two (2) 1-year options (not yet exercised option). When developing the Overall Goal in 2021, the estimate used only accounted for the trolley portion of the scope, and not also the bus operations portion of the scope. This may account for the difference between the estimated and actual awarded amounts.

Project	Estimated Federal $ to be Awarded in FFY 2022 - 2024, as used in Overall Goal	Per NAICS, Estimated DBE% Weighted Ratio, as used in Overall Goal	If Contract Awarded to DBE	Actual Federal $ Awarded in FFY 2024	Notes
Parking Lot Sweeping Services	$106,068	0.04%	No. Invitation for Bid (IFB) process was used. Two (2) bids were received, none of which were from a DBE. Awarded to the firm with the lowest, responsive and responsible bidder, **San Diego Power Clean.**	$309,408	When developing Overall Goal in 2021, the estimate only included the amount to be solicited for a new 3-year base contract. However, staff later decided to solicit for a new 5-year base contract instead. This may account for the difference between the estimated and actual awarded amounts.
On-Call Plumbing Services	$147,987	0.14%	No. IFB process was used. Five (5) bids were received, none of which were from a DBE firm. Awarded to the lowest, responsive and responsible bidder, **Drain Medic.**	$162,462	3-year base contract awarded.

Project	Estimated Federal $ to be Awarded in FFY 2022 - 2024, as used in Overall Goal	Per NAICS, Estimated DBE% Weighted Ratio, as used in Overall Goal	If Contract Awarded to DBE	Actual Federal $ Awarded in FFY 2024	Notes
LRV OBVSS Preventative Maintenance	$470,707	0.0%	No. In 2022, **Seon Design (USA) Corp** was awarded this contract as a sole source**.**	$276,558	Amount awarded Includes two amendments to exercise both the 2-year option period and option to purchase hardware and install. When soliciting this contract in 2022, it was for a 2-year base, with 2-year option and option of purchase and install of additional hardware. Since the base period was already awarded previously in the triennial period, this may account for the difference between estimated and actual awarded amount.

Project	Estimated Federal $ to be Awarded in FFY 2022 - 2024, as used in Overall Goal	Per NAICS, Estimated DBE% Weighted Ratio, as used in Overall Goal	If Contract Awarded to DBE	Actual Federal $ Awarded in FFY 2024	Notes
On-Call Electrical Repair Services	$168,456	0.16%	**YES, *however* DBE firm does not have the appropriate NAICS code for electrical repair services so unable to count towards DBE achievement**. IFB process was used. Six (6) bids were received, two (2) of which were from a DBE firm. Awarded to the lowest, responsive and responsible bidder, **Advanced Railway Innovations.**	$141,080	3-year base contract awarded. When developing Overall Goal in 2021, estimate included exercising remaining two 1-year option years, as well as this 3-year base contract. The remaining option years were exercised in FFY 2022 and the new 3-year base contract was awarded in FFY 2024, which may account for the difference between the estimated and actual amounts here.

Project	Estimated Federal $ to be Awarded in FFY 2022 - 2024, as used in Overall Goal	Per NAICS, Estimated DBE% Weighted Ratio, as used in Overall Goal	If Contract Awarded to DBE	Actual Federal $ Awarded in FFY 2024	Notes
Bridge Inspection Services	$865,540	0.28%	No. In 2018, MTS issued a mini-RFP to its existing on-call construction management firm panel. Three (3) proposals were received. Awarded to the firm with the best value proposal, **Jacobs Management** (previously known as CH2M Hill)**.**	$ 322,460	This is an amendment to add funds and extend the existing work order for bridge inspection services. A separate procurement will occur for a new competitively procured multi-year bridge inspection services work order in the next triennial period. When developing Overall Goal in 2021, the estimate used was based on the assumption that the new 5-year base contract would be awarded in this triennial period, which may account for the difference between the estimated and actual awarded amounts.
Office Trailer Lease - LRV Maintenance	$11,794	0.0%	No. Requested three (3) quotes. Single bid received. Offered to the lowest, responsive bidder, B**ert's Office Trailers**.	$17,037	3-year lease for office trailer.

Project	Estimated Federal $ to be Awarded in FFY 2022 - 2024, as used in Overall Goal	Per NAICS, Estimated DBE% Weighted Ratio, as used in Overall Goal	If Contract Awarded to DBE	Actual Federal $ Awarded in FFY 2024	Notes
Weed Abatement Services	$322,003	0.03%	No. In 2019, a IFB process was used. Three (3) bids were received. Awarded the lowest responsive and responsible bidder, **Quality Sprayers.**	$33,600	Amendment to add funds and extend period of performance for 9 months, on existing contract for a 5-year base, which may account for the difference between estimated and actual awarded amounts.
Interior Bus Cleaning Services	$739,071	1.03%	No. In 2019, **Arc of San Diego** was awarded this contract as a sole source.	$737,471	This is an amendment to exercise the remaining 2-year option.
Trash Disposal, Green Waste, & Recycling Services	$727,023	0.17%	No. In 2018, a IFB process was used. Two (2) bids received. Awarded to the lowest, responsive and responsible bidder, **EDCO Disposal Services.**	$206,147	This is an amendment to exercise one (1) of the five (5), one (1)-year options, as well as funds for increased disposal fees. When contract awarded in 2018, it was for a five (5) year base period with five (5), one (1) year options terms. This may account for the difference between the estimated and actual awarded amount.

Project	Estimated Federal $ to be Awarded in FFY 2022 - 2024, as used in Overall Goal	Per NAICS, Estimated DBE% Weighted Ratio, as used in Overall Goal	If Contract Awarded to DBE	Actual Federal $ Awarded in FFY 2024	Notes
Railcar Maintenance Training	$72,512	0.08%	No. Awarded to ITLC as a sole source.	$36,800	Three (3) year base period executed. When developing Overall Goal, estimated a 5-year base period, which may account for difference between estimated and actual awarded amounts.
Track Geometry Testing	$179,220	0.0%	No. RFP process was used. Single bid received. Awarded to the proposer with the best value proposal, **Holland L.P**.	$184,766	Awarded a five (5)-year base with three (3)-year option (not yet exercised).
Communication Cabinets HVAC Maintenance	$269,422	0.14%	No. RFP process was used Two (2) bids received, one of which was from a DBE firm. Awarded to the proposer with the best value proposal, **Comfort Mechanical.**	$560,958	Awarded a five (5) year period. When developing Overall Goal in 2021, estimate used was likely too low based on recent cost increases, as well as this contract increased preventative maintenance from quarterly to bi-monthly. This may account for the difference between estimated and actual awarded amounts.

V. Proposed Corrective Action Plan

The following list describes the effectiveness of race-neutral measures used in FFY 2024, MTS's proposed corrective actions to increase DBE participation in the future, and the timeline in which MTS aims to implement these corrective actions.

A. Outreach Measure of Advertising Events and Other Resources

The first outreach measure is participation at conferences, events or meetings, which may include teaming opportunities between prospective prime contractors and prospective subcontractors, and/or certified firms, such as DBEs, Small Businesses (SB), Woman Owned Businesses (WBE), Minority Owned Businesses (MBE), Disabled Veteran Business Enterprises (DVBE), Persons with Disabilities Business Enterprises (PDBE) and Lesbian, Gay, Bisexual and Transgender Businesses (LGBTBE) (collectively referred as "SB"). MTS also actively promotes DBE and SB conferences, programs, and events offered by other agencies.

1. Events and Other Resources - How implemented in FFY 2024:

MTS's goal is to: attend at least six (6) outreach events each FFY; attend Public Agency Consortium (PAC) meetings; advertise other agencies' outreach events to MTS's vendor list, upon request; and maintain a survey question on PlanetBids (MTS's e-bid management site) to learn how newly registered firms heard about MTS to see if outreach event attendance is effective or not.

MTS attended 6 outreach events and meetings in FFY 2024 (October 1, 2023 to September 30, 2024) and 4 outreach events thus far in FFY 2025.

Outreach Event Attendance		
Event Name	**Event Date**	**FFY**
Connecting with Contracts Celebrating National Veterans and Military Month - San Diego & Imperial Valley Small Business Development Center (SBDC) Network in partnership with the City of Oceanside (In-Person)	11/8/2023	2024
Local Small Business Council Meeting – California Department of Transportation (Caltrans) (On-line)	2/28/2024	2024
Small Business Expo - San Diego & Imperial SBDC (In-person)	6/20/2024	2024
DBE Workshop – Flatiron in partnership with Caltrans District 11 (On-line)	6/21/2024	2024

Construction Expo - San Diego Unified School District (SDUSD) (In person)	7/17/2024	2024
20th Annual Procurement and Resource Fair - Caltrans (In person)	8/14/2024	2024
Subcontractor & DBE outreach for SR 78 Asset Management CMGC San Diego Project - Caltrans (On-line)	10/10/2024	2025
Small Business Expo III 2024 - Caltrans & PAC (In person)	10/24/2024	2025
Disparity Study and DBE Goal – Caltrans	11/12/2024	2025
Business and Workforce Open House – SANDAG (In person)	12/16/2024	2025

At in-person events in which MTS has a booth, MTS offers a QR code that vendors can use to be directed to MTS's PlanetBids website to register on MTS's PlanetBids website. MTS staff is also available to verbally provide information on MTS's DBE program, how to learn about upcoming contract opportunities, and how to learn about DBE and SB available certifications.

PAC is a partnership of many San Diego local public agencies focused on increasing bidding opportunities and the likelihood of success of SBs on public agency contracts. Generally, PAC offers meetings every two (2) months. MTS also continued its participation with this group.

MTS hosted its own DBE and SB outreach events as well. MTS hosted a "How to do business with MTS" webinar on 2/15/2024, that provided information on how to register on MTS's Planet Bids website. MTS also hosted two (2) webinars on 5/29/2024 and 7/10/2024 and conducted an online survey to seek feedback on MTS's proposed new DBE Overall Triennial Goal. Outreach included responding to questions from vendors, which provided MTS an opportunity to further share information on MTS's DBE and SB program and upcoming contracting opportunities and requesting new vendors to register on MTS's PlanetBids website to keep informed of upcoming contracting opportunities.

In addition, MTS advertised other public agencies' outreach events by sending information for the outreach event via email to firms on MTS's Vendor List, as requested. MTS advertised other agency's outreach events nine (9) times in FFY 2024.

Sharing Notice to MTS's Vendors on Other Agency's Outreach Events		
Event Name	**Event Date**	**Date Emailed to MTS Vendors**
Small Business Bonding Series	3/12/2024	2/22/2024
Elevate – SBDC Small Business Conference	3/20/2024	2/22/2024
4th Annual BELL Business & Government Contracting Summit	6/28/2024	4/16/2024
Connecting with Contracts: Government Contracting, Selling to Government	6/4/2024	4/18/2024
Caltrans District 11's 20th Annual Procurement and Resource Fair	8/14/2024	5/10/2024
SDUSD Construction Expo 2024	7/17/2024	5/17/2024
Small Business Expo	6/20/2024	5/22/2024
Caltrans District 11 20th Annual Procurement and Resource Fair	8/14/2024	7/22/2024
Meet The Primes - San Diego Airport Meet the Primes	9/5/2024	8/28/2024
Veteran Success: Honoring Service and Empowering Business Growth - San Diego Airport, SBDC, & City of Oceanside Event	11/21/2024	11/4/2024
SANDAG Business and Workforce Open House	12/16/2024	11/18/2024

2. Events and Other Resources - Effectiveness of Measure in FFY 2024:

MTS continues to meet new contractors unfamiliar with MTS's procurement program (e.g. they did not know that MTS advertises its formal procurements on PlanetBids; they did not know the difference between the various certification programs available for firms, and the different benefits that come with each; and they did not know what type of services and goods MTS procures, as some assume MTS only procures buses and trolleys and might not realize MTS also needs general services such as administrative supplies, preventative maintenance services for building assets etc.). Attending these events and advertising MTS's DBE Program likely helps contractors understand that MTS may be a potential contracting partner in the future and increases their likelihood of registering on MTS's PlanetBids.

To measure the effectiveness of MTS's attendance at outreach events and advertising other agency's outreach events, MTS requests that any firm registering on MTS's PlanetBids e-procurement website, or updating their

profile, to answer "How did you hear about registering with MTS?**".** Since October 1, 2023, from a total of 804 firms, 671 firms responded to this survey question.

"How did you hear about registering with MTS" Survey Question when registering on MTS's PlanetBids		
Survey Response Choices	**Number of Responses**	**Percent**
Other	194	29%
Notification from MTS Staff	136	20%
Another Agency	130	19%
DBE/Small Business outreach event	92	14%
A prime contractor	73	11%
Newspaper	28	4%
A Subcontractor	18	3%
TOTAL	671	100%

Results from MTS's PlanetBids Survey Question show that outside of those responses that stated "other", the top three results were: "notification from MTS staff", "another agency" and "DBE/Small Business outreach event". This shows that attendance at outreach events is beneficial to increasing the number of DBE and SB firms learning about MTS's contracting opportunities. MTS will continue to maintain the goal of attending at least six (6) outreach events.

As for the PAC meetings, MTS has found this group to be very helpful. MTS has learned the best practices from each agency on how they increase participation from DBEs, SBs and emerging businesses. MTS will continue to maintain the goal of attending PAC bi-monthly meetings.

It is unclear how effective advertising other agency's outreach events is on increasing DBE and SB participation on MTS's contracting opportunities. However this measure shows we value the partnership and connections we have made with other public agencies, and that helping firms learn about other outreach events is a benefit to all firms so they can grow their businesses within the San Diego community generally. MTS will continue to share information to MTS vendors on other public agency DBE and SB outreach events.

3. <u>Events and Other Resources - How to improve in FFY 2025</u>:

To improve, MTS noticed that the majority of responses to “How did you hear about registering with MTS” chose “other”. Unfortunately, there does not appear to be a “write-in” option if choosing “other” in order to learn exactly how they learned about registering with MTS. MTS will be re-evaluating how it can update MTS’s PlanetBids drop down box to add additional appropriate responses to better capture how else firms are hearing about registering on MTS’s PlanetBids website. One example could be from PlanetBids itself, as if a firm is registered on another agency’s PlanetBids website, there are features where they can be notified through PlanetBids that there is similar work available on MTS’s website if interested to review. "PlanetBids” is currently not an available drop-down option when answering this survey question.

4. Events and Other Resources – Timeline of Corrective Action in FFY 2025:

By June 30, 2025, MTS aims to work with MTS Procurement Department and PlanetBids as necessary to review and revise the dropdown choices for this survey question.

B. Outreach Measure of Advertising Bonding, Financial Assistance and Other Business Resources

The second outreach measure is providing information to contractors on how to obtain bonding, financing assistance and other business resources.

1. Bonding, Financial Assistance and Other Business Resources - How implemented in FFY 2024:

MTS, through its webpage and contract language, refers the DBE and SB contracting community to the: federal Small Business Administration Bonding Assistance Program (U.S. SBA), which has delivered millions of loans, loan guarantees, contracts, counseling sessions and other forms of assistance to SBs; the SBDC, which provides a vast array of no- and low-cost support to entrepreneurs and SB; and the California Grants Portal, which provides access to all grants and loans offered by California state agencies. MTS also encourages businesses to use minority and women-owned banks when seeking financial services.

Also, MTS through its webpage refers the DBE and SB contracting community to other resources, such as technical assistance resources and

ways to grow their businesses. This includes: The Procurement Technical Assistance Center, which offers free procurement technical assistances services to SB; the Caltrans Office of Business & Economic Opportunity Program, which provides contractors resources to becoming certified, finding contracting opportunities, and how to work with Caltrans; and the Caltrans Construction Mentor-Protégé Program, which assists in the development of emerging construction companies to better compete in the market.

2. Bonding, Financial Assistance and Other Business Resources - Effectiveness of Measure in FFY 2024:

Generally, DBE and SB firms do not report to MTS on whether they have used these bonding, financial assistance or other business resources. Therefore, it is unclear how effective this measure is to increase DBE and SB participation. One way to indirectly measure the effectiveness of this outreach measure is by reviewing the number of views of MTS's DBE Webpage, using Google Analytics.

Since October 1, 2023 until present, there have been 472 views of the MTS DBE Website page, which shows about an average of 33 views a month. Assuming the majority of the 472 are individual firms (and not the same firm reviewing the information multiple times), this appears to be a good resource for vendors to learn more about MTS's DBE Program generally, and the resources available to them.

MTS will continue to maintain its DBE Webpage, as it requires little cost and maintenance by MTS Staff to ensure it is current with up-to-date resources, and the information provided is useful to interested DBE and SB firms looking to grow their businesses.

3. Bonding, Financial Assistance and Other Business Resources - How to Improve in FFY 2025:

To improve, MTS will update its DBE Webpage to include the U.S. Chamber of Commerce's website link, which provides a digital platform for DBEs and SBs on timely and actionable information and resources for businesses, including a current up to date list of grants, loans and programs available to small businesses throughout the country.

4. Bonding, Financial Assistance and Other Business Resources – Timeline of Corrective Action in FFY 2025:

By February 1, 2025, MTS aims to update its DBE Webpage to include a link to the U.S. Chamber of Commerce's website.

C. Outreach Measure of Soliciting DBEs and SBs

The third outreach measure MTS performs is soliciting DBEs and other SB participation on upcoming contract opportunities.

1. Soliciting DBEs and SBs - How implemented in FFY 2024:

For procurements within the formal competitive threshold (i.e. estimated value over $150,000 for goods and services and over $50,000 for construction), MTS posts its procurements on MTS's PlanetBids website at a minimum, and may also post additional notices in other ways (e.g. newspaper). For procurements within the simplified acquisition threshold (i.e. estimated value between $5,000 to $150,000 for goods and services and $1,000 to $50,000 for construction), MTS seeks at least three (3) bids or proposals, which generally means direct notification to three (3) or more bidders. For procurements within the micro purchase threshold (i.e. estimated value under $5,000 for goods and services and under $1,000 for construction), MTS seeks at least one (1) bid or proposal.

Posting on MTS's PlanetBids allows advertising to significantly more contractors, including DBE and SB contractors, that might not have otherwise received notice of the procurement if MTS just asked for quotes directly from only three (3) vendors. MTS currently has over 8,000 vendors registered on its PlanetBids website. To ensure more DBE and SB contractors learn of MTS's small acquisition thresholds, one of MTS's outreach measures includes posting federally funded procurements estimated at over $25,000 on PlanetBids, as appropriate, to increase notice.

Further, whenever MTS posts a solicitation on PlanetBids, the procurement is sent to all MTS's registered vendors (which includes DBEs and other SBs). To expand outreach, MTS uses a "broadcast" feature which allows the solicitation to be sent to any DBE registered firm on any other local public agency's PlanetBids website. This measure also aims to reach more

DBE and SB contractors, even if they are not currently registered on MTS's PlanetBids website.

MTS also uses the Caltrans DBE database to find DBEs who may not be registered on MTS's PlanetBids website but perform the category work related to the solicitation and sends a direct email to these firms so that they can register on PlanetBids and/or review an upcoming solicitation that is posted on PlanetBids.

When seeking three (3) quotes for federal procurements within the small purchase acquisition threshold that are not posted on PlanetBids, if there are DBEs available and it is not a sole source procurement, MTS requests that its Buyers and Contracting Officers contact at least 1 DBE. In the instances where there is no available DBE that performs that type of work, Buyers and Contracting Officers are requested to alternatively seek at least 1 quote from an SB contractor. The Contract Specialist assists the Procurement Department in identifying DBEs and/or SBs.

MTS also has recently created a small business set-aside implementation guideline document to identify which procurements would be successful in implementing a small business set aside, which would only allow a U.S. SBA certified small business to submit a bid or proposal (as well as any DBE certified firm, since a DBE must meet the U.S. SBA small business standard size in order to be a DBE).

Further, as a resource to prime contractors, MTS makes available information on how to view a listing of potential DBE and other SB subcontractors by including a link to DBE and other SB databases on MTS's DBE Webpage and in MTS's contracting language.

Lastly, during construction related pre-bid meetings as well as during kickoff meetings with prime contracts on on-call master agreements, MTS presents information on MTS's DBE Program and encourages prime contractors to utilize DBE and SBE subcontractors if subcontracting opportunity available and explains how to find DBE and SB subcontractors. For larger construction projects, MTS also explains the incentives provided to DBE and SBE contractors participating on projects that utilize MTS's Project Labor Agreement.

2. Soliciting DBEs and SBs - Effectiveness of Measure in FFY 2024:

As discussed previously, in FFY 2024, MTS achieved a 2.10% DBE participation rate on its federally funded contracts, a shortfall from MTS's DBE Overall Goal of 6.3%. Reasons include but are not limited to that the types of contracts MTS uses federal funds are those that generally have limited DBE firms available to perform that work. This makes it difficult to ascertain whether one or more of MTS's outreach measures to solicit DBE and SB firms are ineffective, or whether it is the unique, specialized nature of the procurements that are federally funded.

Further reviewing the DBE participation achieved, 100% was from prime DBE contractors for FFY 2024 awards. There were no DBE subcontracts awarded on a federally funded contract in FFY 2024. This shows that how we solicit DBEs and SBs (whether it is direct notice to DBE certified firms, requesting one (1) of three (3) quotes from a DBE firm, posting procurements on PlanetBids etc.) appears most targeted to DBE primes and not DBE subcontractors. This is an area in which further review is needed.

Lastly, in FFY 2024, MTS did not implement a small business set aside on any federally funded procurements. MTS only recently developed an internal guideline document that identifies how and when to decide if it is appropriate to implement, as MTS wants to ensure there would be enough SB and DBEs that perform that work to ensure enough competitive bids are received. MTS recently identified one (1) federally funded procurement for weed abatement services as a potential candidate. However, after reviewing the U.S. SBA database and DBE databases, and what firms submitted previous bids received for this work, MTS did not find at least three (3) SB or DBE vendors that performed this work in MTS's geographic market area. Therefore, MTS declined to implement a small business set aside requirement on this procurement due to concerns it would too restrictively limit competition. Nonetheless, a small business set aside would be an effective way to increase DBE and SB participation and thus MTS does want to continue to review more potential procurements that could benefit from its inclusion.

3. <u>Soliciting DBEs and SBs - How to improve in FFY 2025</u>:

To improve, MTS wants to use a small business set aside on more federally funded procurements. So long as MTS reasonably can ascertain sufficient number of vendors that perform the work, this would ensure only SB and DBEs submit a bid and be successful. It is MTS's goal to identify at least

three (3) federally funded procurements that could be reviewed to determine if a small business set aside would be appropriate, depending if it meets MTS's small business set aside guidelines.

In addition, MTS wants to increase notice to the DBE and SB community about the benefits of working on MTS's large construction projects that implement a project labor agreement. It is MTS's goal to update its Project Labor Agreement website and its pre-bid meeting materials to better highlight all the benefits of participating on these large construction projects to better incentivize DBE and SB subcontractor participation.

Lastly, MTS wants to identify better ways to get DBE subcontractors on its federally funded projects. This could include more outreach to prime contractors on on-call master agreements to have them prioritize identification of DBE subcontractors for their work orders, whether it be for architectural and engineering, construction management of JOCs. Since MTS utilizes a 100% race-neutral DBE program, MTS cannot require contract specific goals or quotas on its contracts. Nonetheless, MTS can still strongly encourage that primes identify DBE and SB subcontractors when possible. MTS aims to work with Procurement and Project Manager staff to come up with strategies to accomplish this goal.

4. Soliciting DBEs and SBs -Timeline of Corrective Action in FFY 2025:

MTS aims to identify at least three (3) federally funded procurements that can be reviewed for whether it can utilize a small business set aside by June 30, 2025.

Also, MTS aims to update its website and pre-bid meeting materials on DBE and SB incentives for participating on Project Labor Agreements by June 30, 2025.

Lastly, MTS aims to work with its Procurement and Project Manager staff to develop strategies to strongly encourage prime contractors on its on-call master agreements to identify DBE and SB subcontractors when there are subcontracting opportunities by June 30, 2025.

D. Informing Firms about DBE and SB Certifications

The fourth outreach measure is informing contractors of the benefits of becoming certified as a DBE or SB, the eligibility requirements, and the link to the Certifying Agency's online directory.

1. Informing Firms about DBE and SB Certifications - How Implemented in FFY 2024:

MTS provides this information on MTS's DBE Webpage, as well as in its DBE and SB contract clauses, with links to where a firm can apply or learn more about the various certifications. In addition, upon request from a contractor, MTS contacts the firm to provide information on how to become eligible, the eligibility criteria, and other resources that may assist them in the application process.

Also, MTS sends targeted email communications to vendors that MTS likely knows are interested in DBE and/or SB certifications. Specifically, this includes when firms fill out MTS's New Vendor Form. On MTS's New Vendor Form, the firm is requested to fill out whether their firm has any DBE or SB certifications. In the instances where they state they are a DBE or SB, but after review of relevant databases, MTS cannot locate a certification, MTS will email these vendors information on how to become DBE or SB certified. MTS will also send targeted emails when vendors request further information about DBE and SB certification.

2. Informing Firms about DBE and SB Certifications - Effectiveness of Measure in FFY 2024:

Since October 1, 2024, 804 vendors registered and/or updated their existing profile on PlanetBids, of which 140 classified their firm as a DBE. However, it is unclear whether these firms registered on MTS's PlanetBids website after receiving an email blast from MTS after using the Caltrans DBE database, or whether these firms learned about MTS after an outreach event, direct contact from MTS staff, or some other method.

MTS has no data to show whether any of the vendors that were emailed (33 firms emailed in FFY 2024) or that used of any MTS resources about certification, subsequently pursued DBE or SB certification in the last FFY. It is not common for a newly certified DBE or SB firm to reach out to MTS to inform MTS of their recent change in certification status.

3. Informing Firms about DBE and SB Certifications - How to Improve in FFY 2025:

MTS will continue to provide this information on its DBE Webpage, within its DBE and SB contract clauses, and upon request to vendors, as it is easy to maintain and it is good information for interested firms.

To improve, MTS will be adding information about how to become a DBE or SB certified firm as part of its pre-bid meeting materials for construction projects and on its Project Labor Agreement website.

4. Informing Firms about DBE and other SB Certifications – Timeline of Corrective Action in FFY 2025:

MTS aims to update its pre-bid meeting materials and its Project Labor Agreement website with this information by March 15, 2025.

MTS's race-neutral outreach measures, along with the above corrective actions, aim to increase participation of DBEs and SBs and should have a positive impact on MTS's achievement of its DBE Overall Goal over the remaining triennial period.

If you have any further questions regarding MTS's DBE Program, please contact me at 619-557-4539 or Samantha.Leslie@sdmts.com.

Sincerely,

/s/ Samantha Leslie

Samantha Leslie
Deputy General Counsel / DBE Liaison Officer

MTS History of DBE Semi Annual Reports

Contract Awards/Commitments*

	Federal DBE GOAL	REPORTING PERIOD	TOTAL DOLLARS AWARDED (fed & local)	Total DBE $$	Total DBE %	Total SBE $$	Total SBE %
FFY16	**3.75%**	**Oct 1 15 to Mar 31 16**	$ 63,883,438.52	$ 298,902.02	0.47%	$ 2,929,504.04	4.59%
		Apr 1 16 to Sept 30 16	$ 32,178,592.14	$ 976,115.34	3.03%	$ 996,434.97	3.10%
FFY17**		**Oct 1 16 to Mar 31 17**	$ 92,516,929.91	$ 5,611,166.70	6.07%	$ 3,735,641.71	4.04%
		Apr 1 17 to Sept 30 17	$ 40,939,010.42	$ 478,288.92	1.17%	$ 1,622,764.06	3.96%
FFY18		**Oct 1 17 to Mar 31 18**	$ 31,874,559.08	$ 754,167.60	2.37%	$ 3,002,750.48	9.42%
		Apr 1 18 to Sept 30 18	$ 68,024,202.91	$ 1,725,734.24	2.54%	$ 4,982,014.37	7.32%
FFY16-18	**3.75%**	**Oct 1, 2015 thru Sept 30, 2018 (6 semi-annual reports)**	**$ 329,416,732.98**	**$ 9,844,374.82**	**2.99%**	**$ 17,269,109.63**	**5.24%**

	Federal DBE GOAL	REPORTING PERIOD	Total Federal $$	Federal DBE $$	**Federal DBE %**	Federal SBE $$	Federal SBE %
FFY16	**3.75%**	**Oct 1 15 to Mar 31 16**	$ 4,094,298.13	$ 11,859.89	**0.29%**	$ 246,645.99	6.02%
		Apr 1 16 to Sept 30 16	$ 6,418,545.41	$ 255,760.97	**3.98%**	$ 148,325.08	2.31%
FFY17**		**Oct 1 16 to Mar 31 17**	$ 19,827,518.60	$ 3,781,098.94	**19.07%**	$ 196,188.57	0.99%
		Apr 1 17 to Sept 30 17	$ 3,326,175.53	$ 31,444.62	**0.95%**	$ 405,594.52	12.19%
FFY18		**Oct 1 17 to Mar 31 18**	$ 5,888,603.26	$ 107,876.47	**1.83%**	$ 716,139.92	12.16%
		Apr 1 18 to Sept 30 18	$ 5,453,720.86	$ 977,533.90	**17.92%**	$ 267,303.01	4.90%
FFY16-18	**3.75%**	**Oct 1, 2015 thru Sept 30, 2018 (6 semi-annual reports)**	**$ 45,008,861.79**	**$ 5,165,574.79**	**11.48%**	**$ 1,980,197.09**	**4.40%**

	Federal DBE GOAL	REPORTING PERIOD	Total Local $$	Local DBE $$	Local DBE %	Local SBE $	LOCAL SBE %
FFY16	**3.75%**	**Oct 1 15 to Mar 31 16**	$ 59,789,140.39	$ 287,042.13	0.48%	$ 2,682,858.05	4.49%
		Apr 1 16 to Sept 30 16	$ 25,760,046.73	$ 720,354.37	2.80%	$ 848,109.89	3.29%
FFY17**		**Oct 1 16 to Mar 31 17**	$ 72,689,411.31	$ 1,830,067.76	2.52%	$ 3,539,453.14	4.87%
		Apr 1 17 to Sept 30 17	$ 37,612,834.89	$ 446,844.30	1.19%	$ 1,217,169.54	3.24%
FFY18		**Oct 1 17 to Mar 31 18**	$ 25,985,955.82	$ 646,291.13	2.49%	$ 2,286,610.56	8.80%
		Apr 1 18 to Sept 30 18	$ 62,570,482.05	$ 748,200.34	1.20%	$ 4,714,711.36	7.54%
FFY16-18	**3.75%**	**Oct 1, 2015 thru Sept 30, 2018 (6 semi-annual reports)**	**$284,407,871.19**	**$ 4,678,800.03**	**1.65%**	**$ 15,288,912.54**	**5.38%**
	Federal DBE GOAL	**REPORTING PERIOD**	TOTAL DOLLARS AWARDED (fed & local)	Total DBE $$	Total DBE %	Total SBE $$	Total SBE %
FFY19	**2.9%**	**Oct 1 18 to Mar 31 19**	$ 73,790,097.91	$ 606,817.10	0.82%	$ 5,715,068.36	7.75%
		Apr 1 19 to Sept 30 19	$ 40,005,268.47	$ 6,243,719.33	15.61%	$ 1,796,894.06	4.49%
FFY20		**Oct 1 19 to Mar 31 20**	$ 52,022,126.82	$ 4,330,163.32	8.32%	$ 4,831,911.79	9.29%
		Apr 1 20 to Sept 30 20	$ 230,588,830.67	$ 636,712.08	0.28%	$ 2,322,909.77	1.01%
		*Apr 1 20 to Sept 30 20 w/o First Transit contract (*for reference only*)*	*$ 47,280,121.00*	*$ 636,712.08*	*1.35%*	*$ 2,322,909.77*	*4.91%*
FFY21		**Oct 1 20 to Mar 31 21**	$ 546,248,722.19	$ 428,054.08	0.08%	$ 5,511,166.79	1.01%
		*Oct 1 20 to Mar 31 21 w/o Transdev contract (*for reference only*)*	*$ 39,863,273.69*	*$ 428,054.08*	*1.07%*	*$ 5,511,166.79*	*13.83%*
		Apr 1 21 to Sept 30 21	$ 96,111,004.32	$ 461,370.54	0.48%	$ 44,133,244.11	45.92%

	Federal DBE GOAL	REPORTING PERIOD	Total Federal $$	Federal DBE $$	Federal DBE %	Federal SBE $$	Federal SBE %
FFY19		**Oct 1 18 to Mar 31 19**	$ 8,603,476.55	$ 204,022.26	**2.37%**	$ 182,110.81	2.12%
		Apr 1 19 to Sept 30 19	$ 9,005,016.32	$ 3,884,727.66	**43.14%**	$ 644,406.58	7.16%
FFY20		**Oct 1 19 to Mar 31 20**	$ 7,065,591.07	$ 84,861.22	**1.20%**	$ 1,309,065.78	18.53%
		Apr 1 20 to Sept 30 20	$ 130,881,224.89	$ 135,337.29	**0.10%**	$ 242,071.52	0.18%
	2.9%	*Apr 1 20 to Sept 30 20 w/o First Transit contract (*for reference only*)*	*$ 14,306,408.31*	*$ 135,337.29*	*0.95%*	*$ 242,071.52*	*1.69%*
FFY21		**Oct 1 20 to Mar 31 21**	$ 182,514,682.65	$ 45,759.00	**0.03%**	$ 369,213.11	0.20%
		*Oct 1 20 to Mar 31 21 w/o Transdev contract (*for reference only*)*	*$ 1,059,896.95*	*$ 45,759.00*	*4.32%*	*$ 369,213.11*	*34.83%*
		Apr 1 21 to Sept 30 21	$ 14,952,198.32	$ 44,380.72	**0.30%**	$ 712,640.36	4.77%
	Federal DBE GOAL	**REPORTING PERIOD**	**Total Local $$**	**Local DBE $$**	**Local DBE %**	**Local SBE $**	**LOCAL SBE %**
FFY19		**Oct 1 18 to Mar 31 19**	$ 65,186,621.36	$ 402,794.84	0.62%	$ 5,532,957.55	8.49%
		Apr 1 19 to Sept 30 19	$ 31,000,252.15	$ 2,358,991.67	7.61%	$ 1,152,487.48	3.72%
FFY20		**Oct 1 19 to Mar 31 20**	$ 44,956,535.75	$ 4,245,302.10	9.44%	$ 3,522,846.01	7.84%
		Apr 1 20 to Sept 30 20	$ 99,707,605.78	$ 501,374.79	0.50%	$ 2,080,838.25	2.09%
	2.9%	*Apr 1 20 to Sept 30 20 w/o First Transit contract (*for reference only*)*	*$ 32,973,712.69*	*$ 501,374.79*	*1.52%*	*$ 2,080,838.25*	*6.31%*
FFY21		**Oct 1 20 to Mar 31 21**	$ 363,734,039.54	$ 382,295.08	0.11%	$ 5,141,953.68	1.41%
		*Oct 1 20 to Mar 31 21 w/o Transdev contract (*for reference only*)*	*$ 38,803,376.74*	*$ 382,295.08*	*0.99%*	*$ 5,141,953.68*	*13.25%*
		Apr 1 21 to Sept 30 21	$ 81,158,806.00	$ 416,989.82	0.51%	$ 43,420,603.75	53.50%

	Federal DBE GOAL	REPORTING PERIOD	TOTAL DOLLARS AWARDED (fed & local)	Total DBE $$	Total DBE %	Total SBE $$	Total SBE %
FFY19-21	2.9%	**Oct 1, 2018 thru Sept 30, 2021 (6 semi-annual reports)**	**$ 1,038,766,050.38**	**$ 12,706,836.45**	**1.22%**	**$ 64,311,194.88**	**6.19%**
		*Oct 1, 2018 thru Sept 30, 2021 (6 semi-annual reports) w/o First Transit or Transdev contract (*for reference only*)*	*$ 349,071,892.21*	*$ 12,706,836.45*	*3.64%*	*$ 64,311,194.88*	*18.42%*
	Federal DBE GOAL	**REPORTING PERIOD**	Total Federal $$	Federal DBE $$	**Federal DBE %**	Federal SBE $$	Federal SBE %
FFY19-21	2.9%	**Oct 1, 2018 thru Sept 30, 2021 (6 semi-annual reports)**	**$ 353,022,189.80**	**$ 4,399,088.15**	**1.25%**	**$ 3,459,508.16**	**0.98%**
		*Oct 1, 2018 thru Sept 30, 2021 (6 semi-annual reports) w/o First Transit or Transdev contract (*for reference only*)*	*$ 54,992,587.52*	*$ 4,399,088.15*	*8.00%*	*$ 3,459,508.16*	*6.29%*
	Federal DBE GOAL	**REPORTING PERIOD**	Total Local $$	Local DBE $$	Local DBE %	Local SBE $	LOCAL SBE %
FFY19-21	2.9%	**Oct 1, 2018 thru Sept 30, 2021 (6 semi-annual reports)**	**$ 685,743,860.58**	**$ 8,307,748.30**	**1.21%**	**$ 60,851,686.72**	**8.87%**
		*Oct 1, 2018 thru Sept 30, 2021 (6 semi-annual reports) w/o First Transit or Transdev contract (*for reference only*)*	*$ 294,079,304.69*	*$ 8,307,748.30*	*2.83%*	*$ 60,851,686.72*	*20.69%*

	Federal DBE GOAL	REPORTING PERIOD	TOTAL DOLLARS AWARDED (fed & local)	Total DBE $$	Total DBE %	Total SBE $$	Total SBE %
FFY22	6.3%	Oct 1 21 to Mar 31 22	$ 58,074,628.88	$ 637,356.70	1.10%	$ 6,907,845.36	11.89%
		Apr 1 22 to Sept 30 22	$ 45,351,112.49	$ 670,801.19	1.48%	$ 1,810,431.39	3.99%
FFY23		Oct 1 22 to Mar 31 23	$ 67,365,767.07	$ 10,440,863.02	15.50%	$ 12,221,020.20	18.14%
		Apr 1 23 to Sept 30 23	$ 53,799,232.47	$ 5,446,585.33	10.12%	$ 1,208,807.09	2.25%
FFY24		Oct 1 23 to Mar 31 24	$ 77,886,701.74	$ 4,246,084.11	5.45%	$ 8,310,162.54	10.67%
		Apr 1 24 to Sept 30 24	$ 73,649,043.32	$ 6,949,059.93	9.44%	$ 4,564,695.97	6.20%

	Federal DBE GOAL	REPORTING PERIOD	Total Federal $$	Federal DBE $$	**Federal DBE %**	Federal SBE $$	Federal SBE %
FFY22	6.3%	Oct 1 21 to Mar 31 22	$ 7,843,315.85	$ 234,599.40	**2.99%**	$ 760,885.51	9.70%
		Apr 1 22 to Sept 30 22	$ 6,977,851.08	$ 92,523.71	**1.33%**	$ 231,078.11	3.31%
FFY23		Oct 1 22 to Mar 31 23	$ 17,806,277.45	$ 7,965,351.88	**44.73%**	$ 1,029,876.32	5.78%
		Apr 1 23 to Sept 30 23	$ 9,630,377.28	$ 2,237,323.28	**23.23%**	$ 126,527.09	1.31%
FFY24		Oct 1 23 to Mar 31 24	$ 11,394,054.87	$ 240,626.03	**2.11%**	$ 1,832,026.03	16.08%
		Apr 1 24 to Sept 30 24	$ 3,624,621.11	$ 75,249.65	**2.08%**	$ 871,257.12	24.04%

	Federal DBE GOAL	REPORTING PERIOD	Total Local $$	Local DBE $$	Local DBE %	Local SBE $	LOCAL SBE %
FFY22	6.3%	Oct 1 21 to Mar 31 22	$ 50,231,313.03	$ 402,757.30	0.80%	$ 6,146,959.85	12.24%
		Apr 1 22 to Sept 30 22	$ 38,373,261.41	$ 578,277.48	1.51%	$ 1,579,353.28	4.12%
FFY23		Oct 1 22 to Mar 31 23	$ 49,559,489.62	$ 2,475,511.14	5.00%	$ 11,191,143.88	22.58%
		Apr 1 23 to Sept 30 23	$ 44,168,855.19	$ 3,209,262.05	7.27%	$ 1,082,280.00	2.45%
FFY24		Oct 1 23 to Mar 31 24	$ 66,492,646.87	$ 4,005,458.08	6.02%	$ 6,478,136.51	9.74%
		Apr 1 24 to Sept 30 24	$ 70,024,422.21	$ 6,873,810.28	9.82%	$ 3,693,438.85	5.27%

			TOTAL DOLLARS AWARDED (fed & local)	Total DBE $$	Total DBE %	Total SBE $$	Total SBE %
FFY22-24	**6.3%**	**Oct 1, 2021 thru Sept 30, 2024 (6 semi-annual reports *IN PROGRESS*)**	**$ 376,126,485.97**	**$ 28,390,750.28**	**7.55%**	**$ 35,022,962.55**	**9.31%**
			Total Federal $$	Federal DBE $$	**Federal DBE %**	Federal SBE $$	Federal SBE %
FFY22-24	**6.3%**	**Oct 1, 2021 thru Sept 30, 2024 (6 semi-annual reports *IN PROGRESS*)**	**$ 57,276,497.64**	**$ 10,845,673.95**	**18.94%**	**$ 4,851,650.18**	**8.47%**
			Total Local $$	Local DBE $$	Local DBE %	Local SBE $	LOCAL SBE %
FFY22-24	**6.3%**	**Oct 1, 2021 thru Sept 30, 2024 (6 semi-annual reports *IN PROGRESS*)**	**$ 318,849,988.33**	**$ 17,545,076.33**	**5.50%**	**$ 30,171,312.37**	**9.46%**

***Transit Vehicle Procurements (buses, trolleys) from Transit Vehicle Manufacturers (TVM) are not included in this Report per DOT DBE Regulations. TVMs have their own DBE Program, Goals and Reporting requirements. Inventory procurements are also not included. Only at time an inventory item is issued from store room will the federal/local breakdown be known, not at the time of purchase. ***

****In FY17, MTS began using the U.S. Small Business Administration Database, which provides a listing of Small Businesses. This Database tracks firms in which revenues and/or number of employees do not exceed the North American Industry Classifcation System (NAICS) code's small business size standards, which is used to determine whether a DBE is a small business or not.****

Metropolitan Transit System

Agenda Item No. 11

MEETING OF THE SAN DIEGO METROPOLITAN TRANSIT SYSTEM
BOARD OF DIRECTORS

January 16, 2025

SUBJECT:

Imperial Avenue Division (IAD) Zero Emission Bus (ZEB) Overhead Charging Phase 1– Contract Award

RECOMMENDATION:

That the San Diego Metropolitan Transit System (MTS) Board of Directors authorize the Chief Executive Officer (CEO) to execute MTS Doc. No. PWB411.0-25 (in substantially the same format as Attachment A), with G A Abell, Inc. dba Precision Electric Co., for the IAD ZEB Overhead Charging – Phase 1 Construction Project in the amount of $24,648,797.74 plus 10% contingency.

Budget Impact

The total contract cost of this contract is estimated to be $27,113,677.51 ($24,648,797.74 plus 10% contingency of $2,464,879.774). The project will be funded by MTS Capital Improvement Program (CIP) 3009119701 – IAD Battery Electric Bus (BEB) Charging Infrastructure. The project costs are summarized below.

Description	Total Bid Amount	Contingency (10%)	Bid With Contingency (10%)
Phase 1 Base Bid	$19,230,280.76	$1,923,028.08	$21,153,308.84
Add Alternate 1	$1,348,976.50	$134,897.65	$1,483,874.15
Add Alternate 2	$1,255,704.70	$125,570.47	$1,381,275.17
Add Alternate 3	$2,402,020.31	$240,202.03	$2,642,222.34
Add Alternate 4	$411,815.47	$41,181.55	$452,997.02
Total	**$24,648,797.74**	**$2,464,879.77**	**$27,113,677.51**

DISCUSSION:

The IAD ZEB Charging – Phase 1 construction project consists of the construction of a new overhead gantry system capable of providing charging to BEBs at IAD. The project consists of civil, electrical, and structural site improvements as well as new service from the local electrical utility to provide new primary switchgear for future BEB projects. New primary electric switchgear and duct banks are being installed with latency to provide future growth opportunities for anticipated expansion of BEB fleet growth at the facility, current duct bank design includes

spare conduits capable of expanding the entire yard to BEB vehicles. Once complete, IAD will have the ability to charge thirty (30) battery electric buses, and additional capacity on the overhead structure to add ten (10) additional bus charging positions in the future. The phasing is intended to accommodate bus deliveries expected for Fiscal Year (FY)25 and FY26.

On September 28, 2024, staff issued an Invitation for Bids (IFB). The following single bid was received:

ZEB OH INFRASTRUCTURE CONSTRUCTION		
COMPANY NAME	FIRM CERTIFICATIONS	BID AMOUNT
G A Abell, Inc. dba Precision Electric Co.	N/A	$24,648,797.74
MTS – Independent Cost Estimate (ICE)		*$23,813,359.00*

To ascertain that the solicitation was not restrictive, on December 19, 2024, MTS emailed a survey to all the firms that had downloaded the IFB on PlanetBids asking them their reason/s for not bidding. MTS received seven (7) responses back by the deadline of December 23, 2024.

MTS had advertised the IFB for two consecutive weeks on a newspaper, posted the IFB on PlanetBids, and emailed Disadvantaged Business Enterprise (DBEs) to alert as many bidders as possible. Overall, the results indicated that neither the IFB nor MTS's procurement processes played a role in their decision not to respond, and that the scope of work and other terms and conditions were not overly restrictive. Therefore, competition was considered adequate and MTS proceeded with this as a competitive solicitation.

Based on the bid received, and in comparison with the ICE, MTS staff recommends awarding the contract to G A Abell, Inc. dba Precision Electric Co. Staff determined the price to be fair and reasonable.

The Contractor will be using the following subcontractors:

SUBCONTRACTOR NAME	FIRM CERTIFICATIONS
EC Constructors, Inc.	N/A
World Bridge Technologies, Inc.	Small Business

Therefore, staff recommends that the MTS Board of Directors authorize the CEO to execute MTS Doc. No. PWB411.0-25 (in substantially the same format as Attachment A), with G A Abell, Inc. dba Precision Electric Co., for the IAD ZEB Overhead Charging – Phase 1 Construction Project in the amount of $24,648,797.74 plus 10% contingency.

/S/ Sharon Cooney
Sharon Cooney
Chief Executive Officer

Key Staff Contact: Mark Olson, 619.557.4588, mark.olson@sdmts.com

Attachments: A. Draft Agreement PWB411.0-25
B. Scope of Work/Specifications
C. Bid Costs

Metropolitan Transit System

STANDARD CONSTRUCTION AGREEMENT

FOR

MTS DOC. NO. PWB411.0-25

IMPERIAL AVENUE DIVISION (IAD) ZERO EMISSION BUS (ZEB) OVERHEAD CHARGING - PHASE 1

THIS AGREEMENT is entered into this _____ day of _____ 2025, in the State of California by and between San Diego Metropolitan Transit System ("MTS"), a California public agency, and the following, hereinafter referred to as "Contractor":

Name: G A Abell, Inc. dba Precision Electric Co. Address: 8137 Winter Gardens

Lakeside, CA 92040

Form of Business: Corporation
(Corporation, Partnership, Sole Proprietor, etc.)

Email: estimating@pecsd.com

Telephone: _____

Authorized person to sign contracts Adam Cox (Name) General Manager (Title)

The specified Contract Documents are part of this Agreement. The Contractor agrees to furnish to MTS services and materials, as follows:

Contractor shall furnish all necessary management, supervision, labor, materials, tools, supplies, equipment, plant, services, engineering, testing and/or any other act or thing required to diligently and fully perform and complete the Project as specified in accordance with the Standard Agreement and General Conditions (Exhibit A), Scope of Work, Special Conditions and Attachments (Exhibit B), Bid Price Form (Exhibit C), Federal Requirements (Exhibit D) and Forms (Exhibit E).

SCOPE OF WORK.

Contractor, for and in consideration of the payment to be made to Contractor as hereinafter provided, shall furnish all plant, labor, technical and professional services, supervision, materials and equipment, other than such materials and equipment as may be specified to be furnished by MTS, and perform all operations necessary to complete the Work in strict conformance with the Contract Documents (defined below) for the following public work of improvement:

IMPERIAL AVENUE DIVISION (IAD) ZERO EMISSION BUS (ZEB) OVERHEAD CHARGING - PHASE 1

Contractor is an independent contractor and not an agent of MTS. The Contractor and its surety shall be liable to MTS for any damages arising as a result of the Contractor's failure to comply with this obligation.

CONTRACT TIME.

Time is of the essence in the performance of the Work. The Work shall be commenced by the date stated in MTS's Notice to Proceed. The Contractor shall complete all Work required by the Contract Documents within **290 calendar days from the commencement date stated in the Notice to Proceed not including lead time of equipment. 30 additional days for each add/alternates.** By its signature hereunder, Contractor agrees the Contract Time is adequate and reasonable to complete the Work.

CONTRACT PRICE.

MTS shall pay the Contractor as full compensation for the performance of the Contract, subject to any additions or deductions as provided in the Contract Documents, and including all applicable taxes and costs, the sum of twenty-four million, six hundred forty-eight thousand, seven hundred ninety-seven dollars and seventy-four cents ($24,648,797.74). Payment shall be made as set forth in the General Conditions.

PROVISIONS REQUIRED BY LAW.

Each and every provision of law required to be included in these Contract Documents shall be deemed to be included in these Contract Documents. The Contractor shall comply with all requirements of the California Labor Code applicable to this Project.

INDEMNIFICATION.

Contractor shall provide indemnification as set forth in the General Conditions.

PREVAILING WAGES.

Contractor shall be required to pay the prevailing rate of wages in accordance with the Labor Code which such rates shall be made available at MTS's Administrative Office or may be obtained online at http://www.dir.ca.gov and which must be posted at the job site.

SAN DIEGO METROPOLITAN TRANSIT SYSTEM	**G A ABELL, INC. DBA PRECISION ELECTRIC CO.**
By: _____ Sharon Cooney, Chief Executive Officer **Approved as to form:** **By:** _____ Karen Landers, General Counsel	**By:** _____ **Title:** _____

Technical Specification List

DIVISION 1	GENERAL REQUIREMENTS
01 23 00	Alternates
01 71 23	Construction Staking and Surveying
DIVISION 2	EXISTING CONDITIONS
02 41 19	Demolition
DIVISION 3	CONCRETE
03 10 00	Concrete Forming and Accessories
03 20 00	Concrete Reinforcing
03 30 00	Cast-in-Place Concrete
DIVISION 5	METALS
05 12 00	Structural Steel Framing
05 21 00	Steel Joist Framing
05 31 00	Steel Decking
05 51 00	Metal Stairs
DIVISION 9	FINISHES
09 91 13	Exterior Paint
DIVISION 10	SPECIALTIES
10 56 00	Storage Assemblies
DIVISION 11	EQUIPMENT
11 05 11	Requirements for Owner Furnished Contractor Installed Bus Charging Equipment
11 96 00	General Shop Equipment
DIVISION 12	FURNISHINGS
12 57 83	Custom Industrial Furniture
DIVISION 13	SPECIAL CONSTRUCTION
13 34 19	Pre-Engineered Metal Building Systems
DIVISION 22	PLUMBING
22 15 00	General Service Compressed-Air Systems
DIVISION 23	HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)
23 05 00	Common Work Results for HVAC
23 05 19	Meters and Gages for HVAC Piping
23 05 23	General Duty Valves for HVAC Piping
23 05 29	Hangers and Supports for HVAC Piping and Equipment
23 11 23	Facility Natural Gas Piping

Technical Specification List

DIVISION 26	ELECTRICAL
26 05 05	General Provisions for Electrical Systems
26 05 13	Medium Voltage Cables
26 05 19	Low-Voltage Electrical Power Conductors and Cables
26 05 26	Grounding And Bonding For Electrical Systems
26 05 29	Hangers and Supports for Electrical Systems
26 05 33	Raceways and Boxes for Electrical Systems
26 05 36	Cable Trays
26 05 43	Underground Ducts & Raceways for Electrical Systems
26 05 53	Identification for Electrical Systems
26 05 73	Electrical System Study
26 11 16	Secondary Unit Substation - Secondary less than 1000 v
26 12 16	Substation Transformers - Dry-Type
26 13 13	Switchgear - Metal Enclosed MV Breaker
26 24 13	Switchboards
26 24 16	Panelboards
26 27 26	Wiring Devices
26 31 00	Photovoltaic System
26 31 01	Battery Energy Storage System
26 32 13	Gas Engine Driven Generator Sets
26 37 13	Microgrid Energy Management System
26 41 13	Lightning Protection for Structures
26 43 13	Surge Protection Devices
26 56 00	Exterior Lighting
DIVISION 28	ELECTRONIC SAFETY AND SECURITY
28 33 00	Fuel Gas Detection and Alarm
DIVISION 31	EARTHWORK
31 20 00	Excavation
31 23 33	Gas Line Trenching, Backfill, and Resurfacing
31 63 29	Drilled Concrete Piers and Shaft
DIVISION 32	EXTERIOR IMPROVEMENTS
32 11 23	Aggregate Base Courses
32 12 16	Asphalt Paving
32 13 13	Vehicular Concrete Paving
32 17 23	Parking Striping
32 31 13	Bollards and Bollard Covers
32 39 13	Removable Bollards
DIVISION 44	POLLUTION CONTROL EQUIPMENT
44 13 73	Catalytic Reduction Equipment

SECTION 01 23 00
ALTERNATES

PART 1 – GENERAL

The provisions of the Contract, including General and Special Conditions and the requirements of MTS General Conditions, apply to the Work in this Section.

1.01 SUMMARY

A. Section includes description of all alternates in the project.

B. Base bid package shall include the following: medium voltage substation a switchgear, Substation B transformer, Substation B low voltage switchboard, and all duct banks, electrical vaults, and conduits/stub-ups to all alternative options. Microgrid energy management system and controller shall be prepared as part of base package for future integration with any of the alternatives. The base bid also includes the installation of the gas line from the generator to the future SDG&E meter location.

1.02 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.

2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.03 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A schedule of alternates is included at the end of this Section. Specification

Sections referenced in schedule and clouded and identified as elements of alternate work on the drawings contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION

3.01 SCHEUDLE OF ALTERNATES

A. Alternate No 1: Battery Energy Storage System. Battery energy storage system, circuit breakers in low voltage switchboard section on Substation B, associated power conductors and grounding cable, and associated control cables for connection to microgrid energy management system. Additional grounding to steel structure can be installed if required by specific OEM. As indicated on the drawings and in sections.

26 31 01 BATTERY ELECTRICAL SUPPLY SYSTEM

26 37 13 MICROGRID ENERGY MANAGEMENT SYSTEM

B. Alternate No. 2: Photovoltaic System. PV panel, inverters, circuit breakers in low voltage switchboard section on Substation B, associated power conductors and grounding cable, associated control cables for connection to microgrid energy management system, disconnect switch and other PV associated equipment. As indicated on the drawings and in sections.

26 31 00 PHOTOVOLTAIC SYSTEM

26 37 13 MICROGRID ENERGY MANAGEMENT SYSTEM

C. Alternate No. 3: Permanent Standby Generator, Substation A Transformer, Substation A low voltage switchboard and circuit breakers, power conductors and grounding cables from Substation A MV Switchgear to Substation A Transformer, power conductors and grounding cables from Substation A Low Voltage Switchboard to Generator, connection of generator to Grounding Electrodes, associated lightning protection equipment, associated controls cables for connection of generator and Substation A Low Voltage switchboard breakers to microgrid energy management system, and other generator associated equipment. As indicated on the drawing and in sections

23 05 00 COMMON WORK RESULTS FOR HVAC

23 05 19 METERS AND GAGES FOR HVAC PIPING

23 05 23 GENERAL-DUTY VALVES FOR HVAC PIPING

23 05 29 HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

23 11 23 FACILITY NATURAL-GAS PIPING

26 32 13 GAS-ENGINE-DRIVEN GENERATOR SETS

28 33 00 FUEL GAS DETECTION AND ALARM

26 24 13 SWITCHBOARDS

26 12 16 SUBSTATION TRANSFORMERS - DRY-TYPE

26 37 13 MICROGRID ENERGY MANAGEMENT SYSTEM

26 41 13 LIGHTNING PROTECTION FOR STRUCTURES

D. Alternate No. 4: Earthwork for contaminated soils. Work includes loading, hauling, and disposing of contaminated soil to a California hazardous waste approved site, and importing clean material.

31 20 00 EXCAVATION

END OF SECTION

SECTION 01 71 23

CONSTRUCTION STAKING AND SURVEYING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Construction Staking and Surveying

1.2 RELATED SECTIONS

Not Used

1.3 REFERENCE STANDARDS

A. Caltrans Standard Specifications, Latest Edition

1. Section 5-1.26, "Construction Surveys"
2. Caltrans Surveys Manual, Chapter 12, dated November 2012

1.4 SUBMITTALS

Not Used

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 CONSTRUCTION STAKING AND SURVEYING

A. Construction staking shall be in conformance with Chapter 12 of the Caltrans Surveys Manual, dated November 2012. Legible copies of all construction operations staking sheets shall be provided to Engineer two days before construction work is started.

B. All field construction surveying required for accurate location and the construction of the various items of work under the contract shall be performed and furnished by the Contractor.

C. The contractor shall be responsible for performing a site verification survey to confirm the existing grades and conditions at the site prior to any grading or construction operations. The survey data shall be overlaid electronically, in AutoCAD format, on the original ground as shown on the project plans, and any variations brought to the attention of the Engineer.

D. The Contractor shall notify the Engineer, in writing, 48 hours in advance of any construction staking.

E. The Contractor shall replace any disturbed existing property corner markers, monuments, and local agencies' well monuments disturbed during construction operations. These new markers, monuments, and well monuments shall be documented by a record of survey map or corner record prepared in accordance with Section 8771 of the Business and Professions Code and all applicable laws and regulations and filed in the Office of the County Recorder of San Diego County at the Contractor's expense.

F. The Contractor shall be responsible for preparing and filing with the San Diego County surveyor a Corner Record of the references to existing monuments within the area of each street or highway to be reconstructed under this contract, prior to any reconstruction, as required by Section 8771 of the Business and Professions Code (January 1, 1995).

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. Construction Staking and Surveying will be measured for payment as a lump sum.

4.2 PAYMENT

A. Construction Staking and Surveying furnished and completed in accordance with the Contract Documents will be paid at the Contract Price, as listed on the Bid Item List. This price shall include full compensation for furnishing all labor materials, tools, equipment, supplies, supervision, and incidentals, and doing the work, as specified in the Contract Documents, and as directed by the Engineer.

END OF SECTION

SECTION 02 41 00

DEMOLITION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pavement Demolition

B. Removal of Above Ground Surface Improvements

1.2 RELATED SECTIONS

Not Used

1.3 REFERENCE STANDARDS

A. Caltrans Standard Specifications, Latest Edition

1. Section 5-1.36, "Property and Facility Preservation"

2. Section 10-6, "Watering"

3. Section 18, "Dust Palliative"

1.4 SUBMITTALS

A. Submit a demolition work plan to the Engineer detailing the procedures planned and proposed for the accomplishment of the work. The procedures shall provide for safe conduct of the work, careful removal of materials to be demolished, protection of property which is to remain undisturbed, proper disposal of generated material, and timely coordination with MTS for the disconnection of utility services. The plan shall include a detailed description of the methods and equipment to be used for each operation, hazardous materials disposal, disposal facilities selected, and the sequence of operations.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 DEMOLITION

A. Remove Existing Asphalt. Existing asphalt pavement, including base material, shown on the plans to be removed shall be sawcut and removed to bottom of existing pavement surface. The adjacent 2 feet will be milled to a depth indicated on plans. Resulting holes and depressions shall be repaved per the lines and grade established by the Engineer. Residue from saw cutting operations shall be removed from the pavement surface by vacuuming or

other approved method and shall not be allowed to flow across the pavement nor be left on the surface of the pavement. Residue from saw cutting operations shall be disposed of outside the MTS property.

B. Remove Existing Concrete. Removal of existing concrete, including base material, to the limits as shown on the plans. Removal shall conform to Section 15-1.03B, "Removing Concrete" of the Caltrans Standard Specifications and these Special Provisions. Concrete shall be removed to the bottom of the existing pavement section without damaging portions of existing concrete to remain in place by sawcutting the concrete at the limits of removal shown on the Plans or ordered by the Engineer. Demolition shall consist of performing all work necessary to demolish, remove and dispose of existing concrete pavement, all as shown on the plans and specified in the Standard Specifications and these Special Provisions, and as directed by the Engineer, and for doing all the work that may be required to construct and maintain the facilities within the limits of work including temporary pavement. The joint between any surfacing to be removed and surfacing which is to remain in place shall be cut to a neat line with a power-driven saw to full depth prior to removal operations. Residue from saw cutting operations shall be removed from the pavement surface by vacuuming or other approved method and shall not be allowed to flow across the pavement nor be left on the surface of the pavement. Residue from saw cutting operations shall be legally disposed of outside of the MTS property.

C. Remove Wheel Stops. Wheel stops shall be removed and disposed.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. Sawcut shall be measured by lineal foot of sawcut to a length and depth prescribed on the construction plans.

B. Remove Existing Asphalt shall be measured by the square foot of asphalt removed to a depth of 20 inches below existing grade and horizontally to the limits shown in the construction plans.

C. Remove Existing Concrete Pavement shall be measured by the square foot of concrete removed to a depth of 12 inches below existing grade and horizontally to the limits shown in the construction plans.

D. Removal of wheel shop shall be measured by each wheel stop, as identified on the construction plans.

4.2 PAYMENT

A. Sawcut shall be paid by the lineal foot. This shall include full compensation for all the work, labor, equipment and incidentals required to remove, stockpile and legally dispose of as required.

B. Remove Existing Asphalt shall be paid by the square foot. This shall include full compensation for all the work, labor, equipment and incidentals required to remove asphalt pavement and base, stockpile, and legally dispose of as required.

C. Remove Existing Concrete shall be paid by the square foot. This shall include full compensation for all the work, labor, equipment, and incidentals required to remove asphalt pavement and base, stockpile, and legally dispose of as required.

END OF SECTION

SECTION 03 10 00

CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Form-facing material for cast-in-place concrete.
2. Shoring, bracing, and anchoring.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at **Project site**.

1.3 ACTION SUBMITTALS

A. Product Data: For each of the following:

1. Exposed surface form-facing material.
2. Concealed surface form-facing material.
3. Form ties.
4. Form-release agent.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Minutes of preinstallation conference.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork in accordance with ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such

loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.

1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.

2.2 FORM-FACING MATERIALS

A. As-Cast Surface Form-Facing Material:

1. Provide continuous, true, and smooth concrete surfaces.
2. Furnish in largest practicable sizes to minimize number of joints.
3. Acceptable Materials: As required to comply with Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete, and as follows:

    a. Plywood, metal, or other approved panel materials.
    b. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
        1) APA Plyform Class I, B-B or better; mill oiled and edge sealed.

B. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.

1. Provide lumber dressed on at least two edges and one side for tight fit.

2.3 RELATED MATERIALS

A. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

B. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
2. Form release agent for form liners shall be acceptable to form liner manufacturer.

C. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
1. Furnish ties that, when removed, leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.

PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

A. Comply with ACI 301 (ACI 301M).

B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 (ACI 117M) and to comply with the Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete" for as-cast finishes.

C. Limit concrete surface irregularities as follows:

1. Surface Finish-1.0: ACI 117 Class D, 1 inch (25 mm).

D. Construct forms tight enough to prevent loss of concrete mortar.

1. Minimize joints.
2. Exposed Concrete: Symmetrically align joints in forms.

E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.

1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
3. Install keyways, reglets, recesses, and other accessories, for easy removal.

F. Do not use rust-stained, steel, form-facing material.

G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.

1. Provide and secure units to support screed strips.
2. Use strike-off templates or compacting-type screeds.

H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.

1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
2. Locate temporary openings in forms at inconspicuous locations.

I. **Chamfer** exterior corners and edges of permanently exposed concrete.

J. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.

1. Determine sizes and locations from trades providing such items.

2. Obtain written approval of owner's representative prior to forming openings not indicated on Drawings.

K. Construction and Movement Joints:

1. Construct joints true to line with faces perpendicular to surface plane of concrete.
2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
3. Place joints perpendicular to main reinforcement.

4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.

L. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

M. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

N. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
3. Clean embedded items immediately prior to concrete placement.

3.3 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector and qualified testing agency to perform field tests and inspections and prepare test reports.

1. Employment of Agency in no way relieves Contractor of obligation to perform work in accordance with the requirements in the contract documents.

B. Inspections:

1. Inspect formwork for shape, location, and dimensions of the concrete member being formed.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel reinforcement bars.
2. Welded-wire reinforcement.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Each type of steel reinforcement.
2. Bar supports.
3. Mechanical splice couplers.

B. Shop Drawings: Comply with ACI SP-066:

1. Include placing drawings that detail fabrication, bending, and placement.
2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.

C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.

1. Location of construction joints is subject to approval of the Engineer.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each of the following, signed by manufacturers:

1. Epoxy-Coated Reinforcement: CRSI's "Epoxy Coating Plant Certification."

B. Material Test Reports: For the following, from a qualified testing agency:

1. Steel Reinforcement:

a. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706/A706M.

2. Mechanical splice couplers.

C. Mill certificates showing that all materials are sourced from the United States or any US territories. See section 2.2 below.

D. Field quality-control reports.

E. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60 (Grade 420), deformed.

B. Headed-Steel Reinforcing Bars: ASTM A970/A970M.

C. Epoxy-Coated Reinforcing Bars:

1. Steel Bars: ASTM A615/A615M, Grade 60 (Grade 420), deformed bars.
2. Epoxy Coating: ASTM A775/A775M with less than 2 percent damaged coating in each 12-inch (305-mm) bar length.

D. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

E. Epoxy-Coated Welded-Wire Reinforcement: ASTM A884/A884M, Class A coated, Type 1, plain steel.

2.2 SOURCE OF MATERIALS

A. All structural steel materials used in this project shall comply with the requirements set forth by the Buy America Act (49 U.S.C. § 5323(j)) and its implementing regulations.

B. The Contractor shall provide documentation demonstrating compliance with the Buy America Act for all structural steel materials procured for this project. Such documentation shall include certification of the country of origin for each material,

affirming its production in the United States or its eligibility for an exception as outlined in the Act.

C. Manufacturing begins with the initial melting/mixing and continues through the final coating stage. Any process which modifies the chemical content, the physical size or shape, or the final finish is considered a manufacturing process. This includes but not limited to rolling, extruding, machining, bending, grinding, drilling, welding, and coating. The action of applying a coating to steel or iron is also considered a manufacturing process. Coating includes epoxy coating, galvanizing, aluminizing, painting, and any other coating that protects or enhances the value of steel or iron.

D. The following are considered to be steel manufacturing processes:
   1. Production of steel by any of the following processes:
      a. Open hearth furnace.
      b. Basic oxygen.
      c. Electric furnace.
      d. Direct reduction.
   2. Rolling, heat treating, and any other similar processing.
   3. Fabrication of the products.

E. American-made requirements do not apply to raw materials, scrap (recycled steel or iron), pig iron, and processed/pelletized/reduced iron ore.

F. A certification of materials origin shall be required as requested for any items comprised of, or containing, steel or iron materials prior to such items being incorporated into the steel reinforcement.

2.3 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.

   1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

      a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.
      b. For epoxy-coated reinforcement, use CRSI Class 1A epoxy-coated or other dielectric-polymer-coated wire bar supports.

B. Mechanical Splice Couplers: ACI 318 (ACI 318M) Type 1 or Type 2, same material of reinforcing bar being spliced; tension-compression type.

C. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch (1.2908 mm) in diameter.

1. Finish: Plain or ASTM A884/A884M, Class A, Type 1, epoxy coated, with less than 2 percent damaged coating in each 12-inch (305-mm) wire length.

2.4 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

3.1 PREPARATION

A. Protection of In-Place Conditions:

1. Do not cut or puncture vapor retarder.
2. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.

B. Accurately position, support, and secure reinforcement against displacement.

1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
2. Do not tack weld crossing reinforcing bars.

C. Preserve clearance between bars of not less than 1 inch (25 mm), not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.

D. Provide concrete coverage in accordance with ACI 318 (ACI 318M).

E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

F. Splices: Lap splices as indicated on Drawings.

1. Bars indicated to be continuous, and all vertical bars shall be lapped not less than 36 bar diameters at splices, or 24 inches (610 mm), whichever is greater.
2. Stagger splices in accordance with ACI 318 (ACI 318M).
3. Mechanical Splice Couplers: Install in accordance with manufacturer's instructions.

G. Install welded-wire reinforcement in longest practicable lengths.

1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."

    a. For reinforcement less than W4.0 or D4.0, continuous support spacing shall not exceed 12 inches (305 mm).

2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches (50 mm) for plain wire and 8 inches (200 mm) for deformed wire.
3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
4. Lace overlaps with wire.

3.3 JOINTS

A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by owner’s representative.

1. Place joints perpendicular to main reinforcement.
2. Continue reinforcement across construction joints unless otherwise indicated.
3. Do not continue reinforcement through sides of strip placements of floors and slabs.

3.4 INSTALLATION TOLERANCES

A. Comply with ACI 117 (ACI 117M).

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare test reports.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:

1. Steel-reinforcement placement.
2. Steel-reinforcement mechanical splice couplers.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:

1. Section 316329 "Drilled Piers and Shafts" for pier foundations.
2. Section 032000 “Concrete Reinforcing”
3. Section 032000 “Concrete Forming and Accessories”

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, and other pozzolans materials subject to compliance with requirements.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each of the following.

1. Portland cement.
2. Fly ash.
3. Aggregates.
4. Admixtures:

a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates,

temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.

5. Vapor retarders.
6. Curing materials.
7. Joint fillers.

B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Durability exposure class.
4. Maximum w/cm.
5. Slump limit.
6. Air content.
7. Nominal maximum aggregate size.
8. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
9. Intended placement method.
10. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Shop Drawings:

1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

    a. Location of construction joints is subject to approval of the owner’s representative.

D. For concrete indicated in "Concrete Mixtures" Article, including the following:

1. Concrete Class designation.
2. Location within Project.
3. Exposure Class designation.
4. Formed Surface Finish designation and final finish.
5. Curing process.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Vapor retarders.

5. Joint-filler strips.

B. Material Test Reports: For the following, from a qualified testing agency:

1. Portland cement.
2. Fly ash.
3. Blended hydraulic cement.
4. Aggregates.
5. Admixtures:

C. Research Reports: For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.

D. Preconstruction Test Reports: For each mix design.

E. Field quality-control reports.

F. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

A. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.

1. Include the following information in each test report:

a. Admixture dosage rates.
b. Slump.
c. Air content.
d. Seven-day compressive strength.
e. 28-day compressive strength.

B. Alternatively, provide standard mixes from the ready-mix plant for specified mixes.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301 (ACI 301M).

1.9 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 306.1.

B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M).

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 (ACI 301M) unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Type I/II, gray.
2. Fly Ash: ASTM C618, Class C or F.

B. Normal-Weight Aggregates: ASTM C33/C33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.

1. Alkali-Silica Reaction: Comply with one of the following:

a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. (2.37 kg/cu. m) for moderately reactive aggregate or 3 lb./cu. yd. (1.78 kg/cu. m) for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301 (ACI 301M).

2. Maximum Coarse-Aggregate Size: ASTM C33 size #467 1-1/2 inch nominal.
3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Air-Entraining Admixture: ASTM C260/C260M.

D. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride [in steel-reinforced concrete].

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

E. Water and Water Used to Make Ice: ASTM C94/C94M, potable.

2.3 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

B. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.

1. Color:

a. Ambient Temperature Below 50 deg F (10 deg C): Black.
b. Ambient Temperature between 50 deg F (10 deg C) and 85 deg F (29 deg C): Any color.
c. Ambient Temperature Above 85 deg F (29 deg C): White.

C. Curing Paper: Eight-feet- (2438-mm-) wide paper, consisting of two layers of fibered kraft paper laminated with double coating of asphalt.

D. Water: Potable or complying with ASTM C1602/C1602M.

E. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.

F. Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

2.4 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork.

2.5 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301 (ACI 301M).

1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash or Other Pozzolans: 25 percent by mass.

C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete and concrete with a w/cm below 0.50.

2.6 CONCRETE MIXTURES

A. Class A: Normal-weight concrete used for slabs, piers, grade beams, and tie beams.

1. Exposure Class: ACI 318 (ACI 318M) S3.
2. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
3. Maximum w/cm: 0.45.
4. Slump Limit: 5 inches (125 mm), plus or minus 1 inch (25 mm) plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture at Project site.
5. Air Content: 6% plus or minus 1.5 %.

6. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M and ASTM C1116/C1116M, and furnish batch ticket information.

PART 3 - EXECUTION

3.1 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.

3.2 JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.

1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by owner's representative.
2. Place joints perpendicular to main reinforcement.

    a. Continue reinforcement across construction joints unless otherwise indicated.
    b. Do not continue reinforcement through sides of strip placements of floors and slabs.

C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
2. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface, where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints:

1. Install dowel bars and support assemblies at joints where indicated on Drawings.
2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

3.3 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify owner’s representative and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by owner’s representative in writing, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M), but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

1. If a section cannot be placed continuously, provide construction joints as indicated.
2. Deposit concrete to avoid segregation.
3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301 (ACI 301M).

    a. Do not use vibrators to transport concrete inside forms.
    b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer.
    c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
    d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Do not place concrete floors and slabs in a checkerboard sequence.
2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Maintain reinforcement in position on chairs during concrete placement.
4. Screed slab surfaces with a straightedge and strike off to correct elevations.
5. Level concrete, cut high areas, and fill low areas.
6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

3.4 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 (ACI 301M) Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.

    a. Patch voids larger than 1-1/2 inches (38 mm) wide or 1/2 inch (13 mm) deep.
    b. Remove projections larger than 1 inch (25 mm).
    c. Tie holes do not require patching.
    d. Surface Tolerance: ACI 117 (ACI 117M) Class D.
    e. Apply to all formed concrete surfaces.

B. Related Unformed Surfaces:

1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.5 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Broom Finish: Apply a broom finish to exterior concrete paving in bus storage areas and areas leading to and from bus storage.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with owner's representative before application.

3.6 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

3.7 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 (ACI 301M) and ACI 306.1 for cold weather protection during curing.
2. Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M) for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h (1 kg/sq. m x h), calculated in accordance with ACI 305.1,) before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 (ACI 308.1M) as follows:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
2. If forms remain during curing period, moist cure after loosening forms.
3. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:
   a. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
   b. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
   c. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.

      1) Recoat areas subject to heavy rainfall within three hours after initial application.
      2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1 (ACI 308.1M) as follows:

1. Begin curing immediately after finishing concrete.

3.8 TOLERANCES

A. Conform to ACI 117 (ACI 117M).

3.9 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
2. Testing agency shall immediately report to owner’s representative, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.

3. Testing agency shall report results of tests and inspections, in writing, to Owner, owner's representative, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

    a. Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:

        1) Project name.
        2) Name of testing agency.
        3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
        4) Name of concrete manufacturer.
        5) Date and time of inspection, sampling, and field testing.
        6) Date and time of concrete placement.
        7) Location in Work of concrete represented by samples.
        8) Date and time sample was obtained.
        9) Truck and batch ticket numbers.
        10) Design compressive strength at 28 days.
        11) Concrete mixture designation, proportions, and materials.
        12) Field test results.
        13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
        14) Type of fracture and compressive break strengths at seven days and 28 days.

C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

D. Inspections:

1. Headed bolts and studs.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.
5. Batch Plant Inspections: On a random basis, as determined by owner's representative.

E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.

a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M:

   a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   b. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete; ASTM C173/C173M volumetric method, for structural lightweight concrete.

   a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C1064/C1064M:

   a. One test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.

5. Compression Test Specimens: ASTM C31/C31M:

   a. Cast and laboratory cure two sets of three 6-inch (150 mm) by 12-inch (300 mm) or 4-inch (100 mm) by 8-inch (200 mm) cylinder specimens for each composite sample.
   b. Cast, initial cure, and field cure two sets of three standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C39/C39M.

   a. Test one set of three laboratory-cured specimens at seven days and one set of two specimens at 28 days.
   b. Test one set of two three field-cured specimens at seven days and one set of two specimens at 28 days.
   c. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa) if specified compressive strength is 5000 psi (34.5 MPa), or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi (34.5 MPa).

9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by owner's representative but will not be used as sole basis for approval or rejection of concrete.
10. Additional Tests:

    a. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by owner's representative.
    b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by owner's representative.

        1) Acceptance criteria for concrete strength shall be in accordance with ACI 301 (ACI 301M), section 1.6.6.3.

11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.10 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural steel.
2. Shrinkage-resistant grout.

1.2 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Structural-steel materials.
2. High-strength, bolt-nut-washer assemblies.
3. Anchor rods.
4. Threaded rods.
5. Forged-steel hardware.
6. Shop primer.
7. Galvanized-steel primer.
8. Etching cleaner.
9. Galvanized repair paint.
10. Shrinkage-resistant grout.

B. Shop Drawings: Show fabrication of structural-steel components.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Mill test reports for structural-steel materials, including chemical and physical properties.

C. Mill certificates showing that all materials are sourced from the United States or any US territories. See section 2.2 below.

D. Source quality-control reports.

E. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).

B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE.

C. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with applicable provisions of the following specifications and documents:

1. ANSI/AISC 303.
2. ANSI/AISC 360.
3. ANSI/AISC 341.
4. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

B. Connection Design Information:

1. Option 1: Connection designs have been completed and connections indicated on the Drawings.

C. Moment Connections: Type FR, fully restrained.

D. Construction: Moment frame in N-S and E-W direction.

2.2 SOURCE OF MATERIALS

A. All structural steel materials used in this project shall comply with the requirements set forth by the Buy America Act (49 U.S.C. § 5323(j)) and its implementing regulations.

B. The Contractor shall provide documentation demonstrating compliance with the Buy America Act for all structural steel materials procured for this project. Such documentation shall include certification of the country of origin for each material, affirming its production in the United States or its eligibility for an exception as outlined in the Act.

C. Manufacturing begins with the initial melting/mixing and continues through the final coating stage. Any process which modifies the chemical content, the physical size or shape, or the final finish is considered a manufacturing process. This includes but not limited to rolling, extruding, machining, bending, grinding, drilling, welding, and coating. The action of applying a coating to steel or iron is also considered a manufacturing process. Coating includes epoxy coating, galvanizing, aluminizing, painting, and any other coating that protects or enhances the value of steel or iron.

D. The following are considered to be steel manufacturing processes:
   1. Production of steel by any of the following processes:
      a. Open hearth furnace.
      b. Basic oxygen.
      c. Electric furnace.
      d. Direct reduction.
   2. Rolling, heat treating, and any other similar processing.
   3. Fabrication of the products.

E. Buy America requirements do not apply to raw materials, scrap (recycled steel or iron), pig iron, and processed/pelletized/reduced iron ore.

F. A certification of materials origin shall be required as requested for any items comprised of, or containing, steel or iron materials prior to such items being incorporated into the structural steel.

2.3 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A992/A992M Grade 50 (Grade 345).

B. Channels, Angles: ASTM A36/A36M.

C. Plate and Bar: ASTM A36/A36M.

D. Welding Electrodes: Comply with AWS requirements.

2.4 BOLTS AND CONNECTORS

A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH (ASTM A563M, Class 10S), heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1 (Type 8.8-1), compressible-washer type with plain finish.

B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 1, round head assemblies, consisting of steel structural bolts with splined ends; ASTM A563, Grade DH (ASTM A563M, Class 10S), heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.

1. Finish: Plain.

2.5 RODS

A. Headed Anchor Rods: ASTM F1554, Grade 36, weldable, straight.

1. Finish: Plain.

B. Steel Primer:
1. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.6 SHRINKAGE-RESISTANT GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.7 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.

2.8 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.

1. Joint Type: Pretensioned.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.9 HOT-DIP GALVANIZING

A. Hot-Dip Galvanizing: For steel exposed to the elements, weather or corrosive environments and other steel indicated to be galvanized, provide coating for iron and steel fabrications applied by the hot-dip process.

1. Comply with ASTM A 123 for fabricated products and ASTM A 153 for hardware.
2. Provide thickness of galvanizing specified in referenced standards.
3. Galvanizing bath shall contain special high grade zinc and other earthly materials.

2.10 SHOP PRIMING

A. Comply with section 09 91 13 -Exterior Painting

B. Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.

C. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:
1. SSPC-SP 3.

D. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.11 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform shop tests and inspections.

1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
2. Bolted Connections: Inspect and test shop-bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."

3. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

    a. Liquid Penetrant Inspection: ASTM E165/E165M.
    b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
    c. Ultrasonic Inspection: ASTM E164.
    d. Radiographic Inspection: ASTM E94/E94M.

4. In addition to visual inspection, test and inspect shop-welded shear stud connectors in accordance with requirements in AWS D1.1/D1.1M.
5. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.

B. Baseplates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Pretension anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.

C. Maintain erection tolerances of structural steel within ANSI/AISC 303.

3.3 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.

1. Joint Type: Pretensioned.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:

1. Verify structural-steel materials and inspect steel frame joint details.
2. Verify weld materials and inspect welds.
3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

1. Bolted Connections: Inspect and test bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.

a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

1) Liquid Penetrant Inspection: ASTM E165/E165M.
2) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
3) Ultrasonic Inspection: ASTM E164.
4) Radiographic Inspection: ASTM E94/E94M.

END OF SECTION

SECTION 05 21 00

STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. LH-series long-span steel joists.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of joist, accessory, and product.

1. Include layout, designation, number, type, location, and spacing of joists.
2. Include joining and anchorage details; bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Manufacturer certificates.

C. Mill Certificates: For each type of bolt.

D. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications."

1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 STEEL JOISTS

A. Long-Span Steel Joist: Manufactured steel joists according to "Standard Specification for Longspan Steel Joists, LH-Series and Deep Longspan Steel Joists, DLH-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members; of joist type and end and top-chord arrangements as indicated on Drawings.

2.2 SOURCE OF MATERIALS

A. All structural steel materials used in this project shall comply with the requirements set forth by the Buy America Act (49 U.S.C. § 5323(j)) and its implementing regulations.

B. The Contractor shall provide documentation demonstrating compliance with the Buy America Act for all structural steel materials procured for this project. Such documentation shall include certification of the country of origin for each material, affirming its production in the United States or its eligibility for an exception as outlined in the Act.

C. Manufacturing begins with the initial melting/mixing and continues through the final coating stage. Any process which modifies the chemical content, the physical size or shape, or the final finish is considered a manufacturing process. This includes but not limited to rolling, extruding, machining, bending, grinding, drilling, welding, and coating. The action of applying a coating to steel or iron is also considered a manufacturing process. Coating includes epoxy coating, galvanizing, aluminizing, painting, and any other coating that protects or enhances the value of steel or iron.

D. The following are considered to be steel manufacturing processes:
   1. Production of steel by any of the following processes:
      a. Open hearth furnace.
      b. Basic oxygen.
      c. Electric furnace.
      d. Direct reduction.
   2. Rolling, heat treating, and any other similar processing.
   3. Fabrication of the products.

E. Buy America requirements do not apply to raw materials, scrap (recycled steel or iron), pig iron, and processed/pelletized/reduced iron ore.

F. A certification of materials origin shall be required as requested for any items comprised of, or containing, steel or iron materials prior to such items being incorporated into the structural steel.

2.3 STEEL JOIST ACCESSORIES

A. Bridging:

1. Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.
2. Schematically indicated. Detail and fabricate according to SJI's "Specifications." Furnish additional erection bridging if required for stability.
3. Fabricate as indicated on Drawings and according to SJI's "Specifications." Furnish additional erection bridging if required for stability.

B. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, (ASTM A563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.

1. Finish: Plain.

C. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.4 HOT-DIP GALVANIZING

A. Hot-Dip Galvanizing: For steel exposed to the elements, weather or corrosive environments and other steel indicated to be galvanized, provide coating for iron and steel fabrications applied by the hot-dip process.

1. Comply with ASTM A 123 for fabricated products and ASTM A 153 for hardware.
2. Provide thickness of galvanizing specified in referenced standards.
3. Galvanizing bath shall contain special high grade zinc and other earthly materials.

2.5 CLEANING AND SHOP PAINTING

A. Comply with section 09 91 13 -Exterior Painting

B. Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.

C. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:

1. SSPC-SP 3.

D. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written instructions, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.
3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.

C. Field weld joists to supporting steel framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Visually inspect field welds according to AWS D1.1/D1.1M.

END OF SECTION

SECTION 05 31 00

STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Noncomposite form deck.

1.2 ACTION SUBMITTALS

.

A. Product Data:
   1. Noncomposite form deck.

B. Shop Drawings:

   1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.3 INFORMATIONAL SUBMITTALS

A. Certificates:

   1. Welding certificates.
   2. Product Certificates: For each type of steel deck.

B. Test and Evaluation Reports:

   1. Product Test Reports: For tests performed by a qualified testing agency, indicating that power-actuated mechanical fasteners comply with requirements.
   2. Research Reports: For steel deck, from ICC-ES showing compliance with the building code.

C. Field Quality-Control Submittals:

   1. Field quality-control reports.

D. Qualification Statements: For welding personnel and testing agency.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Welding Qualifications: Qualify procedures and personnel in accordance with SDI QA/QC and the following welding code:

a. AWS D1.3/D1.3M.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store products in accordance with SDI MOC3. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck in accordance with AISI S100.

2.2 NONCOMPOSITE FORM DECK

A. Noncomposite Form Deck: Fabricate ribbed-steel sheet noncomposite deck panels used as a form to comply with SDI NC, with the minimum section properties indicated, and with the following:
1. Galvanized- and Shop-Primed Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33 (230) G60 (Z180) zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.

a. Color: Gray top surface with white underside.

2. Profile Depth: 1-1/2 inches (38 mm)].
3. Design Uncoated-Steel Thickness: 0.0179 inch (0.45 mm).
4. Span Condition: As indicated.
5. Side Laps: Overlapped.

2.3 SOURCE OF MATERIALS

A. All structural steel materials used in this project shall comply with the requirements set forth by the Buy America Act (49 U.S.C. § 5323(j)) and its implementing regulations.

B. The Contractor shall provide documentation demonstrating compliance with the Buy America Act for all structural steel materials procured for this project. Such documentation shall include certification of the country of origin for each material,

affirming its production in the United States or its eligibility for an exception as outlined in the Act.

C. Manufacturing begins with the initial melting/mixing and continues through the final coating stage. Any process which modifies the chemical content, the physical size or shape, or the final finish is considered a manufacturing process. This includes but not limited to rolling, extruding, machining, bending, grinding, drilling, welding, and coating. The action of applying a coating to steel or iron is also considered a manufacturing process. Coating includes epoxy coating, galvanizing, aluminizing, painting, and any other coating that protects or enhances the value of steel or iron.

D. The following are considered to be steel manufacturing processes:
   1. Production of steel by any of the following processes:
      a. Open hearth furnace.
      b. Basic oxygen.
      c. Electric furnace.
      d. Direct reduction.
   2. Rolling, heat treating, and any other similar processing.
   3. Fabrication of the products.

E. Buy America requirements do not apply to raw materials, scrap (recycled steel or iron), pig iron, and processed/pelletized/reduced iron ore.

F. A certification of materials origin shall be required as requested for any items comprised of, or containing, steel or iron materials prior to such items being incorporated into the structural steel.

2.4 HOT-DIP GALVANIZING

A. Hot-Dip Galvanizing: For steel exposed to the elements, weather or corrosive environments and other steel indicated to be galvanized, provide coating for iron and steel fabrications applied by the hot-dip process.

   1. Comply with ASTM A 123 for fabricated products and ASTM A 153 for hardware.
   2. Provide thickness of galvanizing specified in referenced standards.
   3. Galvanizing bath shall contain special high grade zinc and other earthly materials.

2.5 SHOP PRIMING

A. Comply with section 09 91 13 -Exterior Painting

B. Shop prime steel surfaces, except the following:

   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
   2. Surfaces to be field welded.

C. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:

D. Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.6 SOURCE QUALITY CONTROL

2.7 ACCESSORIES

A. Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile recommended by SDI standards for overhang and slab depth.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch (1.52 mm) thick, with factory-punched hole of 3/8-inch (9.5-mm) minimum diameter.

I. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck. For drains, cut holes in the field.

J. Galvanizing Repair Paint: ASTM A780/A780M.

K. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install deck panels and accessories in accordance with SDI C, SDI NC, and SDI RD, as applicable; manufacturer's written instructions; and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install in accordance with deck manufacturer's written instructions.

3.2 INSTALLATION OF FLOOR DECK

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:

1. Weld Diameter: 3/4 inch (19 mm), nominal.
2. Weld Spacing:

    a. Weld edge ribs of panels at each support. Space additional welds an average of 16 inches (400 mm) apart, but not more than 18 inches (460 mm) apart.

3. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 36 inches (1 m), and as follows:

1. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of [1-1/2 inches (38 mm), with end joints as follows:

1. End Joints: Lapped.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure in accordance with SDI recommendations unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, in accordance with SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.3 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint in accordance with ASTM A780/A780M and manufacturer's written instructions.

B. Repair Painting:

1. Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation and apply repair paint.
2. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Special inspections and qualification of welding special inspectors for cold-formed steel floor and roof deck in accordance with quality-assurance inspection requirements of SDI QA/QC.

a. Field welds will be subject to inspection.

2. Steel decking will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION

SECTION 05 51 00

METAL STAIRS

PART1 - GENERAL

1.01 SECTION INCLUDES

A. Stairs with concrete treads.

B. Structural steel stair framing and supports.

1.02 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

B. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable.

C. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

D. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength.

E. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.

F. AWS D1.1/D1.1M - Structural Welding Code - Steel.

G. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.

H. SSPC-SP 2 - Hand Tool Cleaning.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
2. Include the design engineer's seal and signature on each sheet of shop

drawings.

C. Design Data: As required by authorities having jurisdiction.

1.04 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.

PART 2 PRODUCTS

2.01 METAL STAIRS - GENERAL

A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.
   1. Regulatory Requirements: Provide stairs and railings that comply with most stringent requirements of local, state, and federal regulations; where requirements of Contract Documents exceed those of regulations, comply with Contract Documents.
   2. Structural Design: Provide complete stair and railing assemblies that comply with the applicable local code.
   3. Dimensions: As indicated on drawings.
   4. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
   5. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
   6. Separate dissimilar metals using paint or permanent tape.

B. Metal Jointing and Finish Quality Levels:
   1. Architectural: All joints as inconspicuous as possible, whether welded or mechanical.
      a. Welded Joints: Continuously welded and ground smooth and flush.
      b. Mechanical Joints: Butted tight, flush, and hairline; concealed fastenings only.
      c. Exposed Edges and Corners: Eased to small uniform radius.
      d. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for highest quality gloss finish.

C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.02 METAL STAIRS WITH CONCRETE TREADS

A. Jointing and Finish Quality Level: Architectural, as defined above.

B. Risers: Closed.

C. Treads: Metal pan with field-installed concrete fill.
   1. Concrete Depth: 1-1/2 inches, minimum.
   2. Tread Pan Material: Steel sheet.
   3. Tread Pan Thickness: As required by design; 14 gauge, 0.075 inch minimum.
   4. Concrete Reinforcement: Welded wire mesh.
   5. Concrete Finish: For resilient floor covering.

D. Risers: Same material and thickness as tread pans.
   1. Riser/Nosing Profile: Sloped riser with rounded nosing of minimum radius.
   2. Nosing Return: Flush with top of concrete fill, not more than 1/2 inch wide.

E. Stringers: Rolled steel channels.
   1. Stringer Depth: 10 inches.
   2. End Closure: Sheet steel of same thickness as risers welded across ends.

F. Landings: Same construction as treads, supported and reinforced as required to achieve design load capacity.

G. Railings: Steel pipe railings.

H. Finish: Shop- or factory-prime painted.

2.03 HANDRAILS AND GUARDS

A. Wall-Mounted Rails: See Section 055213.

B. Guards: Pipe railings, see Section 055213.

2.04 MATERIALS

A. Steel Sections: ASTM A 36/A 36M.

B. Galvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.
   1. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
   2. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).

C. Concrete Reinforcement: Mesh type as detailed, galvanized.

2.05 ACCESSORIES

A. Steel Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.

B. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

C. Shop and Touch-Up Primer: SSPC-Paint 15, and comply with VOC limitations of authorities having jurisdiction.

2.06 HOT-DIP GALVANIZING

A. Hot-Dip Galvanizing: For steel exposed to the elements, weather or corrosive environments and other steel indicated to be galvanized, provide coating for iron and steel fabrications applied by the hot-dip process.

1. Comply with ASTM A 123 for fabricated products and ASTM A 153 for hardware.
2. Provide thickness of galvanizing specified in referenced standards.
3. Galvanizing bath shall contain special high grade zinc and other earthly materials.

2.07 SHOP PRIMING

B. Comply with section 09 91 13 -Exterior Painting

C. Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.

D. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:
1. SSPC-SP 3.

E. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. When field welding is required, clean and strip primed steel items to bare metal.
B. Supply items required to be cast into concrete with setting templates.

3.03 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Provide anchors, plates, angles, hangers, and struts required for connecting stairs to structure.

C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

D. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.

F. Obtain approval prior to site cutting or creating adjustments not scheduled.

G. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

END OFSECTION

SECTION 09 91 13

EXTERIOR PAINTING

PART 1 - GENERAL

The provisions of the Contract, including General and Special Conditions and the requirements of Division 1, apply to the Work in this Section.

1.01 WORK INCLUDED

A. Surface preparation and the application of the specified paint systems on the following exterior substrates:

1. All exterior steel and iron items and surfaces (with or without shop applied primers, galvanized or ungalvanized) and exterior galvanized metal surfaces, including all structural steel, steel joist framing, steel decking, steel fabrications and miscellaneous steel.

2. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Work does not include surface preparation and application of paint system to pre-finished exterior metal items, finished metal surfaces, operating parts, and labels.

1. Prefinished exterior metal items include:

a. Pre-finished standing seam metal roofs.

b. Pre-finished metal wall panels.

c. Pre-finished mechanical, electrical and lighting equipment and equipment enclosures

2. Finished metal surfaces include the following:

a. Anodized aluminum.

b. Stainless steel.

c. Chromium plate.

d. Copper and copper alloys.

e. Bronze and brass.

3. Operating parts include moving parts of operating equipment and the following:

   a. Valve and damper operators.

   b. Linkages.

   c. Sensing devices.

   d. Motor and fan shafts.

   e. Pantographs

C. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.02 RELATED REQUIREMENTS

A. For Work indicated under 1.01 of this Specification Section and further addressed in other Specification Sections:

1. 05 12 00 – Structural Steel Framing

2. 05 21 00 – Steel Joist Framing

3. 05 31 00 – Steel Decking

1.03 DEFINITIONS

A. AMPP/SSPC: Association for Materials Protection and Performance / Society for Protective Coatings.

B. MPI: Master Painters Institute.

C. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

D. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

E. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

F. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

G. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

H. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.04 ALTERNATIVE BIDS

A. Refer to Division 1 - General Requirements for possible effect on Work of this Section.

1.05 QUALITY ASSURANCE

A. All paints shall conform to ASTM D3960 Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings and applicable Federal, State, and local codes and ordinances.

B. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

C. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

D. Mockups: Provide a full-coat benchmark finish sample for each type of coating and substrate required. Comply with procedures specified in Painting and Decorating Contractors of America PDCA P5. Duplicate finish of approved sample Submittals.

1. Engineer will select one surface to represent surfaces and conditions for application of each type of coating and substrate.

2. Apply benchmark samples, according to requirements for the completed Work, after permanent lighting and other environmental services have been activated. Provide required sheen, color, and texture on each surface.

a. After finishes are accepted, Engineer will use the room or surface to evaluate coating systems of a similar nature.

b. Approval of mockup shall include the surface cleaning and preparation procedure that were implemented at the specific mockup location

3. Final approval of colors will be by Owner from benchmark samples.

E. Surface cleaning and preparation procedures required prior to applying paint shall be the responsibility of the paint system manufacturer.

1.06 STANDARD AND REGULATORY REQUIREMENTS

A. Paint and necessary surface preparations indicated within this specification section shall comply with all applicable national, state and local codes and regulations. Additional, more specific compliance requirements shall include, but not necessarily be limited to the following:

1. California Green Building Standards (CalGreen), most recent edition.

2. MPI Architectural Painting Specification Manual, most recent edition.

3. SSPC-SP5/NACE 1: Surface Preparation Standard White Metal Blast Cleaning.

4. SSPC-SP10/NACE 2: Surface Preparation Standard Near-White Metal Blast Cleaning.

5. SSPC-SP16: Surface Preparation Standard SSPC-SP 16 – Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steel, and non-Ferrous Metals.

6. ASTM A780: Practice for Repair of Damage and Uncoated Areas of Hot-Dip Galvanized Coatings.

7. PDCA-P1: Painting and Decorating Contractors of America.

B. 'Buy America' Requirements: All manufactured products listed within this specification section are part of a federally assisted procurement involving funds granted by the Federal Transit Administration (FTA), and shall comply with Buy America requirements as delineated by Title 49 Code of Federal Regulations (CFR) Subsection 661.

1.07 SUBMITTALS

A. Product Data: For each paint system indicated, include block fillers and primers.

1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.

2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

3. Provide information indicating compliance of each joint sealant product with the most recent edition of California Green Building Standards (CalGreen) VOC limits.

B. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.

1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.

2. Provide a list of materials and applications for each coat of each Sample. Label each Sample for location and application. Use same designations indicated on Drawings and in schedules. Include color designations.

3. Submit two 8-inch by 12-inch Samples for each type of finish coating for Engineer's review of color and texture only.

C. Qualification Data: For Applicator.

D. Maintenance Material Submittal

1. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

a. Paint: 5 gallons of each material and color applied.

E. 'Buy America' Certificates: 'Buy America' certificates required during bidding shall also be required as part of each product submittal. Certificates shall be complete and accurate. Certificates shall indicate either compliance or non-compliance with the 'Buy America' regulations. Certificates of non-compliance shall also include copies of any granted waivers.

1.08 PRODUCT SUBSTITUTIONS

A. Follow requirements specified in Division 1 - General Requirements.

B. Additional costs resulting from substitution of products other than those specified, including drawing changes and construction, will be at the expense of the Contractor.

C. Substitution Approval: Manufacturers listed for each equipment item may bid without submittal for that item. Manufacturers not listed shall submit for approval in accordance with "Instructions to Bidders". Prior to procurement, submittals for each equipment item by Mark Number shall be provided in accordance with Division 1 - General Requirements.

1.09 WARRANTY

A. Warrant work specified herein for one year from substantial completion against defects in materials, function and workmanship.

B. Warranty shall include materials and labor necessary to correct defects.

C. Defects shall include, but not necessarily limited to, abnormal deterioration of finish.

D. Submit warranties in accordance with Notice to Bidders and Special Provisions of these specifications.

E. All paint, paint accessories, and other finish components specified herein shall be readily available locally in the United States.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:

1. Product name or title of material.

2. Product description (generic classification or binder type).

3. Manufacturer's stock number and date of manufacture.

4. Contents by volume, for pigment and vehicle constituents.

5. Thinning instructions.

6. Application instructions.

7. Color name and number.

8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F and a maximum ambient temperature of 95 deg F, or as otherwise recommended by the product manufacturer. Maintain storage containers in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.11 PROJECT FIELD CONDITIONS

A. Apply all products specified herein according to manufacturer’s recommended instructions for project field conditions. Where manufacturer’s instructions on project field conditions are not available, follow the instruction provided below. Where there is a conflict between the instructions below and manufacturer’s recommended instructions, the manufacturer’s recommended instructions shall prevail.

1. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F.

2. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F.

3. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

a. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

PART 2 - PRODUCTS

2.01 GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

3. Painting system shall be designed and intended for use in protecting metals from corrosion in a marine (coastal) environment.

C. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

2.02 MANUFACTURERS

A. Garon Products, Inc., 2150 HWY 35 Suite 250 Sea Girt, NJ 08750

B. Sherwin Williams 101 W. Prospect Ave., Cleveland, OH 44115

C. Benjamin Moore & Co., 101 Paragon Drive, Montvale, NJ 07645

D. US Technical Coatings, 1000 McFarland 400 Blvd., Alpharetta, GA 30004

E. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not necessarily limited to, products listed in these specifications for the paint category indicated.

2.03 PAINT SYSTEMS

A. Paint System Components:

1. Primer: On non-galvanized steel substrates where primer is recommended by the manufacturer, provide a zinc rich polyurethane rust inhibiting primer. Minimum volume solids 50% +/-2%.. Apply prior to other paint system coats.

2. Intermediate Coat / Primer: Over primed non-galvanized surfaces and bare galvanized steel, provide a minimum two-part epoxy mastic and resin paint system consisting of high solids epoxy designed and intended for protection of industrial steel exposed to fresh and/or saltwater conditions. Minimum volume solids 72% +/-2%.

    a. The paint system shall be suitable as a high build primer or finish coat, self-priming on steel, requiring marginal surface preparation, as indicated in the manufacturer's published literature.

3. Top Coat: Provide polyurethane top coat. Minimum volume solid 62% +/-2%..

B. Provide and apply block fillers, compatible with the selected manufacturer's paint system and produced by the same manufacturer of the paint system, where necessary to achieve smooth surfaces.

C. Colors: As indicated on the Drawings and/or as selected by Owner from Manufacturer's standard range of colors.

D. All paint system components shall be provided by the same manufacturer and intended to work together by the manufacturer.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for application of the Paint System.

B. Review other Sections in which primers are provided to determine compatibility of the total system for various substrates. Furnish information on characteristics of finish materials that can be used to determine compatible primers.

C. Verify with the Applicator and Paint System Manufacturer the suitability and compatibility of the Paint System with substrates, including surface conditions and compatibility with existing finishes and primers.

D. Obtain written verification of compatibility and suitability of primed substrates with the Paint System from the Paint System Manufacturer and submit to Owner prior to application of the Paint System.

E. Notify Engineer about anticipated problems when using the materials specified over substrates primed by others.

F. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Comply with Paint System manufacturer's written instructions and recommendations, and MPI Architectural Painting Specification Manual as applicable, to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Determine compatibility and suitability of any shop primers with the Paint System prior to Preparation, as indicated in 3.01 of this specification section.

D. Cleaning: Clean surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified

1. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, and grease.

2. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

E. Surface Preparation: Prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. As necessary, provide barrier coats or tie-coats over incompatible primers or completely remove existing primer and re-prime, per Paint System manufacturer’s written recommendations. All barrier coats, tie-coats or re-prime coats shall be compatible with the Paint System. Paint System manufacturer shall provide written verification of compatibility.

2. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with The Society for Protective Coating’s (SSPC) recommendations.

a. Blast steel surfaces clean as recommended by paint system manufacturer and according to SSPC-SP 5/NACE No. 1, SSPC-SP10/NACE No.2.

b. Treat existing painted surfaces with surface preparation methods

recommended by coating manufacturer and in accordance with the coating schedule.

3. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods. Use Oakite Cleaner LTS or equal for pretreatment of any non-primed galvanized metal before finish painting.

   a. Prepare all galvanized and non-ferrous metals in accordance with SSPC-SP2, or as otherwise recommended by the paint system manufacturer.

   b. Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780 – Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

F. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.

2. Blend material before application to produce a mixture of uniform density. Blend as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.

3. Use only thinners approved by paint manufacturer and only within recommended limits.

G. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.03 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.

2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.

3. Provide finish coats that are compatible with primers used.

4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.

5. Paint surfaces behind movable equipment and furniture the same as similar

exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

6. Paint interior surfaces of ducts with a flat, non-specular black paint where visible through registers or grilles.

7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.

8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.

9. Sand lightly between each succeeding enamel or varnish coat.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.

2. Omit primer over metal surfaces that have been shop primed and touchup painted with a primer that has been determined to be compatible with the Paint System.

3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.

2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.

3. Spray Equipment: Use airless or conventional spray equipment with orifice size as recommended by manufacturer for material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed to outdoor weather conditions.

F. Mechanical items to be painted include, but are not limited to, the following:

1. Uninsulated metal piping.

2. Uninsulated plastic piping.

3. Pipe hangers and supports.

4. Tanks that do not have factory-applied final finishes.

5. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.

6. Duct, equipment, and pipe insulation having "all-service jacket" or other paintable jacket material.

7. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

G. Electrical items to be painted include, but are not limited to, the following:

1. Switchgear.

2. Panelboards.

3. Electrical equipment that is indicated to have a factory-primed finish for field painting.

H. Block Fillers: Apply block fillers compatible to the Paint System to concrete masonry block at a rate to ensure complete coverage with pores filled.

I. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and either has not been prime coated by others, or that has been determined to have a compatible paint / primed surface for the Paint System primer. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn- through or other defects due to insufficient sealing.

J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

K. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.

1. Provide satin finish for final coats.

L. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.04 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.

2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.05 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Engineer, and leave in an undamaged condition.

D. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.

E. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in Painting and Decorating Contractors of America PDCA P1.

3.06 EXTERIOR PAINTING SCHEDULE

A. Steel and Iron Substrates (non-galvanized):

1. Zinc rich metal primer, Garon Steelz Coat ZR, or equal.

2. Epoxy mastic, Garon Steelz Shield HV, or equal.

3. Polyurethane top coat, Garon Steelz Top UV, or equal

B. Galvanized-Metal Substrates:

1. Epoxy mastic, Garon Steelz Shield HV, or equal.

2. Polyurethane top coat, Garon Steelz Top UV, or equal

END OF SECTION

SECTION 10 56 00

STORAGE ASSEMBLIES

PART 1 - GENERAL
The General Provisions of the Contract, including General and Special Conditions and the requirements of Division 1, apply to the Work in this Section.

1.01 WORK INCLUDED

A. Equipment items as listed below by Equipment Mark Number:

1. CABINET, FLAMMABLE MATERIALS,
LARGE Equipment Mark Number:
1140

2. CABINET, STORAGE, SHOP,
24 INCH Equipment Mark
Number: 1190

3. DESK, STAND-UP
Equipment Mark Number: 1220

B. Installation of equipment with labor, services, and incidentals necessary for complete and operational equipment installation.

C. Utilities to be roughed in at location recommended by manufacturer.

1.02 ALTERNATIVE BIDS

A. Refer to Division 1 - General Requirements for possible effect on Work of this Section.

1.03 QUALITY ASSURANCE

A. Equipment shall be produced by a manufacturer of established reputation with a minimum of five years experience supplying specified equipment.

1.04 STANDARD AND REGULATORY REQUIREMENTS

A. Equipment indicated within this specification section shall comply with all applicable national, state and local codes and regulations, including seismic, fire, and racking codes and regulations. Additional, more specific compliance requirements may be listed under individual equipment headings.

B. ‘Buy America’ Requirements: All manufactured products listed within this specification section are part of a federally assisted procurement involving funds granted by the Federal Transit

Administration (FTA), and shall comply with Buy America requirements as delineated by Title 49 Code of Federal Regulations (CFR) Subsection 661.

1.05 SUBMITTALS

A. Refer to Sheet Q.14 Equipment Schedule for submittal requirements listed in the "Submittals" column of the equipment list. In the event of conflict between Sheet Q.14 Equipment Schedule and the following expanded submittal descriptions, Sheet Q.14 Equipment Schedule is to govern.

B. Product Data:

1. Submit Product Data in accordance with Division 1 - General Requirements of these specifications.

2. All Product Data submittals shall identify proposed project specific items marked by arrow, circle, underline, reproducible highlight, or other markings clearly discernable by the reviewer, to show which specific items, parts and accessories are being submitted for the project product data review. Non-marked or generic product data submittals with no marks indicating specific items, parts and accessories will be a cause for rejection.

3. Restrict submitted material to pertinent data. For instance, do not include manufacturer's complete catalog when pertinent information is contained on a single page.

C. Operation and Maintenance Manual:

1. Provide a Complete parts list, operating instructions, and maintenance manual covering equipment at time of installation including, but not limited to:

a. Description of system and components.

b. Manufacturer's printed operating instructions.

c. Printed listing of periodic preventive maintenance items and recommended frequency required to validate warranties. Failure to provide maintenance information will indicate that preventive maintenance is not a condition for validation of warranties.

d. List of original manufacturer's parts, including suppliers' part numbers and cuts, recommended spare parts stockage quantity and local parts and service source.

2. Assemble and provide copies of manual in 8-1/2 by 11 inch format. Foldout diagrams and illustrations are acceptable. Manual to be reproducible by dry copy method. Provide copies per provisions of Division 1 - General Requirements.

D. Shop Drawings: Submit shop drawings in accordance with Division 1 -General Requirements of these specifications. Refer to Sheet Q.14 Equipment Schedule for the equipment mark numbers requiring shop drawings.

1. Submitted shop drawings shall be project specific and shall include a minimum 1/8 inch to 1 foot scaled (or larger standard architectural imperial scale), dimensioned, graphical representation of the size, orientation, and location for the submitted equipment. The drawings shall further include dimensions from structural elements or architectural grid lines, operational clearances, locations of any utility service connection points, mounting requirements, and structural supports required for the submitted equipment.

E. Required Documents for Permit and Local Jurisdictional Approval: Where required by local jurisdiction and/or code officials, the contractor/supplier shall be responsible for producing and submitting all documentation required for obtaining any and all applicable approvals related to the specified equipment. This documentation may include, but may not be limited to, engineered signed and stamped plans, details, anchorage layouts for storage equipment, as well as racks to show compliance with locally adopted ASCE, seismic, fire, and other codes. A copy of these required documents shall be included with the product submittal to the architect/consultant team for their review.

F. ’Buy America’ Certificates: ‘Buy America’ certificates required during bidding shall also be required as part of each product submittal. Certificates shall be complete and accurate. Certificates shall indicate either compliance or non-compliance with the ‘Buy America’ regulations. Certificates of non-compliance shall also include copies of any granted waivers.

1.06 PRODUCT SUBSTITUTIONS

A. Follow requirements specified in Division 1 - General Requirements.

B. Additional costs resulting from substitution of products other than those specified, including drawing changes and construction, will be at the expense of the Contractor.

C. Substitution Approval: Manufacturers listed for each equipment item may bid without submittal for that item. Manufacturers not listed shall submit for approval in accordance with "Instructions to Bidders". Prior to procurement, submittals for each equipment item by Mark Number shall be provided in accordance with Division 1 - General Requirements.

1.07 WARRANTY

A. Warrant work specified herein for one year from substantial completion against defects in materials, function and workmanship.

B. Warranty shall include materials and labor necessary to correct defects.

C. Defects shall include, but not be limited to loose, damaged and missing parts and abnormal deterioration of finish.

D. Submit warranties in accordance with Division 1 - General Requirements of these specifications.

E. All parts shall be readily available locally in the United States.

1.08 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment in manufacturer's containers, appropriately packaged and/or crated for protection during shipment and storage in humid, dusty conditions. Equipment shall be stored per manufacturer's recommendation.

B. Indelibly label all containers, including those contained in others, on outside with item description(s) per title and Mark Number of this specification.

C. Provide equipment and materials specified complete in one shipment for each equipment item. Split or partial shipments are not permissible.

1.09 LABELING

A. Manufacturer shall securely attach in a prominent location on each major item of equipment a non-corrosive nameplate showing manufacturer's name, address, model number, serial number, and pertinent utility or operating data.

B. All electrical equipment and materials shall be new and shall be listed by Underwriter's Laboratories, Inc. (U.L.), or other National Recognized Testing Laboratory (NRTL), in categories for which standards have been set by that agency and labeled as such in the manufacturer's plant.

PART 2 - PRODUCTS

2.01 CABINET, FLAMMABLE MATERIALS,
LARGE Equipment Mark Number:
1140

A. General:

1. Description: An upright cabinet with adjustable interior shelves and closeable, lockable doors and handles, designed for the purpose of storing flammable liquids in containers.

2. Compliance: The storage cabinet shall comply with the latest edition of all applicable local, state, and federal codes, including OSHA safety requirements. The storage cabinet shall also comply with the latest editions of the following:

a. NFPA 30: Flammable and Combustible Liquids Code.

b. NFPA 1: Fire Code.

c. International Fire Code.

d. Self-closing models meet UFC 79.

B. Capacities and Dimensions:

1. Storage capacity: Up to nine each, 5 gallon containers. Supports up to 350 pounds.

2. Overall dimensions, nominal:

a. Width: 43 inches.

b. Depth: 18 inches.

c. Height: 65 inches.

3. Shipping weight, nominal: 342 pounds.

C. Features and Construction:

1. Walls and doors: Construction shall consist of double wall 18 gauge sheet steel with 1-1/2 inch air space between inner and outer walls. Doors shall be self-closing at high ambient temperatures, with a 3 point key lock

2. Containment: Cabinet shall have a 2 inch pan-type bottom, raised leakproof sill.

3. Screened flame arrester vent: Two vents per cabinet, one each at left side bottom and right side top, shall be threaded for and provided with 2 inch NPT steel plugs, fire baffle and cap

4. Adjustment: Leveling feet shall be provided at all four corners.

5. Ground: Electrical grounding attachments shall be provided on each side.

6. Closure: Self-closing door with manual latch with fusible link. The spring-loaded fusible link shall melt should the ambient temperature reach 160 degrees Fahrenheit, which will release the latch holding door open.

7. Shelf: Two each adjustable shelves shall be provided between 5-3/8 inches from top and 7-5/16 inches from bottom on 1/2 inch centers.

D. Finish: Durable enamel in safety yellow with "FLAMMABLE - KEEP FIRE AWAY" in minimum 4 inch bright red letters across doors.

E. Manufacturers Reference:

1. Prime manufacturer: Specifications are based on equipment identified herein by manufacturer's name and model to establish acceptable standards of quality, performance, features, and construction.

a. Equipto
225 Main Street

Tatamy, PA 18085
Phone: (800) 323-0801
Fax: (888) 859-2121
Website: www.equipto.com

b. Model: FSC45M

2. Other manufacturers: Contingent upon compliance with these specifications and documentation requirements set forth in SUBMITTALS, equipment produced by other manufacturers, including the following, may be considered as equal.

a. Lyon Workspace
Products 420 North
Main Montgomery, IL
60538
Phone: (630) 892-8941, (800) 433-8488
Fax: (800) 367-6681
Website: www.lyonworkspace.com

b. Republic Storage Systems
Company 1038 Beldon Avenue,
Northeast Canton, OH 44705
Phone: (330) 438-5800, (800) 477-1255
Fax: (330) 454-7772
Website: www.republicstorage.com

2.02 CABINET, STORAGE, SHOP,
24 INCH Equipment Mark
Number: 1190

A. Capacities and Dimensions:

1. Shelving: Full width shelves, five each.

2. Shelf capacity: 200 pounds, minimum.

3. Overall dimensions:

a. Width: 36 inches.

b. Depth: 24 inches.

c. Height: 78 inches.

4. Weight: 180 pounds, nominal.

B. Features and Construction:

1. Shelves: Four box edge half-length shelves of 18 gauge steel construction shall be adjustable on maximum 2 inch centers without removing fasteners.

2. Doors: Three point box edge latching doors of 18 gauge steel construction shall have common locks and two keys for each cabinet. Doors shall open a full 180 degrees and be flush mounted when closed with latching actuated by grip-type satin chrome plated steel handle.

3. Base and Body: Base and Body of the cabinet shall be constructed of a minimum 18 gauge steel. The cabinet shall be pedestal mounted for protection from moisture.

4. Assembly: Back, front, and sides shall be flush with no bolt heads on front or sides.

C. Finish: Durable enamel in Owner's choice of manufacturer's standard colors.

D. Manufacturers Reference:

1. Prime manufacturer: Specifications are based on equipment identified herein by manufacturer's name and model to establish acceptable standards of quality, performance, features, and construction.

   a. Equipto
   225 Main Street
   Tatamy, PA 18085
   Phone: (610) 253-2775, (800) 323-0801
   Fax: (610) 675-2869
   Website: www.equipto.com

   b. Model: 1715

2. Other manufacturers: Contingent upon compliance with these specifications and documentation requirements set forth in SUBMITTALS, equipment produced by other manufacturers, including the following, may be considered as equal.

   a. Lyon Workspace
   Products 420 North
   Main Montgomery, IL
   60538
   Phone: (630) 892-8941, (800) 433-8488
   Fax: (800) 367-6681
   Website: www.lyonworkspace.com

   b. Republic Storage Systems
   Company 1038 Beldon Avenue,
   Northeast Canton, OH 44705
   Phone: (330) 438-5800, (800) 477-1255
   Fax: (330) 454-7772
   Website: www.republicstorage.com

2.03 DESK, STAND-UP
Equipment Mark Number: 1220

A. General:

1. Description: An upright industrial shop desk of steel construction with sloped writing surface top with paper holder shelf above and sliding shelf and lockabale cabinet compartment below.

B. Capacities and Dimensions:

1. Overall desk dimensions, nominal:

a. Width: 36 inches.

b. Depth: 28 inches.

c. Height: 54 inches.

2. Writing surface front edge height, nominal: 42 inches.

3. Shelf dimensions:

a. Width: 34 inches.

b. Depth: 28 inches.

4. Shelf capacity: 1900 pounds

5. Weight, nominal: 364 pounds.

C. Features and Construction:

1. Overall steel construction to be 12 gauge or better, with edges properly finished to prevent injury.

2. Desk to be supported by 7 gauge legs featuring floor anchoring plates, standing at 6 inches tall to allow for forklift transportation.

3. Cabinet area beneath drawer to have bottom, intermediate shelf, and two doors, one having a plated handle and built-in three point locking device.

4. Cabinet doors to be supported by 8 gauge leaf hinges with stainless steel hinge pins

5. Writing surface to be sloped slightly to front with pencil and paper shelf mounted along and above back edge. Surface shall slope no more than 2 inches from back to front.

D. Finish: Durable enamel in manufacturer's standard color.

E. Manufacturers Reference:

1. Prime manufacturer: Specifications are based on equipment identified herein by manufacturer's name and model to establish acceptable standards of quality, performance, features, and construction.

    a. Strong Hold
    P. O. Box 9043
    Louisville, KY
    40209 Phone: 800-
    880-2625 Fax: 502-
    363-3827
    Website: www.strong-hold.com

    b. Model: 34-SD-282

2. Other manufacturers: Contingent upon compliance with these specifications and documentation requirements set forth in SUBMITTALS, equipment produced by other manufacturers, including the following, may be considered as equal.

    a. Republic Storage Systems
    Company 1038 Belden Avenue,
    Northeast Canton, OH 44705
    Phone: (330) 438-5800, (800) 477-1255
    Fax: (330) 454-7772
    Website: www.republicstorage.com

    b. Global Equipment Company, Inc.
    2505 Mill Center Parkway, Suite
    100 Buford, GA 30518
    Phone: (770) 822-5600, (888) 978-7759
    Fax: (800) 336-3818
    Website: www.globalindustrial.com

PART 3 - EXECUTION

3.01 INSPECTION

A. Coordinate location of rough-in work and utility stub-outs to assure match and/or non- interference with equipment to be installed.

B. Inspect delivered equipment for damage from shipping and exposure to weather. Compare delivered equipment with packing lists and specifications to assure receipt of all items.

3.02 INSTALLATION

A. Perform work under direct supervision of Foreman or Construction Superintendent with authority to coordinate installation of scheduled equipment with Architect.

B. Install equipment in accordance with plans, shop drawings, and manufacturer's instructions:

1. Positioning: Place equipment in accordance with any noted special positioning requirements generally level, plumb and at right angles to adjacent work.

2. Fitting: Where field cutting or trimming is necessary, perform in a neat, accurate, professional manner without damaging equipment or adjacent work.

3. Anchorage: Attach equipment securely to floor, per manufacturer's instructions and as directed by Architect, to prevent damage resulting from inadequate fastening. Installation fasteners shall be installed to avoid scratching or damaging adjacent surfaces.

a. Upon completion of work, finish surfaces shall be free of tool marks, scratches, blemishes, and stains.

3.03 TESTING

A. After final installation is complete and prior to authorizing payment, specified equipment shall be checked for compliance with specifications in the presence of the Architect using acceptance procedures provided by the manufacturer.

3.04 CLEANUP

A. Touch-up damage to painted finishes.

B. Wipe and clean equipment of any oil, grease, and solvents, and make ready for use.

C. Clean area around equipment installation and remove packing or installation debris from job site.

D. Notify Architect for acceptance inspection.

3.05 TRAINING

A. Direct the technical representative to provide specified hours of training to designated Owner's maintenance personnel in operation and maintenance of the following equipment. Coordinate, with Owner, training schedule and list of personnel to be trained.

1. CABINET, FLAMMABLE MATERIALS,
LARGE Equipment Mark Number:
1140
Hours Required: X

2. CABINET, STORAGE, SHOP,
24 INCH Equipment Mark
Number: 1190 Hours Required:
X

3. DESK, STAND-UP
   Equipment Mark Number: 1220
   Hours Required: X

B. Obtain, from technical representative, a list of Owner's personnel trained in equipment operations and maintenance.

END OF SECTION

SECTION 11 05 11

REQUIREMENTS FOR OWNER FURNISHED CONTRACTOR INSTALLED BUS CHARGING EQUIPMENT

PART 1 - GENERAL

The provisions of the Contract, including General and Special Conditions and the requirements of Division 1, apply to the Work in this Section.

1.01 WORK INCLUDED

A. Owner Furnished / Contractor Installed (OF/CI) equipment items listed below by Equipment Mark Number:

1. CHARGING CABINET, BATTERY ELECTRIC BUS, 180kW DC POWER Equipment Mark Number 8012

2. CHARGING PANTOGRAPH, INVERTED, FACILITY MOUNTED Equipment Mark Number 8020

3. BATTERY ELECTRIC BUS CHARGER MANAGEMENT SYSTEM Equipment Mark Number 8030

B. Receiving and accepting into possession, relocation/transportation, packing and/or unpacking of the Owner Furnished Equipment indicated above and on the Equipment List in the Drawings.

C. Temporary storage of Owner Furnished Equipment (as needed) in accordance with manufacturer's written instructions, recommendations, and warranties.

D. Roughing-in, installation of equipment, and final connection of utilities, with labor, services, repairs, and incidentals necessary for complete and operational equipment installation.

E. Piping, conduit, wiring, and switching between equipment and utilities.

F. All coordination and scheduling of examination, relocation, installation, and testing of all delineated existing equipment to be relocated as shown in the Equipment Schedule shall be the responsibility of the Contractor.

G. Contractor shall be responsible for repair and/or replacement of all OF/CI equipment during the contractor's period of possession. Decision for repair or replacement of OF/CI equipment shall be by the Owner.

1.02 COORDINATION

A. Contractor shall coordinate OF/CI equipment with Equipment Manufacturer's Representatives.

1. Installation: Coordinate with OF/CI equipment manufacturer's representatives during installation and initial start-up. As needed, request meetings, installation information, and other manufacturer's recommendations from the OF/CI equipment manufacturer's representative. Copy Owner on all requests.

a. For connected OF/CI equipment, coordinate installation with each manufacturer's representative. Schedule meetings with multiple manufacturer's representatives present, as needed, to resolve installation issues.

2. Training: Coordinate and schedule with Owner and OF/CI equipment manufacturer's representatives all training associated with OF/CI equipment. As Owner permits, schedule and conduct all training on-site after successful equipment installation and testing.

a. Coordinate training of connected OF/CI equipment on the same day or within the same week, when possible.

3. Testing: Coordinate, schedule, and perform start up and testing of all OF/CI equipment with Owner and OF/CI equipment manufacturer's representatives.

a. For connected OF/CI equipment, collect and coordinate Manufacturer's recommended testing procedures so that the equipment can be tested both individually and together as a connected system.

b. For OF/CI equipment that involves Owner Vehicles, coordinate and schedule with the Owner use of a vehicle and vehicle operator personnel to perform testing of the OF/CI equipment.

1.03 SUBMITTALS

A. Refer to Sheet Q.1 Equipment Schedule for submittal requirements listed in the "Submittals" column of the equipment list. In the event of conflict between Sheet Q.1 Equipment Schedule and the following expanded submittal descriptions, Section Sheet Q.1 Equipment Schedule is to govern.

B. Test Reports:

1. Prior to start-up and testing, provide OF/CI manufacturer's recommended start up and testing procedures in checklist form for individual testing of OF/CI equipment.

2. Prior to start-up and testing, develop and submit a comprehensive system testing plan based on OF/CI manufacturer's recommendations that include

testing of all connected OF/CI equipment items as a single system.

3. Submit for Owner and Engineer's review. Revise as necessary based on Owner and Engineer's review and comment.

4. At a minimum, each test report shall contain the name of the equipment / system being tested, date of testing, attendees, start-up and testing checklist(s), observations and identified issues, next steps and/or course of corrective action.

5. Upon completion of each start-up and test, submit a completed test report for Owner and Engineer's record.

6. Refer to Part 3 of this specification section for additional information on start up and testing.

C. Training: Provide manufacturer's training information in digital format for each OF/CI Equipment Item. Refer to Part 3 of this specification section for additional information on Training.

PART 2 - PRODUCTS

Owner Furnished Contractor Installed (OF/CI) Equipment items are listed in the Equipment List shown in the Drawings and are identified by Equipment Mark Numbers and shall be located/installed as shown on the Drawings and per equipment manufacturer's installation instructions.

PART 3 - EXECUTION

3.01 GENERAL

A. Scheduling: The Contractor shall prepare for approval a schedule indicating dates for accepting into possession each item of OF/CI equipment and the dates the OF/CI equipment will be relocated, installed, and ready for operation.

B. Manufacturer's Documentation: The Contractor shall request from the Owner all manufacturer's written instructions recommendations and warranties related to the OF/CI equipment, storage of the equipment, installation of the equipment, commissioning and/or testing of the equipment, and start-up of the equipment prior to accepting possession. The Contractor shall review be responsible for complying with the manufacturer's written instructions, recommendations, and warranties to the OF/CI equipment during the entirety of the Contractor's period of possession.

C. Receipt / Manifest: The Contractor shall provide the Owner with a written receipt and/or manifest detailing type and quantity of each OF/CI Equipment item. The receipt / manifest shall include readily identifiable name for the item, quantity of each item, and date the item is taken into contractor's possession. The receipt / manifest shall be signed and dated by both the Contractor and the Owner when the OF/CI equipment is taken into possession by the Contractor.

3.02 PREPARATION AND RELOCATION

A. Equipment Examination: Before each OF/CI equipment item is removed from the existing locations, it shall be examined in the presence of the Owner, and any damage shall be recorded. Contractor shall submit a written report noting the condition of all equipment. The report shall be signed and dated by both the Contractor and the Owner. No damaged items shall be removed unless written approval is provided by the Owner. All additional damage shall be the responsibility of the Contractor, and affected parts shall be repaired or replaced.

B. Packing and/or unpacking: Contractor shall review the OF/CI equipment to determine what packing and/or unpacking is reasonably required upon and during accepting it into possession. The Contractor shall provide any necessary packing materials and labor as well as provide any unpacking labor. The Contractor shall properly dispose of packing materials in their own disposal containers for their haul off.

C. Contractor shall be responsible for any equipment and/or vehicles required for moving and relocating OF/CI equipment from Owner’s storage facility.

D. When moving equipment, Contractor shall be responsible for removing bolts or fastening devices and disconnecting from existing utilities if needed and as required.

3.03 INSTALLATION

A. Installation Coordination: Contractor shall coordinate installation of all OF/CI equipment with required utility connections, spatial needs, and structural connections prior to installation. Contractor shall follow manufacturer’s written instructions for installation and final connection of utilities.

B. Contractor shall provide all miscellaneous hardware and material required for final installation.

C. Perform work under direct supervision of Foreman or Construction Superintendent with authority to coordinate installation of scheduled OF/CI equipment.

D. Install equipment in accordance with plans, shop drawings and manufacturer's instructions:

1. Positioning: Place equipment in accordance with any noted special positioning requirements generally level, plumb and at right angles to adjacent work.

2. Fitting: Where field cutting or trimming is necessary, perform in a neat, accurate, professional manner without damaging equipment or adjacent work.

3. Anchorage: Attach equipment securely to floor/foundation, per Construction Documents and Manufacturer’s written instructions, to prevent damage

resulting from inadequate fastening. Installation fasteners shall be installed to avoid scratching or damaging adjacent surfaces.

4. All final utility connections shall be made by the Contractor's qualified personnel or their designated sub-contractor's qualified personnel, and shall be performed in compliance with state and local codes and ordinances and per manufacturer's written instructions.

5. Upon completion of work, finish surfaces shall be free of tool marks, scratches, blemishes, and stains.

3.04 EQUIPMENT STARTUP

A. Follow all manufacturer's recommended instructions and procedures for individual start up of equipment.

3.05 EQUIPMENT TESTING

A. All, specified equipment shall be tested for compliance with specification in the presence of the Engineer and the Owner using acceptance procedures provided by the manufacturer.

B. Final testing and post installation inspection are required and shall be performed by the manufacturer or the manufacturer's designated representative only. Final testing and inspection shall not be performed by the installer unless the installer is also the manufacturer.

C. Coordinate with the Owner for availability of vehicles and vehicle operator personnel for the purposes of testing equipment. Coordinate testing dates times with the Owner for availability of buses, bus operator(s), and Owner witnesses.

D. Field Testing

1. Field testing shall be performed upon installation at the site to validate each unit operational performance and functionality prior to full energization. The test shall include the following:

   a. Insulation Resistance testing for AC and DC power conductors

   b. Point to point continuity testing between, charger, control module and pantograph

   c. Control systems operational testing (normal and failure mode)

   d. Safety Testing (interlocks)

   e. Rated output tests

   f. Compatible EV field test vehicles as provided by the Owner.

E. Systems testing shall consist of the following:

1. Systems testing shall be performed for each unit after field testing is completed to validate functionality requirements using Owner provided BEBs in coordination with the Charger Management System (CMS) to validate the functionality of the equipment.

2. Prior to testing provide a Systems Testing Plan that includes:

    a. Testing sequential and concurrent charging capabilities.

        1) Validation of charging ratios

    b. Testing local emergency E-Stop

    c. Testing CMS E-stop

    d. Testing Local annunciation

    e. Testing Failure Mode

        1) Regression type testing

    f. Testing data transfer with CMS host provider and bus telematics

    g. Testing Communication and visual charger status indicator lighting

    h. Testing at different times of day and with differing bus starting states of charge, and with either no, or one other bus hooked up to the same charger on another dispenser,

    i. Testing with manual interruption at each spot (each e-stop, CMS e-stop, from the bus itself) and with a pantograph redeployment after the interruption.

F. Manufacturer / Installer shall submit all testing plans and testing schedule for approval 60 days prior to testing. Testing procedures and checklists shall be developed that indicates proper testing of all major functions of the equipment. This procedure and checklist will form the basis of the testing process.

G. Testing shall be witnessed by the Owner or its representatives and shall include signature sign- off that the test were performed in the presence of the Owner's representative.

3.06 CLEANUP

A. Touch-up damage to painted finishes.

B. Wipe and clean equipment of any oil, grease, and solvents, and make ready for use.

C. Clean area around equipment installation and remove packing or installation debris from job site.

D. Notify Owner and Owner's Representative for acceptance inspection.

3.07 TRAINING

A. As specified above, direct the technical representative to provide specified hours of training to Owner's maintenance personnel in operation and maintenance of the following equipment.

1. CHARGING CABINET, BATTERY ELECTRIC BUS, 180kW DC POWER Equipment Mark Number 8012
   Hours Required: 8

2. CHARGING PANTOGRAPH, INVERTED, FACILITY MOUNTED Equipment Mark Number 8020
   Hours Required: 8

3. BATTERY ELECTRIC BUS CHARGER MANAGEMENT SYSTEM Equipment Mark Number 8030
   Hours Required: 8

B. Obtain, from technical representative, a list of Owner's personnel to be trained in the equipment operations and maintenance.

C. Provide a Windows compatible movie file format recording on USB stick of the training session. The training movie can be a recording of a live session or a produced training video.

END OF SECTION

SECTION 11 96 00

GENERAL SHOP EQUIPMENT

PART 1 - GENERAL
The General Provisions of the Contract, including General and Special Conditions and the requirements of Division 1, apply to the Work in this Section.

1.01 WORK INCLUDED

A. Equipment items as listed below by Equipment Mark Number:

1. CHARGER, BATTERY, FIXED
Equipment Mark Number: 2125

2. PALLET, CONTAINMENT, HAZARDOUS MATERIALS
Equipment Mark Number: 5785

3. DE-IONIZER, BATTERY WATER
Equipment Mark Number: 9280

B. Roughing-in, installation of equipment, and final connection of utilities, with labor, services, and incidentals necessary for complete and operational equipment installation.

C. Piping, wiring, and switching between equipment and utilities.

1.02 ALTERNATIVE BIDS

A. Refer to Division 1 - General Requirements for possible effect on Work of this Section.

1.03 QUALITY ASSURANCE

A. Experience: Equipment shall be produced by a manufacturer of established reputation with a minimum of five years experience supplying specified equipment.

B. Manufacturer's Representative:

1. Installation: Provide a qualified manufacturer's representative at site to supervise work related to equipment installation, check out and start up.

2. Training: Provide technical representative to train Owner's maintenance personnel in operation and maintenance of specified equipment.

1.04 STANDARD AND REGULATORY REQUIREMENTS

A. Equipment indicated within this specification section shall comply with all applicable national, state and local codes and regulations, including seismic, fire, and racking codes and regulations. Additional, more specific compliance requirements may be listed under individual equipment headings.

B. Permitting: Any individual equipment permits required by the local authority having jurisdiction (AHJ) shall be responsibility of the Contractor. The contractor shall obtain all necessary information, provide all necessary documents, and submit for any and all individual equipment permit as required by the AHJ. Individual equipment permits shall include, but not necessarily be limited to, any deferred equipment submittals, seismic permitting, fire marshal approvals, and equipment installation/start-up permitting.

C. 'Buy America' Requirements: All manufactured products listed within this specification section are part of a federally assisted procurement involving funds granted by the Federal Transit Administration (FTA), and shall comply with Buy America requirements as delineated by Title 49 Code of Federal Regulations (CFR) Subsection 661.

1.05 SUBMITTALS

A. Refer to Sheet Q.14 Equipment Schedule for submittal requirements listed in the "Submittals" column of the equipment list. In the event of conflict between Sheet Q.14 Equipment Schedule and the following expanded submittal descriptions, Section Sheet Q.14 Equipment Schedule is to govern.

B. Product Data:

1. Submit Product Data in accordance with Division 1 - General Requirements of these specifications.

2. All Product Data submittals shall identify proposed project specific items marked by arrow, circle, underline, reproducible highlight, or other markings clearly discernable by the reviewer, to show which specific items, parts and accessories are being submitted for the project product data review. Non-marked or generic product data submittals with no marks indicating specific items, parts and accessories will be a cause for rejection.

3. Restrict submitted material to pertinent data. For instance, do not include manufacturer's complete catalog when pertinent information is contained on a single page.

C. Operation and Maintenance Manual:

1. Provide a Complete parts list, operating instructions, and maintenance manual covering equipment at time of installation including, but not limited to:

a. Description of system and components.

b. Schematic diagrams of electrical, plumbing and compressed air systems.

c. Manufacturer's printed operating instructions.

d. Printed listing of periodic preventive maintenance items and recommended frequency required to validate warranties. Failure to provide maintenance information will indicate that preventive maintenance is not a condition for validation of warranties.

e. List of original manufacturer's parts, including suppliers' part numbers and cuts, recommended spare parts stockage quantity and local parts and service source.

2. Assemble and provide copies of manual in 8-1/2 by 11 inch format. Foldout diagrams and illustrations are acceptable. Manual to be reproducible by dry copy method. Provide copies per provisions of Division 1 - General Requirements.

D. Submit Shop Drawings in accordance with Division 1 -General Requirements of these specifications. Refer to Sheet Q.14 Equipment Schedule for the equipment mark numbers requiring shop drawings.

1. Submitted shop drawings shall be project specific and shall include a minimum 1/8 inch to 1 foot scaled (or larger standard architectural imperial scale), dimensioned, graphical representation of the size, orientation, and location for the submitted equipment. The drawings shall further include dimensions from structural elements or architectural grid lines, operational clearances, locations of any utility service connection points, mounting requirements, and structural supports required for the submitted equipment.

E. Required Documents for Permit and Local Jurisdictional Approval: Where required by local jurisdiction and/or code officials, the contractor/supplier shall be responsible for producing and submitting all documentation required for obtaining any and all applicable approvals related to the specified equipment. This documentation may include, but may not be limited to, engineered signed and stamped plans, details, anchorage layouts, as well as other documents to show compliance with locally adopted codes. A copy of these required documents shall be included with the product submittal to the architect/consultant team for their review.

F. ’Buy America’ Certificates: ‘Buy America’ certificates required during bidding shall also be required as part of each product submittal. Certificates shall be complete and accurate. Certificates shall indicate either compliance or non-compliance with the ‘Buy America’ regulations. Certificates of non-compliance shall also include copies of any granted waivers.

1.06 PRODUCT SUBSTITUTIONS

A. Follow requirements specified in Division 1 - General Requirements.

B. Additional costs resulting from substitution of products other than those specified, including drawing changes and construction, will be at the expense of the Contractor.

C. Substitution Approval: Manufacturers listed for each equipment item may bid without submittal for that item. Manufacturers not listed shall submit for approval in accordance with "Instructions to Bidders". Prior to procurement, submittals for each equipment item by Mark Number shall be provided in accordance with Division 1 - General Requirements.

1.07 WARRANTY

A. Warrant work specified herein for one year from substantial completion against defects in materials, function and workmanship.

B. Warranty shall include materials and labor necessary to correct defects.

C. Defects shall include, but not be limited to noisy, rough, or substandard operation; loose, damaged, and missing parts; and abnormal deterioration of finish.

D. Submit warranties in accordance with Division 1 - General Requirements of these specifications.

E. All parts shall be readily available locally in the United States.

1.08 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment in manufacturer's containers, appropriately packaged and/or crated for protection during shipment and storage in humid, dusty conditions.

B. Indelibly label all containers, including those contained in others, on outside with item description(s) per title and Mark Number of this specification.

C. Provide equipment and materials specified complete in one shipment for each equipment item. Split or partial shipments are not permissible.

1.09 LABELING

A. Manufacturer shall securely attach in a prominent location on each major item of equipment a non-corrosive nameplate showing manufacturer's name, address, model number, serial number, and pertinent utility or operating data.

B. All electrical equipment and materials shall be new and shall be listed by Underwriter's Laboratories, Inc. (U.L.), or other National Recognized Testing Laboratory (NRTL), in categories for which standards have been set by that agency and labeled as such in the manufacturer's plans

PART 2 - PRODUCTS

2.01 CHARGER, BATTERY, FIXED
Equipment Mark Number: 2125

A. Capacities and Dimensions:

1. DC output rating: 15 VDC, 30 amps.

2. Charging capacity: 1 to 10, 12 VDC batteries.

3. Charge rates: 16 rates

4. Cabinet Dimensions:

a. Height: 16 inches.

b. Width: 19 inches.

c. Depth: 16 inches.

d. Shipping weight: 64 pounds with accessories.

B. Features and Construction:

1. Cabinet: Charger shall be enclosed in bonderized steel with reinforced frame, suitable for wall mounting.

2. Meters:

a. Volt meter range: 11 to 17 VDC.

b. Amp meter range: 0 to 10 amps.

3. Current limiting: Automatic AC line shall have compensation and overload protection.

4. Rectifiers: Hermetically sealed silicone diode shall have full wave rectifiers.

5. Safety features: Safety features shall include automatic surge protection, load and DC voltage regulation.

6. Charging rate controls: The unit shall be equipped with fine and coarse controls.

C. Accessories:

1. Bus bar set: Wood backboard assembly complete with connecting cables, insulated clamp storage bar and 10 pairs of 300 amp rated charging leads

premounted at bus bar end with vinyl insulated clamps on other end. Associated No. 6075, quantity one each.

D. Utilities Available: 120 VAC, 10 amps.

E. Finish: Durable enamel in manufacturer's standard color.

F. Manufacturers Reference:

1. Prime manufacturer: Specifications are based on equipment identified herein by manufacturer's name and model to establish acceptable standards of quality, performance, features, and construction.

a. Associated Equipment Corporation
5043 Farlin Avenue
St. Louis, MO 63115
Telephone: (314) 385-5178, (800) 949-1472
Fax: (314) 385-3254
Website: www.associatedequip.com

b. Model: 6065 with Accessories

2. Other manufacturers: Contingent upon compliance with these specifications and documentation requirements set forth in SUBMITTALS, equipment produced by other manufacturers may be considered as equal.

2.02 PALLET, CONTAINMENT, HAZARDOUS MATERIALS
Equipment Mark Number: 5785

A. General:

1. Description: A square spill containment pallet composed of fluorinated polyethylene (to resist chlorinated solvents) that includes an integral, fully sealed sump pit located below a support grate. The pallet shall be sized for the storage of up to four, upright, 55 gallon drums and designed to accommodate forklifts for ease of relocation.

2. Compliance: The unit shall comply with all applicable current editions of local, state and federal codes and regulations, including all applicable portions of the following:

a. Container Storage Regulation 40 CFR 264.175 for secondary containment as administered by the EPA.

b. National Pollutant Discharge Elimination System (NPDES) 40 CFR 122.26 for source point pollution prevention into water sources as administered by the EPA.

c. Spill Prevention, Control, and Countermeasures Rule (SPCC) as part of the Clean Water Act as administered by the EPA.

B. Capacity and Dimensions:

1. Load capacity: 6,000 pounds.

2. Containment capacity: 66 gallons, minimum.

3. Storage capacity: 18 square feet or four 55-gallon drums.

4. Overall dimensions:

a. Length: 51 inches.

b. Width: 51 inches.

c. Height: 10 inches.

5. Weight, nominal: 80 pounds.

C. Features and Construction:

1. Pallet Body/Sump: The pallet body/sump shall be of one piece fluorinated polyethylene construction, free of drains, joints, holes, or defects that would allow the passage of fluid to the outside of the pallet.

2. Pallet grating: A removable, non-slip, grate style fluorinated polyethylene pallet floor, either in one piece or in sections, all capable of supporting a total uniform distributed load of 6,000 pounds minimum. Grate openings shall be of sufficient size and spacing to allow spillage to pass through and to be captured in the containment sump.

3. Forklift pockets: Pallet shall be formed with four-way forklift access integral into the body of the pallet to ensure ease of transportation.

D. Finish: Manufacturer's standard color.

E. Manufacturers Reference:

1. Prime manufacturer: Specifications are based on equipment identified herein by manufacturer's name and model to establish acceptable standards of quality, performance, features, and construction.

a. UltraTech International, Inc.
11542 Davis Creek Court
Jacksonville, FL 32256
Phone: (904) 292-9019; (800) 764-9563

Fax: (904) 292-1325
Website: www.spillcontainment.com

b. Model: Ultra-Spill Pallet P4 Fluorinated, part# 1232

2. Other manufacturers: Contingent upon compliance with these specifications and documentation requirements set forth in SUBMITTALS, equipment produced by other manufacturers, including the following, may be considered as equal.

a. Chemtech International, Inc.
Westtown Business Center
1568 McDaniel Drive
West Chester, PA 19380
Phone: (888) 709-8070, (610) 566-7177
Fax: (484) 266-7137
Website: www.chemtech-us.com

b. Interstate Products, Inc.
5585 Marquesas Circle Unit 10-C
Sarasota, FL 34233
Phone: (800) 474.7294
Fax: (800) 448.6329
Website: store.interstateproducts.com

2.03 DE-IONIZER, BATTERY WATER
Equipment Mark Number: 9280

A. Capacities and Dimensions:

1. Intermittent flow: 2 GPM.

2. Filter capacity: 600 gallons.

3. Hoses:

a. Input: 3/8 inch by 10 feet long.

b. Output: 3/8 inch by 20 feet long.

B. Overall dimensions:

a. Width: 6 inches.

b. Depth: 6 inches.

c. Height: 44 inches.

d. Weight, nominal: 28 pounds.

C. Features and Construction:

1. Description: De-ionizer shall be a wall-mounted unit capable of processing pressurized domestic water into de-ionized water for use in battery servicing. Unit shall come complete with wall mounting plate, one disposable filter cartridge, purity light, hose hanger, hose quick connects, input/output hoses, and watering gun.

2. Filter: The disposable filter cartridge shall contain beds of cationic and anionic resins that can electrostatically remove dissolved impurities with an output comparable to distilled water.

3. Monitor: The purity light shall be capable of monitoring the conductivity of the output water continuously and signals when filter cartridge has reached the end of its useful life.

D. Accessories:

1. Replacement cartridges, Model PS-600, two each.

2. Battery watering gun: Model GUN-G, one each.

E. Utilities Available:

1. Water: 3/8 inch domestic water supply.

2. Electric: 120 VAC.

F. Manufacturer's Reference:

1. Prime manufacturer: Specifications are based on equipment identified herein by manufacturer's name and model to establish acceptable standards of quality, performance, features, and construction.

   a. Philadelphia Scientific
   207 Progress Drive
   Montgomery, PA 18936
   Phone: (215) 616-0390
   Fax: (215) 616-0500
   Website: www.phlsci.com

   b. Model: PS-300 with Accessories

2. Other manufacturers: Above named manufacturer constitutes only known source of equipment specified. Contingent upon compliance with these specifications and documentation requirements set forth in SUBMITTALS, equipment produced by other manufacturers may be considered as equal.

PART 3 - EXECUTION

3.01 INSPECTION

A. Coordinate location of rough-in work and utility stub-outs to assure match with equipment to be installed.

B. Inspect delivered equipment for damage from shipping and exposure to weather.

C. Compare delivered equipment with packing lists and specifications to assure receipt of all items.

3.02 INSTALLATION

A. Perform work under direct supervision of Foreman or Construction Superintendent with authority to coordinate installation of scheduled equipment with Architect.

B. Install equipment in accordance with plans, shop drawings and manufacturer's instructions:

1. Positioning: Place equipment in accordance with any noted special positioning requirements generally level, plumb and at right angles to adjacent work.

2. Fitting: Where field cutting or trimming is necessary, perform in a neat, accurate, professional manner without damaging equipment or adjacent work.

3. Anchorage: Attach equipment securely to floor, as directed by Architect, to prevent damage resulting from inadequate fastening. Installation fasteners shall be installed to avoid scratching or damaging adjacent surfaces.

4. Upon completion of work, finish surfaces shall be free of tool marks, scratches, blemishes, and stains.

3.03 TESTING

A. After final connections are made and prior to authorizing payment, specified equipment shall be tested for compliance with all specified features in the presence of the Architect using acceptance procedures provided by the manufacturer.

3.04 CLEANUP

A. Touch-up damage to painted finishes.

B. Wipe and clean equipment of any oil, grease, and solvents, and make ready for use.

C. Clean area around equipment installation and remove packing or installation debris from job site.

D. Notify Architect for acceptance inspection.

3.05 TRAINING

A. Direct the technical representative to provide specified hours of training to designated Owner's maintenance personnel in operation and maintenance of the following equipment. Coordinate, with Owner, training schedule and list of personnel to be trained.

1. CHARGER, BATTERY, FIXED
   Equipment Mark Number: 2125
   Hours Required: X

2. PALLET, CONTAINMENT, HAZARDOUS MATERIALS
   Equipment Mark Number: 5785
   Hours Required: X

3. DE-IONIZER, BATTERY WATER
   Equipment Mark Number: 9280
   Hours Required: X

B. Obtain, from technical representative, a list of Owner's personnel trained in equipment operations and maintenance.

END OF SECTION

SECTION 12 57 83

CUSTOM INDUSTRIAL FURNITURE

PART 1 - GENERAL

The General Provisions of the Contract, including General and Special Conditions and the requirements of Division 1, apply to the Work in this Section.

1.01 WORK INCLUDED

A. Equipment items as listed below by Equipment Mark Number:

1. WORKBENCH, SEVERE USE
   Equipment Mark Number: 1860

2. DROPS, AIR/ELECTRIC, TRAPEZE
   Equipment Mark Number: 8190

B. Contractor shall fabricate and provide item per specifications.

C. Contractor shall install equipment with labor, services, and incidentals necessary for complete and operational equipment installation.

1.02 ALTERNATIVE BIDS

A. Refer to Division 1 - General Requirements for possible effect on Work of this Section.

1.03 QUALITY ASSURANCE

A. Experience: Equipment shall be manufactured by a manufacturer of established reputation with a minimum of five years experience performing similar fabrication techniques.

1.04 STANDARD AND REGULATORY REQUIREMENTS

A. Equipment indicated within this specification section shall comply with all applicable national, state and local codes and regulations, including seismic, fire, and racking codes and regulations. Additional, more specific compliance requirements may be listed under individual equipment headings.

B. ‘Buy America’ Requirements: All manufactured products listed within this specification section are part of a federally assisted procurement involving funds granted by the

Federal Transit Administration (FTA), and shall comply with Buy America requirements as delineated by Title 49 Code of Federal Regulations (CFR) Subsection 661.

1.05 SUBMITTALS

A. Refer to Sheet Q.14 Equipment Schedule for submittal requirements listed in the "Submittals" column of the equipment list. In the event of conflict between Sheet Q.14 Equipment Schedule and the following expanded submittal descriptions, Sheet Q.14 Equipment Schedule is to govern.

B. Submit Shop Drawings in accordance with Division 1 -General Requirements of these specifications. Refer to Sheet Q.14 Equipment Schedule for the equipment mark numbers requiring shop drawings.

1. Submitted shop drawings shall be project specific and shall include a minimum 1/8 inch to 1 foot scaled (or larger standard architectural imperial scale), dimensioned, graphical representation of the size, orientation, and location for the submitted equipment. The drawings shall further include dimensions from structural elements or architectural grid lines, operational clearances, locations of any utility service connection points, mounting requirements, and structural supports required for the submitted equipment.

C. 'Buy America' Certificates: 'Buy America' certificates required during bidding shall also be required as part of each product submittal. Certificates shall be complete and accurate. Certificates shall indicate either compliance or non-compliance with the 'Buy America' regulations. Certificates of non-compliance shall also include copies of any granted waivers.

1.06 WARRANTY

A. Warrant work specified herein for one year from substantial completion against defects in materials, function and workmanship.

B. Warranty shall include materials and labor necessary to correct defects.

C. Defects shall include, but not be limited to loose, damaged, and missing parts and abnormal deterioration of finish.

D. Submit warranties in accordance with Division 1 - General Requirements of these specifications.

1.07 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment appropriately packaged and/or crated for protection during shipment and storage in humid, dusty conditions.

B. Indelibly label all containers, including those contained in others, on outside with item description(s) per title and Mark Number of this specification.

C. Provide equipment and materials specified complete in one shipment for each equipment item. Split or partial shipments are not permissible.

PART 2 - PRODUCTS

2.01 WORKBENCH, SEVERE USE
Equipment Mark Number: 1860

A. Capacities and Dimensions:

1. Capacity: 2,500 pounds.

2. Work surface thickness: 3/8 inch.

3. Overall dimensions:

a. Width: 72 inches.

b. Depth: 32 inches.

c. Height: 34 inches.

B. Features and Construction:

1. Construction:

a. Legs: Workbench legs shall be fabricated of 3 by 3 by 3/16 inch steel tubing as shown.

b. Leg braces: Leg braces shall be 3 by 3 by 1/4 inch angle steel with continuous electrical welds to tubing as shown.

c. Top braces: Top braces shall be 3 by 3 by 1/4 inch angle steel with continuous electrical welds to tubing as shown.

d. Top: Top shall be 3/8 inch plate steel with 50 percent minimum electrical welds to top braces. Corners of top shall have 2 inch radius as shown for protection of personnel. All edges shall be ground smooth.

e. Welds: All welds shall conform to American Welding Society standards.

C. Finish: Cover all exposed steel surfaces including both sides of top, braces, and legs with one coat zinc chromate primer and two coats epoxy paint in Owner's choice of colors.

D. Manufacturer's Reference: Fabricated item as shown on Q drawings.

2.02 DROPS, AIR/ELECTRIC, TRAPEZE
Equipment Mark Number: 8190

A. Capacities and Dimensions:

1. Dimensions, frame:

a. Width: 24 inches.

b. Depth: 2-1/4 inches.

c. Height: As shown.

2. Installation height: 78 inches from finish floor to lowest point of assembly, excluding accessories.

B. Features and Construction:

1. Frame: Unit shall be fabricated from 2 by 1 by 1/8 inch rectangular hollow structural steel.

2. Supports: Welded link, 1/4 inch proof coil chain shall be attached to trapeze frame with eyebolts and to overhead structure with appropriate shackles.

3. Welds: Frame welds shall be continuous meeting American Welding Society standards.

4. Electrical:

a. 120 VAC quadraplex outlet and rigid conduit shall be mounted to frame with U-bolt supports.

b. Connection: Flexible conduit shall be used to connect building and trapeze rigid conduit.

5. Air: Trapeze air piping and principal devices shall be as follows starting at building air piping.

a. Cut-off valve: 3/4 inch, , one each at connection to building air piping.

b. Connection: Flexible air line shall be used to connect building and trapeze piping.

c. Main leg and horizontal manifold: 3/4 inch, black steel pipe.

d. Drain valve: 3/4 inch, , one each at bottom of main leg.

e. Filter/regulator/lubricator: Ingersoll Rand ARO 2000 series Filter, Regulator, and Lubricator (FLR) Combination, model number C38351-810,

or approved equal, shall be installed as shown. Together, the FLR Combination shall have the following features:

1) The unit shall have 3/4 inch ports.

2) The unit shall be manual drain type with 3.5 ounce (minimum) metal lubricator bowl, have a sight glass, and have a 5 micron filter.

3) The unit shall be capable of handling an inlet pressure of 250 pounds per square inch (PSI).

4) The unit shall be capable of handling temperatures between 23 and 175 degrees Fahrenheit (F).

5) The unit shall have a 0-140 PSI gauge range.

f. Lubricant oil for Filter/regulator/lubricator: Lubricator shall be filled with oil per manufacturer's recommendations. Oil shall be of a type specifically designed and produced for industrial grade air tool equipment, having an SAE (Society of Automotive Engineers) viscosity grade between 10 and 20, a flashpoint no less than 350 degrees Fahrenheit, and a pour point no higher than -20 degrees Fahrenheit.

g. Quick disconnect couplings: 3/8 inch female quick disconnect coupling, and 1/2 inch female quick disconnect coupling, - shall be installed as shown with elbows as needed for couplings to point downward.

6. Bracing: Piping shall be substantially bracketed to frame including inlet and outlet piping from air filter/lubricator/regulator assembly.

7. Miscellaneous: All materials, fittings, and connectors as required for a complete and operable installation shall be provided by Contractor.

8. ***Data: Terminate utility data line to a single gang surface mount data box with Ethernet jacks and coverplate.***

9. Data box: Surface mount design. Fasten to trapeze frame with screw fasteners. Box shall be capable of securely holding two 8P8C (RJ45) data jacks and compatible cover plate. Box shall be constructed of high-impact, fire retardant plastic, rated/listed by a Nationally Recognized Testing Laboratory (NRTL) to meet UL94V-O standards. Provide gray color.

10. Jacks: Terminate utility data lines with 8P8C (RJ45) CAT 6 Ethernet jack securely mounted within the box. Jacks shall meet be rated/listed by NRTL to meet all ANSI/TIA-568 Specifications for CAT 6 Ethernet. Install per manufacturer's recommendations and industry standards.

11. Coverplate: Provide and install NEMA style single gang box coverplate with two angled, recessed data outlets. Coverplate shall be 304 stainless steel

construction, and shall be compatible with data box dimensions and screw hole pattern.

C. Utilities Available:

1. Electrical: 120 VAC, 20 A.

2. Compressed air: 3/4 inch, 150 to 250 PSI.

3. ***Data: 8P8C (RJ45) CAT 6 Ethernet, two connections***

D. Finish: Cover frame with epoxy compatible zinc chromate primer and finish coat of safety yellow epoxy enamel.

E. Manufacturers Reference: Fabricated item as shown on EQ drawings.

PART 3 - EXECUTION

3.01 INSPECTION

A. Coordinate location of rough-in work and utility stub-outs to assure match and/or non-interference with equipment to be installed.

B. Inspect delivered equipment for damage from shipping and exposure to weather. Compare delivered equipment with packing lists and specifications to assure receipt of all items.

3.02 INSTALLATION

A. Perform work under direct supervision of Foreman or Construction Superintendent with authority to coordinate installation of scheduled equipment with Architect.

B. Install equipment in accordance with plans, shop drawings and manufacturer's instructions:

1. Positioning: Place equipment in accordance with any noted special positioning requirements generally level, plumb and at right angles to adjacent work.

2. Fitting: Where field cutting or trimming is necessary, perform in a neat, accurate, professional manner without damaging equipment or adjacent work.

3. Anchorage: Attach equipment securely to floor, as directed by Architect, to prevent damage resulting from inadequate fastening. Installation fasteners shall be installed to avoid scratching or damaging adjacent surfaces.

4. Upon completion of work, finish surfaces shall be free of tool marks, scratches, blemishes, and stains.

3.03 TESTING

A. After final connections are made and prior to authorizing payment, specified equipment shall be tested for compliance with specifications in the presence of the Architect using acceptance procedures provided by the manufacturer.

3.04 CLEANUP

A. Touch-up damage to finishes.

B. Wipe and clean equipment of any oil, grease, and solvents, and make ready for use.

C. Clean area around equipment installation and remove packing or installation debris from job site.

D. Notify Architect for acceptance inspection.

END OF SECTION

SECTION 13 34 19

PRE-ENGINEERED METAL BUILDING SYSTEMS

PART 1 - GENERAL
The General Provisions of the Contract, including General and Special Conditions and the requirements of Division 1, apply to the Work in this Section.

1.01 WORK INCLUDED

A. Design, provision, and installation for the pre-engineered metal building system, consisting of the following major component categories:

1. Structural and steel framing components.

2. Metal roof panels and trim.

3. Metal wall panels and trim.

4. Metal building doors and openings.

5. Metal building accessories.

B. Design, provision, and installation for the concrete slab and sub surface foundation for the pre-engineered metal building system.

C. Design, provision, and installation for the electrical system for the pre-engineered metal building system, consisting of the following major component categories:

1. Electrical subpanel(s)

2. Lighting

3. Electrical cabling, wiring, conduits, and outlets.

4. Lightning Protection

D. Design, provision, and installation for the mechanical ventilation system for the pre-engineered metal building system.

E. Design, provision, and installation of waterproofing and flashing at connections with existing building.

F. Design, provision, and installation of galvanized chain link fence and fenceposts protection.

G. Portions of the Work indicated in this specification section are further defined in other Specification Sections. Refer to sub-section 1.02 Related Requirements of this Specification Section for additional information.

H. Portions of the Work indicated in this specification section are further defined in the Drawings. Refer to Drawings for additional information.

I. Design and provide building and building components in accordance with applicable codes, including seismic requirements.

J. All labor, services, and incidentals necessary for complete and properly operational pre-engineered metal building system installation.

1.02 RELATED REQUIREMENTS

A. For Work indicated under 1.01 of this Specification Section and further addressed in other Specification Sections:

1. Design, provision, and installation for the concrete slab and sub surface foundation for the pre-engineered metal building system shall conform to the following Specification Sections:

a. 03 10 00 - Concrete Forming and Accessories

b. 03 20 00 – Concrete Reinforcing

c. 03 30 00 – Cast-In-Place Concrete

d. 05 12 00 – Structural Steel Framing

e. 31 63 29 – Drilled Concrete Piers and Shafts

2. Design, provision, and installation for the electrical system for the pre-engineered metal building system shall conform to the following Specification Sections:

a. 26 05 05 – General Provisions for Electrical Systems

b. 26 05 19 – Low-Voltage Electrical Power Conductors and Cables

c. 26 05 26 – Grounding and Bonding for Electrical Systems

d. 26 05 29 – Hangers and Supports for Electrical Systems

e. 26 05 33 – Raceways and Boxes for Electrical Systems

f. 26 05 43 – Underground Ducts Raceways for Electrical Systems

g. 26 05 53 – Identification for Electrical Systems

h. 26 24 16 – Panelboards

i. 26 27 26 – Wiring Devices

j. 26 41 13 – Lightning Protection for Structures

k. 26 56 00 – Exterior Lighting

3. Design, provision, and installation for a mechanical ventilation system for the pre-engineered metal building system shall conform to the following Specification Sections:

a. 23 05 00 – Common Work Results for HVAC

b. 23 05 29 – Hangars and Supports for HVAC Piping and Equipment

B. For other Specification Sections generally affecting the Work in this Specification Section, at a minimum, refer to the following:

1. 03 30 00 – Cast-In-Place Concrete

2. 26 05 43 – Underground Ducts raceways for Electrical Systems

3. 26 31 00 – Photovoltaic System

1.03 ALTERNATIVE BIDS

A. Refer to Division 1 - General Requirements for possible effect on Work of this Section.

1.04 DEFINITIONS

A. Pre-Engineered Metal Building System: Use of the phase ‘Pre-Engineered Metal Building System’ within the Contract Documents shall refer to all systems, components, sub-components, and services indicated under sub-section 1.01 Work Included of this Specification Section.

B. Code: Refers to all applicable codes, amendments, ordinances and regulations. Refer to 1.06 Regulatory Requirements and Permitting for additional information.

C. Manufacturer’s Engineer of Record: A professional engineer registered to practice with in the State of California and employed by the pre-engineered metal building system manufacturer / installer, responsible for design of the specified pre-engineered metal building system and stamping of design drawings and calculations.

1.05 REFERENCE STANDARDS

A. Refer to other Specification Sections for additional reference standards that may affect Work in this section. See 1.02 Related Requirements in this Section for additional information.

B. American Institute of Steel Construction (AISC):

1. AISC 360 - Specification for Structural Steel Buildings.
2. AISC 341 – Seismic Provisions for Structural Steel Buildings.
3. AISC 303 – Code of Standard Practice for Steel Buildings and Bridges.
4. AISC Design Guide 3 – Serviceability for Steel Buildings

C. American Iron and Steel Institute (AISI):

1. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members.

D. American Welding Society (AWS):

1. AWS D1.1 / D1.1M – Structural Welding Code – Steel.
2. AWS D1.3 / D1.3M – Structural Welding Code – Sheet Steel.

E. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE):

1. ASHRAE 90.1-2022 - Energy Standard for Buildings Except Low-Rise Residential Buildings (I-P Edition).

F. ASTM International (ASTM):

1. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel.
2. ASTM C39/C39M – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
3. ASTM E 72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
4. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
5. ASTM G 87 – Standard Practice for Conducting Moist SO2 Tests.
6. ASTM E 96 / E 96M – Standard Test Methods for Water Vapor Transmission of Materials.
7. ASTM B 117 – Standard Practice for Operating Salt Spray (Fog) Apparatus.
8. ASTM A123 – Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
9. ASTM A 153 – Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.

10. ASTM E 283 - Standard Test Method for Determining Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences Across Specimen.

11. ASTM A 325 – Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

12. ASTM E 331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

13. ASTM F 436 - Standard Specification for Hardened Steel Washers

14. ASTM A 475 - Standard Specification for Zinc-Coated Steel Wire Strand.

15. ASTM A 500/A 500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

16. ASTM C 518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

17. ASTM D 522 – Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.

18. ASTM D 523 – Standard Test Method for Specular Gloss.

19. ASTM A 529/A 529M - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality.

20. ASTM A 563 - Standard Specification for Carbon and Alloy Steel Nuts.

21. ASTM A 572/A 572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.

22. ASTM D 635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.

23. ASTM A 653 / A 653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

24. ASTM A 792 / A 792M – Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

25. ASTM A 992/A 992M - Standard Specification for Structural Steel Shapes.

26. ASTM D 968 – Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive.

27. ASTM A 1011/A 1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength, Low-Alloy and High-Strength Low-Alloy with Improved Formability and Ultra-High Strength

28. ASTM A 1018/A 1018A - Standard Specification for Steel, Sheet and Strip, Heavy- Thickness Coils, Hot-Rolled, Carbon, Commercial, Drawing, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

29. ASTM C 1363 – Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus.

30. ASTM E 1592 – Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.

31. ASTM E 1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.

32. ASTM E 1680 - Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems.

33. ASTM D 1929 - Standard Test Method for Determining Ignition Temperature of Plastics.

34. ASTM F 1941 - Standard Specification for Electrodeposited Coatings on Threaded Fasteners (Unified Inch Screw Threads (UN/UNR))

35. ASTM E 1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

36. ASTM D 2240 - Standard Test Method for Rubber Property—Durometer Hardness.

37. ASTM D 2244 – Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.

38. ASTM D 2247 – Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.

39. ASTM D 2794 – Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

40. ASTM F 3125 - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.

41. ASTM D 3361 – Standard Practice for Unfiltered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.

42. ASTM D 4214 – Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.

G. Metal Building Manufacturers Association (MBMA), MBMA Metal Building Systems Manual.

H. Seismic Design Guide for Metal Building Systems.

I. The Society for Protective Coatings (SSPC):

1. SSPC-Paint 15 - Primer for Use Over Hand Cleaned Steel performs to SSPC-Paint 15 standards.

2. SSPC-SP2 – Hand Tool Cleaning.

J. Underwriters Laboratories (UL):

1. UL 580 – Standard for Tests for Uplift Resistance of Roof Assemblies.

2. UL 723 – Standard for Test for Surface Burning Characteristics of Building Materials.

3. UL-790 - Standard Test Methods for Fire Tests of Roof Coverings.

4. UL-2218 - Impact Resistance of Prepared Roof Covering Materials.

1.06 REGULATORY REQUIREMENTS AND PERMITTING

A. The Pre-engineered metal building system and all included Work shall conform to the most recent edition of all applicable codes and standards. Applicable codes and standards may include, but are not necessarily limited to, those listed immediately below. Contractor shall be responsible for final determination of all applicable codes and standards.

1. California Building Code.

2. California Electrical Code.

3. California Mechanical Code.

4. California Plumbing Code.

5. California Energy Code.

6. California Existing Building Code.

7. California Green Building Standards Code (CALGreen).

8. City of San Diego adoption of the above-mentioned California Codes, as well as all applicable amendments and ordinances.

B. Permitting: Any permits involving Pre-Engineered Metal Building Systems and related items specified herein required by the local authority having jurisdiction (AHJ) shall be responsibility of the Contractor. The contractor shall obtain all necessary information, provide all necessary documents, and submit for all permits as required by the AHJ. Permits shall include, but not necessarily be limited to, any deferred submittals, seismic

permitting, fire marshal approvals, and foundation start-up permitting. All permitting and scheduling of permitting shall be coordinated with the Owner.

C. 'Buy America' Requirements: All manufactured products listed within this specification section are part of a federally assisted procurement involving funds granted by the Federal Transit Administration (FTA), and shall comply with Buy America requirements as delineated by Title 49 Code of Federal Regulations (CFR) Subsection 661.

1.07 ADMINISTRATIVE REQUIREMENTS

A. Convene preinstallation meeting a minimum of two weeks prior to starting installation of subsurface foundation components of the pre-engineered metal building system. Convene a second preinstallation meeting a minimum of two weeks prior to start of vertical erection of pre-engineered metal building system components.

B. Require attendance of parties directly affecting work of this section, including Contractor, Sub-contractor(s), Engineer, installer, and pre-engineered metal building system manufacturer's representative.

C. Review materials, installation, protection, and coordination with other work and existing site conditions.

1.08 DESIGN REQUIREMENTS

A. Design for the pre-engineered metal building system and all components indicated herein shall be performed by the manufacturer of the pre-engineered metal building system in accordance with all building codes applicable to the location in which the building is to be located. Refer to 1.06 Regulatory Requirements and Permitting in this Specification Section for governing codes and responsibility of final determination of applicability of all governing codes and standards.

B. General Design Basis:

1. Use standards, specifications, recommendations, findings, and interpretations of professionally recognized groups as basis for establishing design, drafting, fabrication, and quality criteria, practices, and tolerances for all Work indicated in this Specification Section.

    a. Refer to 1.02 Related Requirements of this Specification Section, and the individual Specification Sections listed therein, for additional Design Requirements related to components of the Work.

2. Design building and structures in accordance with MBMA Practices and Manual including fabrication and erection tolerances, and AISC Code of Standard Practice for Steel Buildings and Bridges.

3. Design structural mill sections and welded plate sections in accordance with AISC 360, ASD Method.

4. Design the lateral force resisting systems and related components for seismic loads in accordance with AISC 341.

5. Design cold-formed steel structural members and panels in accordance with AISI S- 100.

6. Design all bolted joints in accordance with RCSC Specification.

7. Refer to Drawings for additional basis of design information and requirements.

C. Specific Design Criteria:

1. Design Loads:

a. Pre-engineered metal building system supplier / installer shall determine and apply design loads based on and in a method consistent with Code requirements, best engineering practice, using the information contained within the contract documents, and manufacturer's standard design practices.

b. Design loads include dead loads, roof live loads, wind loads, seismic loads, collateral loads, auxiliary loads, floor live loads and applied or specified loads, as defined by Code and standard engineering practice.

1) Additional Dead Loads: shall include photovoltaic panels and photovoltaic equipment, as indicated in the Contract Documents.

2) Collateral Load: in pounds per square foot shall be applied to the entire structure to account for the weight of additional permanent materials other than the building system, such as sprinklers, mechanical systems, electrical systems, hung partitions, and ceilings.

a) This allowance does not include the weight of hung equipment weighing 50 pounds or more.

b) Equipment loads of 50 pounds or more are indicated on the Drawings and the structure shall be strengthened as required.

c) The magnitude and approximate location of concentrated loads greater than 50 pounds are indicated on the Drawings.

3) Load Combinations: Load combinations used to design primary and secondary structural members shall be in accordance with the governing code.

c. Allowable Deflection of Structural Members and Building Components:

1) Maximum deflection of main roof framing members due to total load shall not exceed L/180, or as otherwise shall not exceed what is determined to be allowable per Code.

2) Maximum deflection due to snow loads, wind loads and lateral deflections of roof panels, wall panels, girts, and purlins shall not exceed what is determined to be allowable per Code.

3) Use of composite stiffness for deflection calculations is permitted only when actual calculations for the stiffness are included with the design for the specific project.

4) Calculations for maximum deflections shall be included in the submitted design data.

2. Occupancy Category: S-1 Storage Moderate Hazard (Tire Storage)

3. Insulation requirements for the pre-engineered metal building system shall be provided by the applicable energy code.

4. Climatic Zone: 7

1.09 SUBMITTALS

A. Comply with Division 1 – General Requirements of these specifications.

B. Refer to 1.02 Related Requirements of this Specification Section, and the individual Specification Sections listed therein, for additional submittal requirements related to components of the Work.

1. The submittal requirements listed below supplement, and do not supersede, other submittal requirements listed in the Contract Documents, including related submittal requirements listed in other specification sections.

C. Submittals Due at Time of Bid or Prior:

1. Dealer Certification: Submit certification one week before bid date that the pre-engineered metal building system supplier and metal roof system supplier is a manufacturer's authorized and franchised dealer of the system to be furnished.

a. Certification shall state date on which authorization was granted.

2. Installer Certification: Submit certification one week before bid date that the pre-engineered metal building system and roof system installer has been regularly engaged in the installation of building systems of the same or equal construction to the system specified.

3. Warranty Documentation: Submit warranties specified herein.

4. Design Certification: Submit written "Certificate of design and manufacturing conformance" prepared and signed by the Manufacturer's Engineer of Record, registered to practice in the State of California verifying that the pre-engineered metal building system design and metal roof system design (including subsurface foundations, concrete slab, panels, clips, support system components, and

connections to existing building) will meet indicated loading requirements and codes of authorities having jurisdiction.

a. Certification shall reference specific dead loads, live loads, snow loads, wind loads/speeds, tributary area load reductions (if applicable), concentrated loads, collateral loads, seismic loads, end-use categories, governing code bodies, including year, and load applications.

b. Submit certification one week before bid date on the metal building system manufacturer's letterhead.

D. Pre-Construction/Installation Submittals

1. Product Data:

a. Submit Product Data in accordance with Division 1 - General Requirements of these specifications.

b. Product Data: Submit pre-engineered metal building system manufacturer's product information, specifications, and installation instructions for building components and accessories.

c. Warranties: Submit all required Manufacturer's, Installers', and Contractor warranties for the Metal Building System and components indicated in the Work.

2. Shop Drawings:

a. Sub-Surface Foundation and Slab Drawings: Submit drawings indicating location, size, depth, materials, and details of all sub-surface foundations. Indicate specific conformance with soils / geotechnical reports. Indicate slab dimensions, details, and finishes.

b. Steel Erection Drawings: Submit pre-engineered metal building system manufacturer's erection drawings, including plans, elevations, sections, and details, side wall and endwall elevations, subsurface foundations, concrete slab layout, roof framing, transverse cross-sections, covering and trim details, anchor bolt layouts, connections to existing building, and accessory installation details to clearly indicate proper assembly of building components. Steel Erection Drawings shall be coordinated with Sub-Surface Foundation and Slab Drawings.

c. Structural Design Calculations for both Sub-Surface Foundation / Slab and Steel: sealed and signed by the Manufacturer's Engineer of Record, a professional engineer (or engineers) licensed in the State of California and in accordance with applicable state law.

3. Testing Certifications and Reports:

a. Submit certification verifying that the metal standing seam roof system has been tested and approved by Underwriter's Laboratory as Class 90, having been tested in accordance with U.L. 580 Test Procedure for Uplift Resistance of Roof Assemblies.

b. Submit certification verifying that the metal standing seam roof system has been tested in accordance with ASTM E 1592 test protocols.

c. Provide Material Test Reports for all steel material used in the manufacture of primary and secondary framing members, panels and bolts included in the Work, and when required by ASTM A 6/A 6M.

d. Provide Material Test Reports for all steel material used in the manufacture of primary and secondary framing members, panels and bolts specified in this section and when required by ASTM A 6/A 6M.

e. Provide Material Test Reports for all concrete material used in the construction of the pre-engineered metal building slab and sub-surface structure and when required by ASTM C39.

4. Required Documents for Permit and Local Jurisdictional Approval: Where required by local jurisdiction and/or code officials, the contractor/supplier shall be responsible for producing and submitting all documentation required for obtaining all applicable approvals related to the specified equipment.

   a. This documentation may include, but may not be limited to, engineered signed and stamped plans, details, layouts, as well as other documents to show compliance with locally adopted codes.

   b. A copy of these required documents shall be sent to the architect/engineer consultant team for their review.

5. Manufacturer Installation Manual: Submit manual indicating preparation instructions and recommendations, storage and handling requirements and recommendations, and installation methods for the pre-engineered metal building system and components.

6. Samples:

   a. Submit color chips to Owner for roof and wall panels showing manufacturer's full range of available colors and patterns for each finish product. Provide copy to architect / engineer consultants.

   b. After Owner's color selection, submit samples to Owner representing actual product, color, and patterns. Provide copy to architect / engineer consultants.

7. Quality Control Submittals:

a. IAS AC472 Certificate for each facility involved in the design and fabrication of the pre-engineered metal building system.

b. Certified Erector Certificate issued to the erector by the manufacturer.

E. ’Buy America’ Certificates: ‘Buy America’ certificates required during bidding shall also be required as part of each product submittal. Certificates shall be complete and accurate. Certificates shall indicate either compliance or non-compliance with the ‘Buy America’ regulations. Certificates of non-compliance shall also include copies of any granted waivers.

F. Post Construction / Closeout Submittals:

1. Operation and Maintenance Manual:

a. Provide complete operating instructions and maintenance manual including, but not necessarily limited to:

1) Description of system and components.

2) Manufacturer's printed operating instructions (as applicable).

3) Printed listing of periodic preventive maintenance items and recommended frequency required to validate warranties. Failure to provide maintenance information will indicate that preventive maintenance is not a condition for validation of warranties.

4) Copies of all warranties.

5) List of original manufacturer's parts, including suppliers' part numbers and cuts, recommended spare parts stockage quantity and local parts and service source (as applicable).

b. Assemble and provide copies of manual in 8-1/2 by 11 inch format. Foldout diagrams and illustrations are acceptable. Manual to be reproducible by dry copy method. Provide copies per provisions of Division 1 - General Requirements.

2. As-built drawings of pre-engineered metal building system and components, as indicated in the Work. As built drawings shall include, at a minimum, the following modifications to the originally submitted shop drawings:

a. Any modifications and/or changes made during permitting and/or construction as a result of changes and modifications required by any AHJ, required by the Owner, required as a matter of coordination, required by responses and answers to RFIs, returned Shop Drawing markups, change orders or revisions, in-field modifications and changes.

b. As-built drawings shall also include project name, north arrow, scale of drawing, location of the pre-engineered metal building system on the

overall site and proximity to adjacent buildings structures and large equipment, area of the pre-engineered metal building system in square feet, overall dimensions including eave heights, roof slope.

1.10 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Manufacturer regularly engaged, for past 10 years, in manufacture of metal building systems of similar type to that specified.

2. Manufacturer shall have in their employ an engineer licensed in the State of California and regularly employed in the structural engineering and design of pre-engineered metal building systems or similar for the past 10 years and whose responsibilities include the design of the specified pre-engineered metal building system and stamping of design drawings and calculations.

B. Installer's Qualifications:

1. Installer regularly engaged, for past 5 years, in installation of pre-engineered metal building systems of similar type to that specified.

2. Employ persons trained and certified for installation of pre-engineered metal building systems by the pre-engineered metal building system manufacturer.

3. Certificate of design and manufacturing conformance:

a. Pre-engineered metal building system manufacturer shall submit written certification prepared and signed by a Professional Engineer, registered to practice in the State of California verifying that subsurface foundations, concrete slab, building system design and metal roof system design (including panels, clips, and support system components) meet indicated loading requirements and codes of authorities having jurisdiction.

b. Certification shall reference specific dead loads, live loads, snow loads, wind loads/speeds, tributary area load reductions (if applicable), concentrated loads, collateral loads, seismic loads, end-use categories, governing code bodies, including year, and load applications.

c. Certificate shall be on metal building system manufacturer's letterhead.

d. Refer to Submittals article of this specification section.

C. Material Testing:

1. Provide Material Test Reports for all steel material used in the manufacture of primary and secondary framing members, panels and bolts specified in this section and when required by ASTM A 6/A 6M.

2. Provide Material Test Reports for all concrete material used in the construction of the pre-engineered metal building slab and sub-surface structure and when required by ASTM C39.

3. Refer to 1.02 Related Requirements of this Specification Section, and the individual Specification Sections listed therein, for additional material testing submittal requirements related to components of the Work.

D. Manufacturer's Representative:

1. Installation: Provide a qualified manufacturer's representative at site to supervise work related to installation.

1.11 PRODUCT SUBSTITUTIONS

A. Follow requirements specified in Division 1 - General Requirements.

B. Additional costs resulting from substitution of products other than those specified, including drawing changes and construction, will be at the expense of the Contractor.

C. Substitution Approval: Manufacturers not listed shall submit for approval in accordance with "Instructions to Bidders".

1.12 WARRANTY

A. Manufacturer’s Materials and Workmanship Warranty: Provide warranty on manufacturer’s standard form that indicates manufacturer shall repair and replace metal building systems components due to failure resulting from either materials and/or workmanship for a period of one year, starting from the date of Substantial Completion.

B. Weathertightness Warranty: Provide warranty on manufacturer’s standard form, that indicates manufacturer agrees to repair or replace metal building system components that fail to remain weathertight, including leaks, without monetary limitation, for a minimum of 10 years from date of Substantial Completion. Warranty shall be signed by both the metal roof system manufacturer and the metal roof system installer.

C. Panel Finish Warranty: Provide warranty on manufacturer’s standard form that indicates Manufacturer agrees to repair or replace metal panels that evidence deterioration of factory-applied finish within the specified number years (below) from date of Substantial Completion, including:

1. Acrylic Coated ‘Galvalume’: Product will not rupture, fail structurally, or perforate within period of 20 years due to normal atmospheric corrosion.

2. Fluoropolymer Two-Coat System (PVDF):

a. Color fading in excess of 5 Hunter units per ASTM D 2244 for 25 years.

b. Chalking in excess of No. 8 rating per ASTM D 4214 for 25 years.

c. Failure of adhesion, peeling, checking, or cracking for 40 years.

D. Metal building system manufacturer shall provide a written warranty for 25 years against perforation of metal roof panels due to corrosion under normal weather and atmospheric conditions.

1. Warranty shall be signed by metal roof system manufacturer.

1.13 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage and Handling Requirements:

1. Store and handle materials in accordance with manufacturer's instructions.

2. Keep materials in manufacturer's original, unopened containers and packaging until installation.

3. Do not store materials directly on ground.

4. Store materials on flat, level surface, raised above ground, with adequate support to prevent sagging.

5. Protect materials and finish during storage, handling, and installation to prevent damage.

PART 2 - PRODUCTS

2.01 PRE-ENGINEERED METAL BUILDING SYSTEM MANUFACTURERS

A. Empire Steel Buildings. 5230 Carroll Canyon Rd. San Diego, CA 92121. Phone 800.905.3443. Website www.empirebuilt.com.

B. Metallic Building Systems (Cornerstone Building Brands). 7301 Fairview Street, Houston, TX 77041. Phone 866.800.6353. Website www.metallic.com.

C. Butler Manufacturing, P.O. Box 419917 Kansas City, Missouri 64141. Phone 816.968.3000. Website www.butlermfg.com.

2.02 BUILDING DESCRIPTION

A. Single slope building with roof cantilever on a single, long side. Abuts existing building.

B. Building Dimensions: As indicated on the Drawings.

2.03 PRIMARY STRUCTURAL AND FRAMING MEMBERS

A. General: Framing to be single slope clear span rigid frame with cantilever at one side. Primary frame columns and roof beams to be tapered or straight. Bracing to be standard X-bracing unless otherwise required by constraints of the project. Design in accordance with locally adopted building codes and industry standards and best practices.

B. Recycled Content: Post-consumer recycled content plus one-half of pre-consumer recycled content not less than 75 percent.

C. Hot-rolled shapes: Steel, ASTM A 36 or ASTM A 992, minimum yield of 36 ksi (248 MPa) or 50 ksi (345 MPa).

D. Built-up sections:

1. Design in accordance with AISC Specification for Structural Steel Buildings.

2. Webs:

a. Steel, ASTM A 1011 or ASTM A1018, SS or HSLAS, Grade 55 (380) for webs 3/16 inch (4.76 mm) thick and thinner.

b. Steel, ASTM A 572 Grade 50 (340) or ASTM A572 Grade 55 (380) or ASTM A 529 Grade 55 for webs thicker than 3/16 inch (4.76 mm).

3. Flanges: Steel, ASTM A 529 Grade 55 (380) or ASTM A 572 Grade 50 (340) or 55 (380).

E. Round tube: Steel, ASTM A 500, Grade B or C with minimum yield strength of 42 ksi (290 MPa).

F. Square and rectangular tube: Steel, ASTM A 500, Grade B or C, minimum yield strength of 42 ksi (290 MPa).

G. Cold-formed C sections: Steel, ASTM A 1011, Grade 55 (380), or ASTM A 653, Grade 55 (380). Design in accordance with AISI North American Specification for the Design of Cold-Formed Steel Structural Members

H. X-bracing: Steel, ASTM A 529 or A 572 for rod bracing 36 ksi (248 MPa) or 50 ksi (345 MPa), ASTM A 36 for angle bracing or ASTM A 475 for cable bracing.

I. Finish: Gray Shop Coat. Shop coat only intended to provide temporary protection during transportation and erection.

2.04 SECONDARY STRUCTURAL AND FRAMING MEMBERS

A. Recycled Content: Post-consumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.

B. Roof and wall purlins, girts, and eave struts: Steel, ASTM A 1011 Grade 55 (380), or ASTM A 653, Grade 55 (380).

1. Thickness: 14 gauge: 0.067 inch minimum uncoated thickness.

C. Spandrel Beams: Steel, ASTM A 36/A 36M or ASTM A 992/A 992M wide flange shapes, minimum yield 50 ksi for support of wall systems provided by others, as required by design.

D. Finish: Gray Shop Coat. Shop coat only intended to provide temporary protection during transportation and erection.

2.05 ANCHOR BOLTS AND BOLTS

A. Rigid Frame Connections: Provide High Strength Bolts, Nuts and Washers:

1. Bolts: Steel, ASTM F 3125 Grade A325 Heavy Hex Structural Type I.

2. Washers: ASTM F 436 Type 1 Hardened Steel.

3. Nuts: ASTM A 563 Grade C Heavy Hex. Nuts shall be wax coated by emulsion such that the torque required to complete a Rotational Capacity (RC) test shall be reduced by 40 percent from the un-waxed state.

4. Coating: Hot-Dipped Galvanized per ASTM A153.

B. Other Connections: Provide High Strength or Machine Bolts as required by manufacturer design:

1. High Strength Bolts and Nuts:

a. Bolts: ASTM F 3125 Grade A325 Heavy Hex Structural Type I.

b. Nuts: ASTM A 563 Grade C Heavy Hex.

c. Coating: ASTM F 1941 Electrodeposited Yellow Zinc.

2. Machine Bolts:

a. Bolts: ASTM A 307 Grade Carbon Steel.

b. Nuts: ASTM A 563 Grade A Hex Nut.

c. Coating: ASTM F 1941 Electrodeposited Clear Zinc.

2.06 STANDING SEAM METAL ROOF

A. General: Design of metal building roof and the pre-engineered metal building systems shall be such as to avoid roof penetrations where possible.

1. Where roof penetrations are determined to be necessary, the location of the penetration shall be coordinated to occur in the middle flat portion of a single panel, and not interrupting or near a standing seam joint.

2. Where a roof penetration may span multiple panels, the penetration location shall be coordinated so that edges running parallel to the standing steam panel direction are located in the middle flat portion of individual panels, and not interrupting or near a standing seam joint.

B. Assembly Performance Requirements: Provide roof products and assemblies meeting or exceeding the requirements listed below, or per Code, whichever is the more restrictive requirement.

1. Class 90 rated and listed in accordance with UL-580 for Wind Uplift.

2. Class A rated and listed in accordance with UL-790 for External Fire.

3. Class 4 rated and listed in accordance with UL-2218 for Impact Resistance.

C. Standing Seam Panels:

1. Type: Single skin panels with concealed fastener clips, designed to form 360 degree Pittsburgh seam upon completion of installation.

2. Panel Strength: Determine and certify panel strength as follows:

a. Positive Loading (Toward Panel Supports): Determine in accordance with AISI S100.

b. Negative Loading (Away from Panel Supports): Determine in accordance with ASTM E 1592.

3. Panel profile: Double-Lok:

a. Panel Type: Trapezoidal machine seamed, 1/2:12 minimum roof slope (refer to Drawings)

b. Panel width: 24 inches wide x 3 inches high.

c. Thickness: 24 gauge.

d. Finish: “Galvalume Plus” pre-finished panels consisting of approximately 45 percent zinc and 55 percent aluminum, with a clear acrylic coating.

e. Air Infiltration: Maximum air infiltration of 0.04 cubic feet per minute per square foot of specimen area when tested to ASTM E 1680 at a pressure differential of +/- 1.57 psf.

f. Water Infiltration: No uncontrollable water leakage when tested to ASTM E 1646 at a 20 psf pressure differential when sprayed with 5 gallons of water per hour per square foot of specimen area.

D. Accessories:

1. Pipe flashing (where required).

2. Roof curbs (where required).

a. Finish: Unpainted Galvalume.

3. Roof Vents (where required).

a. Finish: Unpainted Galvalume.

4. Eave trim condition: standard gutters and downspouts.

a. Size of gutter and downspouts, as well as number and placement of downspouts to be determined by pre-engineered metal building manufacturer in accordance with applicable codes.

b. Finish: Color matches wall panels.

5. Thermal breaks: Insulating thermal breaks at roof attachments if and where required by code. Insulating value and/or thermal resistivity per code.

6. Roof and wall flashing between existing building and new pre-manufactured metal building.

7. Flexible expansion joint between existing building and new pre-manufactured metal building.

8. Joint fillers, sealants, backer rods, as required.

2.07 WALL PANELS

A. Assembly Performance Requirements: Provide assemblies that function as exterior walls that meet the following requirements:

1. Air Infiltration: Maximum air infiltration of 0.04 cubic feet per minute per square foot of specimen area when tested to ASTM E 283 at a pressure differential of +/- 1.57 psf (75 Pa).

2. Water Infiltration: No uncontrollable water leakage when tested to ASTM E 331 at a 6.24 psf pressure differential when sprayed with 5 gallons of water per hour per square foot of specimen area.

B. Through-Fastened Panels:

1. Panel type: Single skin ribbed panels with exposed fasteners.

2. Panel strength: Determine in accordance with AISI S100.

3. Panel type: Steel, ASTM A892, “PBR” profile 12 inch x 1 inch with 1-1/4 inch ribs x 12 inch centers, 24 gauge thickness.

4. Exterior finish: Polyvinylidene fluoride (PVDF) resin finish, Kynar 500, Hylar 5000, or equal.

5. Interior finish: 0.5 mil total dry film thickness consisting of primer coat and wash coat of manufacturer's standard light-colored acrylic or polyester backer finish.

6. Color: Selected from manufacturer standard colors.

7. Panel fasteners: Stainless steel, self-drilling with sealing washer.

8. Sealants and closures:

    a. Side-laps: Factory applied, hot melt, foam-able mastic.

    b. End-laps: Field-applied non-skinning sealant.

9. Flexible expansion joint between existing building and new pre-manufactured metal building.

2.08 DOORS AND LOUVERS

A. Personnel Doors:

1. Size: 3 feet by 7 feet for single doors, 6 feet by 7 feet for double doors (consisting of two 3 feet by 7 feet doors), or as otherwise indicated on Drawings.

2. Elevation: As indicated on Drawings.

3. Type: Insulated.

4. Hardware:

    a. Cylindrical lockset.

    b. Exit device, as required by code.

    c. Weather stripping and threshold.

    d. Closers.

    e. Kick plate.

    f. Latch guard.

g. Chain stops.

5. Frame type: Hollow metal framed openings.

6. Door assembly: ‘Knocked down’ for field assembly.

7. Finish: zinc rich corrosion resistant primer with finish coat in owner’s choice of manufacturer’s standard colors.

B. Louvers:

1. Source: By metal building manufacturer.

2. Size: To be selected from available sizes and sized in accordance with mechanical ventilation requirements.

3. Type: Fixed.

4. Frame type: Self framing.

5. Provide with bird and insect screen.

6. Finish: Match adjacent wall color.

C. Overhead Door:

1. Manufacturer: Overhead Door Corporation, Lewisville, TX. Phone: 800-275-3290. Website: www.overheaddoor.com, or equal.

2. Size: As indicated on Drawings.

3. Elevation: As indicated on Drawings.

4. Type: Motorized, 18 gauge galvanized steel slat roll-up door.

5. Finish: Manufacturer’s standard zinc rich corrosion resistant powder coat finish with four year warranty, in manufacturer’s standard color as selected by the owner.

6. Warranty for door and operator: 3 years or 500,000 cycles, whichever is first.

7. Controls: Wall mounted Open/Close/Stop push button.

8. Photo electric beam to stop and/or reverse downward direction of door when an object crosses the door opening path.

9. Motor: direct drive integrated gear motor/brake assembly sized for the door and opening. Include manual corrosion resistant hand chain for door operation in case of power outage.

2.09 INSULATION

A. Manufacturer: Metal Building Insulation, Littleton, CO. Phone 303.867.1179. Website: www.metalbuildinginsulation.com; or equal.

B. Product: Continuous roll fiberglass insulation blankets with reinforced white vinyl backing.

1. Install without gap or spaces and tape seams with matching vinyl tape to provide continuous thermal barrier.

2. Thickness and R-value to conform with requirements of California Building Code and California Energy Code, but not to be less than 2 inches thick.

3. Tabs to interconnect insulation blankets with each other.

4. Support straps at regular, equal intervals (minimum 4 feet) to support insulation blankets. Fasten straps to secondary structure by means of self-tapping stainless steel screws.

2.10 GALVANIZED FENCES AND FENCE POSTS

A. Manufacturer: As selected by Pre-engineered metal building contractor.

B. Location and purpose: Interior perimeter of Pre-engineered metal building, refer to drawings. Locate away from wall to allow fencing to properly protect walls from tire handling.

C. Steel Chain Link Fabric: Height 6 feet, maximum 6 feet wide. 2inch mesh size, 9 gauge, zinc-coated steel fabric: ASTM A392 hot dipped galvanized, standard knuckle and twist fabric selvage.

D. Round steel pipe and rail: Schedule 40 standard weight pipe, in accordance with ASTM F1083, 1.8 oz/ ft² hot dip galvanized zinc exterior and 1.8 oz/ft² hot dip galvanized zinc interior coating. Locate at six foot intervals or less, on center. Line posts and end/corner posts regular grade with minimum steel yield strength of 30,000 pounds per square inch.

1. Include Top, bottom and intermediate horizontal rails, 1.660 in. OD: Schedule 40 standard weight pipe, in accordance with ASTM F1083, 1.8 oz/ ft² hot dip galvanized zinc exterior and 1.8 oz/ft² hot dip galvanized zinc interior coating.

E. Terminal Post Caps, Line Post Loop Tops, Rail and Brace Ends, Boulevard Clamps, Rail Sleeves: In compliance to ASTM F626, pressed steel galvanized after fabrication having a minimum zinc coating of 1.20 oz/ft².

F. Concrete for post footings shall have a 28-day compressive strength of 2,500 psi. (17.2 MPa).

1. Fabric Selection Table: Steel chain link mesh sizes and gauges produced in one piece widths 3 feet (910 mm) to 12 feet (3660 mm)

2.11 CONCRETE SLAB, CONCRETE REINFORCING, AND SUB-SURFACE FOUNDATIONS

A. Design: Pre-engineered metal building supplier / installer shall be responsible for design and provision of the concrete slab and related sub-surface foundations in accordance with applicable codes and industry standards.

B. Investigation: Investigate existing building, existing building structure and sub-structure to determine any impacts on pre-engineered metal building and/or pre-engineered metal building slab or substructure. Inform Owner and Engineer of any issues which may adversely impact the pre-engineered metal building, slab, and/or sub-structure.

C. Coordinate necessary soil preparation with General Contractor prior to work.

D. Schedule all drilling, reinforcing, and pouring of slab and sub-surface foundation with Owner and General Contractor to avoid interference with other on-site activities.

2.12 FABRICATION

A. General:

1. Shop-fabricate framing members for field bolted assembly.

2. Surfaces of bolted connections: Smooth and free from burrs and distortions.

3. Shop connections to conform to manufacturer's standard design practices.

4. Mark framing members with identifying mark.

5. Welding to conform to AWS D1.1 and AWS D1.3 as applicable.

B. Primary Framing:

1. Plates, stiffeners, and related members: Factory welded base plates, splice plates, cap plates, and stiffeners into place on structural members.

2. Bolt holes and related machining: Shop fabricate base plates, splices and flanges to include bolt connection holes. Shop-fabricate webs to include bracing holes.

3. Secondary structural connections (purlins and girts): Ordinary (not pretensioned) bolted connections with welded clips.

4. Welding inspection: Per IAS AC472 Part A.

C. Zee Purlins:

1. Fabricate purlins from cold-formed Z-shaped sections with stiffened flanges.

2. Size flange stiffeners to comply with requirements of AISI S100.

3. Purlin flanges unequal in width for easier nesting during erection.

4. Purlins pre-punched at factory to provide for field bolting to rigid frame clips.

D. Eave Struts:

1. Fabricate eave struts from cold-formed unsymmetrical C-shaped sections with stiffened flanges.

2. Size flange stiffeners to comply with requirements of AISI S100.

3. No welded splices permitted.

4. Eave Struts pre-punched at factory to provide for field bolting to rigid frame clips.

E. Girts: Simple or continuous span as required by design. Connection bolts will install through webs, not flanges.

F. Bracing:

1. Diagonal Bracing:

a. Diagonal bracing in roof and sidewalls may be used to resist longitudinal loads in structure when panel diaphragm cannot be used.

b. Furnish to length and equipped with hillside washers and nuts at each end.

c. Bracing may consist of rods threaded at each end or galvanized cable with suitable threaded end anchors.

d. If load requirements dictate, bracing may be of structural angle or pipe, bolted in place.

2. Special Bracing:

a. When diagonal bracing is not permitted in sidewall use rigid frame type portal or fixed base column.

b. Shear walls may be used where adequate to resist applied wind or seismic forces.

3. Flange Braces: Brace compression flange of primary framing laterally with angles connecting to purlin or girt webs so that flange compressive stress is within allowable limits for any combination of loading.

4. Bridging:

a. Laterally brace top chord of long bay purlins with horizontal bridging if roof system being used will not supply adequate lateral support to top chord.

5. Horizontally bridge bottom chord for lateral bracing. One row of bolted diagonal bridging required for long span purlins 40 feet long and longer.

G. Standing Seam Panels:

1. Provide factory fabricated and finished metal panels and accessories meeting performance requirements, indicated profiles and structural requirements.

2. Fabricate metal joints configured to accept applied sealant providing weathertight seal and preventing metal to metal contact and minimizing noise resulting from thermal movement.

3. Fabricate panels in continuous lengths for full length of detailed runs, except where otherwise indicated on drawings.

4. Sheet Metal Flashing and Trim: Fabricate or install flashing and trim to comply with manufacturer's written instructions and construction drawings.

5. Configure roof panels with interlocking edges with factory applied hot-melt mastic inside female seam. Female side snaps over male side and when seamed creates continuous lock, forming 360 degree Pittsburgh seam.

6. Notch panels at factory at both ends so that field installation can commence or terminate from either end of building.

7. Maximum panel length: 45 feet unless otherwise indicated.

H. End Laps:

1. Fabricate with 16 gauge backup plates and eight end lap joint fasteners installed in six pre-punched holes in flat and in dimples in trapezoidal legs.

2. Apply mastic between panels and secure with self-drilling fasteners through panels and backup plate.

3. Through roof fasteners may be used only at end laps and eaves.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine area to receive metal building system.

B. Clean areas prior to installation.

C. Notify Architect/Engineer of conditions that would adversely affect installation or subsequent use.

D. Do not begin installation until unacceptable conditions are corrected.

3.02 ERECTION OF STRUCTURAL STEEL FRAMING SYSTEM

A. Erect structural steel framing system in accordance with the Drawings and metal building system manufacturer's erection drawings.

B. Fit members square against abutting components.

C. Position members plumb, square, and level.

D. Temporarily brace members until permanently fastened.

E. Do not splice load bearing members.

F. Align and adjust various members forming parts of a complete frame or structure after assembly but before fastening.

G. Welding to conform to AWS D1.1.

H. Fixed Column Bases: Grout flush with floor line after structural steel erection is complete.

I. Field Modifications:

1. Require approval of metal building system manufacturer.

2. Responsibility of building erector.

3.03 INSTALLATION OF METAL ROOF

A. Install roof in accordance with metal roof manufacturer's and metal building system manufacturer's instructions.

B. Install roof system weathertight.

C. Position panel clips for proper, regular attachment to primary and secondary structure.

D. Position and properly align panels prior to attachment.

E. Field seam panel side laps by self-propelled and portable electrical lock-seaming machine.

1. Machine field forms the final 180 degrees of a 360-degree Pittsburgh double-lock standing seam.

2. Factory apply side lap sealant.

F. Panel End Laps: Minimum of 6 inches, sealed with sealant (weather sealing compound), and fastened together by clamping plates.

1. Sealants: Contain hard nylon beads, which prevent mastic from flowing out due to clamping actions.

2. Join panel laps by 2-piece clamped connection consisting of a bottom reinforcing plate and a top panel strap.

3. Locate panel end laps directly over, but not fastened to, supporting secondary roof structural member and stagger, to avoid 4-panel lap-splice condition.

3.04 INSTALLATION OF METAL WALL PANELS

A. Install wall panels in accordance with metal building system manufacturer's instructions.

B. Install wall system weathertight.

C. Verify structural system is plumb before wall panels are attached.

D. Align and attach wall panels in accordance with erection drawings furnished by metal building system manufacturer.

E. Install side laps with minimum of 1 full corrugation.

F. Seal wall panels at base with metal trim.

G. Exterior Trim: Apply same finish as exterior color of wall panels, except the following:

1. Gutters, Downspouts, Eave Trim, Gable Trim, Door-Side Flashings, and Header Flashings: "Kynar 500" or "Hylar 5000" fluoropolymer (PVDF) coating in manufacturer's standard color.

2. Windows: Factory paint aluminum extrusions (thermally broken).

H. Flashings, Trim, Closures, and Similar Items: Install as indicated on erection drawings furnished by metal building system manufacturer.

3.05 INSTALLATION OF INSULATION

A. Insulation Installation: Install insulation in accordance with metal building system manufacturer's instructions.

3.06 PROTECTION

A. Protect installed metal building system to ensure that, except for normal weathering, metal building system will be without damage or deterioration at time of Substantial Completion.

3.07 ADJUSTMENT

A. Touch up, repair, or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 22 15 00

GENERAL SERVICE COMPRESSED-AIR SYSTEMS

PART 1 - GENERAL
The General Provisions of the Contract, including General and Special Conditions and the requirements of Division 1, apply to the Work in this Section.

1.01 WORK INCLUDED

A. Equipment items as listed below by Equipment Mark Number:

1. COMPRESSOR, AIR, RECIEVER MOUNTED, 20HP, ROTARY SCREW
Equipment Mark Number: 2168

B. Roughing-in, installation of equipment, and final connection of utilities, with labor, services, and incidentals necessary for complete and operational equipment installation.

C. Piping, wiring, and switching between equipment and utilities.

1.02 ALTERNATIVE BIDS

A. Refer to Division 1 - General Requirements for possible effect on Work of this Section.

1.03 QUALITY ASSURANCE

A. Experience: Equipment shall be produced by a manufacturer of established reputation with a minimum of five years experience supplying specified equipment.

B. Manufacturer's Representative:

1. Installation: Provide a qualified manufacturer's representative at site to supervise work related to equipment installation, check out and start up.

2. Training: Provide technical representative to train Owner's maintenance personnel in operation and maintenance of specified equipment.

1.04 STANDARD AND REGULATORY REQUIREMENTS

A. Equipment indicated within this specification section shall comply with all applicable national, state and local codes and regulations, including seismic, fire, and racking codes and regulations. Additional, more specific compliance requirements may be listed under individual equipment headings.

B. Permitting: Any individual equipment permits required by the local authority having jurisdiction (AHJ) shall be responsibility of the Contractor. The contractor shall obtain all necessary information, provide all necessary documents, and submit for any and all individual equipment permit as required by the AHJ. Individual equipment permits shall include, but not necessarily be limited to, any deferred equipment submittals, seismic permitting, fire marshal approvals, and equipment installation/start-up permitting.

C. 'Buy America' Requirements: All manufactured products listed within this specification section are part of a federally assisted procurement involving funds granted by the Federal Transit Administration (FTA), and shall comply with Buy America requirements as delineated by Title 49 Code of Federal Regulations (CFR) Subsection 661.

1.05 SUBMITTALS

A. Refer to Sheet Q.14 Equipment Schedule for submittal requirements listed in the "Submittals" column of the equipment list. In the event of conflict between Sheet Q.14 Equipment Schedule and the following expanded submittal descriptions, Section Sheet Q.14 Equipment Schedule is to govern.

B. Product Data:

1. Submit Product Data in accordance with Division 1 - General Requirements of these specifications.

2. All Product Data submittals shall identify proposed project specific items marked by arrow, circle, underline, reproducible highlight, or other markings clearly discernable by the reviewer, to show which specific items, parts and accessories are being submitted for the project product data review. Non-marked or generic product data submittals with no marks indicating specific items, parts and accessories will be a cause for rejection.

3. Restrict submitted material to pertinent data. For instance, do not include manufacturer's complete catalog when pertinent information is contained on a single page.

C. Operation and Maintenance Manual:

1. Provide a Complete parts list, operating instructions, and maintenance manual covering equipment at time of installation including, but not limited to:

a. Description of system and components.

b. Schematic diagrams of electrical, plumbing and compressed air systems.

c. Manufacturer's printed operating instructions.

d. Printed listing of periodic preventive maintenance items and recommended frequency required to validate warranties. Failure to provide maintenance information will indicate that preventive maintenance is not a condition for validation of warranties.

e. List of original manufacturer's parts, including suppliers' part numbers and cuts, recommended spare parts stockage quantity and local parts and service source.

2. Assemble and provide copies of manual in 8-1/2 by 11 inch format. Foldout diagrams and illustrations are acceptable. Manual to be reproducible by dry copy method. Provide copies per provisions of Division 1 - General Requirements.

D. Submit Shop Drawings in accordance with Division 1 -General Requirements of these specifications. Refer to Sheet Q.14 Equipment Schedule for the equipment mark numbers requiring shop drawings.

1. Submitted shop drawings shall be project specific and shall include a minimum 1/8 inch to 1 foot scaled (or larger standard architectural imperial scale), dimensioned, graphical representation of the size, orientation, and location for the submitted equipment. The drawings shall further include dimensions from structural elements or architectural grid lines, operational clearances, locations of any utility service connection points, mounting requirements, and structural supports required for the submitted equipment.

E. Required Documents for Permit and Local Jurisdictional Approval: Where required by local jurisdiction and/or code officials, the contractor/supplier shall be responsible for producing and submitting all documentation required for obtaining any and all applicable approvals related to the specified equipment. This documentation may include, but may not be limited to, engineered signed and stamped plans, details, anchorage layouts, as well as other documents to show compliance with locally adopted codes. A copy of these required documents shall be included with the product submittal to the architect/consultant team for their review.

F. ’Buy America’ Certificates: ‘Buy America’ certificates required during bidding shall also be required as part of each product submittal. Certificates shall be complete and accurate. Certificates shall indicate either compliance or non-compliance with the ‘Buy America’ regulations. Certificates of non-compliance shall also include copies of any granted waivers.

1.06 PRODUCT SUBSTITUTIONS

A. Follow requirements specified in Division 1 - General Requirements.

B. Additional costs resulting from substitution of products other than those specified, including drawing changes and construction, will be at the expense of the Contractor.

C. Substitution Approval: Manufacturers listed for each equipment item may bid without submittal for that item. Manufacturers not listed shall submit for approval in accordance with "Instructions to Bidders". Prior to procurement, submittals for each equipment item by Mark Number shall be provided in accordance with Division 1 - General Requirements.

1.07 WARRANTY

A. Warrant work specified herein for one year from substantial completion against defects in materials, function and workmanship.

B. Warranty shall include materials and labor necessary to correct defects.

C. Defects shall include, but not be limited to noisy, rough, or substandard operation; loose, damaged, and missing parts; and abnormal deterioration of finish.

D. Submit warranties in accordance with Division 1 - General Requirements of these specifications.

E. All parts shall be readily available locally in the United States.

1.08 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment in manufacturer's containers, appropriately packaged and/or crated for protection during shipment and storage in humid, dusty conditions.

B. Indelibly label all containers, including those contained in others, on outside with item description(s) per title and Mark Number of this specification.

C. Provide equipment and materials specified complete in one shipment for each equipment item. Split or partial shipments are not permissible.

1.09 LABELING

A. Manufacturer shall securely attach in a prominent location on each major item of equipment a non-corrosive nameplate showing manufacturer's name, address, model number, serial number, and pertinent utility or operating data.

B. All electrical equipment and materials shall be new and shall be listed by Underwriter's Laboratories, Inc. (U.L.), or other National Recognized Testing Laboratory (NRTL), in categories for which standards have been set by that agency and labeled as such in the manufacturer's plans.

PART 2 - PRODUCTS

2.01 COMPRESSOR, AIR, RECEIVER MOUNTED, 20 HP, ROTARYSCREW
Equipment Mark Number: 2168

A. General: Oil flooded rotary screw, continuous duty, refrigerated air dryer, horizontally receiver tank mounted compressor, with enclosure.
1. Compliance: The equipment shall comply with the most recent editions of all applicable local, state, and federal codes and regulations.

B. Capacities and Dimensions:

1. Compressor:

a. Capacity – Free Air Delivery (FAD): 70 CFM, minimum.

b. Motor: 20 horsepower (HP), minimum.

c. Motor Speed: 3600 revolutions per minute (RPM).

d. Pressure (Full load): 150 pounds per square inch (PSI), minimum.

2. Air Aftercooler:

a. Fan air flow: 1900 CFM, minimum.

b. Static back pressure (approx.): 0.2 inch watercolumn (in-wc) at 95F; 0.16 in-wc at 105F; 0.12 in-wc at 115F.

c. Heat rejection (approx.): 62,000 BTU/hr.

3. Receiver:

a. Capacity: 120 gallons, minimum.

b. Rating: 200 PSI, minimum.

c. Discharge piping: 2 inch NPT.

d. Drain: 1/2 inch NPT.

4. Air Dryer:

a. Pressure dew point (approx.): 41 F

b. Pressure drop (approx.): 3.63psi

5. Overall dimensions, nominal:

a. Length: 68.5 inches.

b. Width: 28 inches.

c. Height: 71 inches.

6. Shipping weight, nominal: 1,200 pounds.

7. Noise Level at 100 percent load: 73 dB(A), max.

8. Operating Temperature Range (approx.): 37F to 113F.

C. Features and Construction:

1. Belt drive motor with drip proof type enclosure.

2. E-Stop: Red emergency stop button terminating power upon depressing.

3. Air intake filter: Dry type with replaceable element.

4. Separator tank: ASME coded 200 PSI sump tank, minimum pressure/check valve, relief valve, high efficiency replaceable oil separator element, fluid level sight indicator and vented fill cap.

5. Air After Cooler: Air cooled with air cooled aftercooler, spin on oil filter, and factory filled with synthetic lubricoolant.

6. Instrumentation: Air pressure gauge, hour meter, and discharge temperature gauge.

7. Protection devices: Class 20 overload relay, high temperature and over pressure shutdown switches, anti-restart pressure switch preventing starting while air compressor is pressurized, and anti-reversing feature.

8. Aftercooler:

a. Type: Aftercooler shall be flywheel fan cooled, belt-guard type with expanded metal grill guards on front and rear.

b. Heat exchanger: Compressed air shall be cooled by running through aluminum finned, multiple pass tubing.

9. Receiver:

a. Type: Compressed air shall be stored in a horizontal receiver tank with legs drilled for floor mounting.

b. Standard equipment: Pressure gauge and manual tank drain shall be part of standard fitting kit.

D. Controls: Full modulation, solenoid controlled with automatic start/stop or constant speed timed dual control. Compressor to include NEMA 1 starter enclosure for general indoor use.

E. Accessories:

1. 500 hour, quarterly, and yearly maintenance kits and tune-up kits, one each. Kits shall include at a minimum additional coolant, air filters, oil filters, and separator.

2. Auto restart: Resets the compressor following a power failure shutdown, one each.

3. Coalescing filter: Oil coalescing filter (.01 Micron) with auto drain, differential pressure slide indicator, and liquid level indicator.

F. Utilities Available:

1. Electrical:

a. Compressor: 208 VAC, 3 Phase, 54 Amps.

b. Air Dryer: 120 VAC, 1 Phase, 6 Amps.

2. Drain: 1/2 inch NPT.

G. Finish: Durable enamel in manufacturer's standard color.

H. Manufacturers Reference:

1. Prime manufacturer: Specifications are based on equipment identified herein by manufacturer's name and model to establish acceptable standards of quality, performance, features, and construction.

a. FS Curtis / Curtis-Toledo, Inc.
1905 Kienlen Avenue
St. Louis, MO 63133
Phone: (314) 383-1300
Website: www.FSCurtis.com

b. Model: NxB-15 with Integrated Air Dryer, Air After Coolers, Receiver and Accessories

2. Other manufacturers: Contingent upon compliance with these specifications and documentation requirements set forth in SUBMITTALS, equipment produced by other manufacturers, including the following, may be considered as equal.

a. Champion Pneumatic Machinery Company, Incorporated
1301 North Euclid Avenue
Princeton, IL 61356
Phone: (815) 875-3321
Fax: (815) 872-0421
Website: www.championpneumatic.com

b. Ingersoll-Rand Company
Air Compressor Group
800-D Beaty Street
Davidson, NC 28036

Phone: (704) 896-4000
Fax: (704) 896-4537
Website: www.air.ingersoll-rand.com

c. Quincy Compressor Division, Coltec, Incorporated
3501 Wismann Lane
Quincy, IL 62301
Phone: (217) 222-7700
Fax: (217) 222-5109
Website: www.quincycompressor.com

PART 3 - EXECUTION

3.01 INSPECTION

A. Coordinate location of rough-in work and utility stub-outs to assure match with equipment to be installed.

B. Inspect delivered equipment for damage from shipping and exposure to weather.

C. Compare delivered equipment with packing lists and specifications to assure receipt of all items.

3.02 INSTALLATION

A. Perform work under direct supervision of Foreman or Construction Superintendent with authority to coordinate installation of scheduled equipment with Architect.

B. Install equipment in accordance with plans, shop drawings and manufacturer's instructions:

1. Positioning: Place equipment in accordance with any noted special positioning requirements generally level, plumb and at right angles to adjacent work.

2. Fitting: Where field cutting or trimming is necessary, perform in a neat, accurate, professional manner without damaging equipment or adjacent work.

3. Anchorage: Attach equipment securely to floor, as directed by Architect, to prevent damage resulting from inadequate fastening. Installation fasteners shall be installed to avoid scratching or damaging adjacent surfaces.

4. Upon completion of work, finish surfaces shall be free of tool marks, scratches, blemishes, and stains.

3.03 TESTING

A. After final connections are made and prior to authorizing payment, specified equipment shall be tested for compliance with all specified features in the presence of the Architect using acceptance procedures provided by the manufacturer.

3.04 CLEANUP

A. Touch-up damage to painted finishes.

B. Wipe and clean equipment of any oil, grease, and solvents, and make ready for use.

C. Clean area around equipment installation and remove packing or installation debris from job site.

D. Notify Architect for acceptance inspection.

3.05 TRAINING

A. Direct the technical representative to provide specified hours of training to designated Owner's maintenance personnel in operation and maintenance of the following equipment. Coordinate, with Owner, training schedule and list of personnel to be trained.

1. COMPRESSOR, AIR, RECIEVER MOUNTED, 20HP, ROTARY SCREW
   Equipment Mark Number: 2168
   Hours Required: 4

B. Obtain, from technical representative, a list of Owner's personnel trained in equipment operations and maintenance.

END OF SECTION

SECTION 23 05 00

COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

A. The General Provisions of the Contract, including General and Special Conditions and the requirements of Division 1, apply to the Work in this Section.

B. The requirements of this Section apply to all sections of Division 23.

C. Definitions:

1. Exposed: Piping, ductwork, and equipment exposed to view in finished rooms.

2. Exterior: Piping, ductwork, and equipment exposed to weather be it temperature, humidity, precipitation, wind, or solar radiation.

D. Abbreviations/Acronyms:

1. ac: Alternating Current

2. AC: Air Conditioning

3. ACU: Air Conditioning Unit

4. ACR: Air Conditioning and Refrigeration

5. AI: Analog Input

6. AISI: American Iron and Steel Institute

7. AO: Analog Output

8. ASJ: All Service Jacket

9. AWG: American Wire Gauge

10. BACnet: Building Automation and Control Networking Protocol

11. BAg: Silver-Copper-Zinc Brazing Alloy

12. BAS: Building Automation System

13. BCuP: Silver-Copper-Phosphorus Brazing Alloy

14. bhp: Brake Horsepower
15. Btu: British Thermal Unit
16. Btu/h: British Thermal Unit Per Hour
17. CDA: Copper Development Association
18. C: Celsius
19. CD: Compact Disk
20. CFM: Cubic Foot Per Minute
21. CH: Chilled Water Supply
22. CHR: Chilled Water Return
23. CLR: Color
24. CO: Carbon Monoxide
25. COR: Contracting Officer's Representative
26. CPD: Condensate Pump Discharge
27. CPM: Cycles Per Minute
28. CPVC: Chlorinated Polyvinyl Chloride
29. CRS: Corrosion Resistant Steel
30. CTPD: Condensate Transfer Pump Discharge
31. CTPS: Condensate Transfer Pump Suction
32. CW: Cold Water
33. CWP: Cold Working Pressure
34. CxA: Commissioning Agent
35. dB: Decibels
36. dB(A): Decibels (A weighted)
37. DDC: Direct Digital Control
38. DI: Digital Input

39. DO: Digital Output
40. DVD: Digital Video Disc
41. DN: Diameter Nominal
42. DWV: Drainage, Waste and Vent
43. EPDM: Ethylene Propylene Diene Monomer
44. EPT: Ethylene Propylene Terpolymer
45. ETO: Ethylene Oxide
46. F: Fahrenheit
47. FAR: Federal Acquisition Regulations
48. FD: Floor Drain
49. FED: Federal
50. FG: Fiberglass
51. FGR: Flue Gas Recirculation
52. FOS: Fuel Oil Supply
53. FOR: Fuel Oil Return
54. FSK: Foil-Scrim-Kraft facing
55. FWPD: Feedwater Pump Discharge
56. FWPS: Feedwater Pump Suction
57. GC: Chilled Glycol Water Supply
58. GCR: Chilled Glycol Water Return
59. GH: Hot Glycol Water Heating Supply
60. GHR: Hot Glycol Water Heating Return
61. gpm: Gallons Per Minute
62. HDPE: High Density Polyethylene
63. Hg: Mercury

64. HOA: Hands-Off-Automatic
65. hp: Horsepower
66. HPS: High Pressure Steam (414 kPa (60 psig) and above)
67. HPR: High Pressure Steam Condensate Return
68. HW: Hot Water
69. HWH: Hot Water Heating Supply
70. HWHR: Hot Water Heating Return
71. Hz: Hertz
72. ID: Inside Diameter
73. IPS: Iron Pipe Size
74. kg: Kilogram
75. klb: 1000 lb
76. kPa: Kilopascal
77. lb: Pound
78. lb/hr: Pounds Per Hour
79. L/s: Liters Per Second
80. L/min: Liters Per Minute
81. LPS: Low Pressure Steam (103 kPa (15 psig) and below)
82. LPR: Low Pressure Steam Condensate Gravity Return
83. MAWP: Maximum Allowable Working Pressure
84. MAX: Maximum
85. MBtu/h: 1000 Btu/h
86. MBtu: 1000 Btu
87. MED: Medical
88. m: Meter

89. MFG: Manufacturer
90. mg: Milligram
91. mg/L: Milligrams Per Liter
92. MIN: Minimum
93. MJ: Megajoules
94. ml: Milliliter
95. mm: Millimeter
96. MPS: Medium Pressure Steam (110 kPa (16 psig) through 414 kPa (60 psig))
97. MPR: Medium Pressure Steam Condensate Return
98. MW: Megawatt
99. NC: Normally Closed
100. NF: Oil Free Dry (Nitrogen)
101. Nm: Newton Meter
102. NO: Normally Open
103. NOx: Nitrous Oxide
104. NPT: National Pipe Thread
105. NPS: Nominal Pipe Size
106. OD: Outside Diameter
107. OSD: Open Sight Drain
108. OS&Y: Outside Stem and Yoke
109. PC: Pumped Condensate
110. PID: Proportional-Integral-Differential
111. PLC: Programmable Logic Controllers
112. PP: Polypropylene
113. PPE: Personal Protection Equipment

114. ppb: Parts Per Billion
115. ppm: Parts Per Million
116. PRV: Pressure Reducing Valve \
117. PSIA: Pounds Per Square Inch Absolute
118. psig: Pounds Per Square Inch Gauge
119. PTFE: Polytetrafluoroethylene
120. PVC: Polyvinyl Chloride
121. PVDC: Polyvinylidene Chloride Vapor Retarder Jacketing, White
122. PVDF: Polyvinylidene Fluoride
123. rad: Radians
124. RH: Relative Humidity
125. RO: Reverse Osmosis
126. rms: Root Mean Square
127. RPM: Revolutions Per Minute
128. RS: Refrigerant Suction
129. RTD: Resistance Temperature Detectors
130. RTRF: Reinforced Thermosetting Resin Fittings
131. RTRP: Reinforced Thermosetting Resin Pipe
132. SCFM: Standard Cubic Feet Per Minute
133. SPEC: Specification
134. SPS: Sterile Processing Services
135. STD: Standard
136. SDR: Standard Dimension Ratio
137. SUS: Saybolt Universal Second
138. SW: Soft water

139. SWP: Steam Working Pressure
140. TAB: Testing, Adjusting, and Balancing
141. TDH: Total Dynamic Head
142. TEFC: Totally Enclosed Fan-Cooled
143. TFE: Tetrafluoroethylene
144. THERM: 100,000 Btu
145. THHN: Thermoplastic High-Heat Resistant Nylon Coated Wire
146. THWN: Thermoplastic Heat & Water-Resistant Nylon Coated Wire
147. T/P: Temperature and Pressure
148. USDA: U.S. Department of Agriculture
149. V: Volt
150. VAC: Vacuum
151. VA: Veterans Administration
152. VAC: Voltage in Alternating Current
153. VA CFM: VA Construction & Facilities Management
154. VA CFM CSS: VA Construction & Facilities Management, Consulting Support Service
155. VAMC: Veterans Administration Medical Center
156. VHA OCAMES: Veterans Health Administration - Office of Capital Asset Management Engineering and Support
157. VR: Vacuum condensate return
158. WCB: Wrought Carbon Steel, Grade B
159. WG: Water Gauge or Water Column
160. WOG: Water, Oil, Gas

1.2 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."

2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. HVAC Mechanical Systems Welding: Before any welding is performed, Contractor shall submit a certificate certifying that welders comply with the following requirements:

1. Qualify welding processes and operators for piping according to ASME BPVC Section IX. Provide proof of current certification.

2. Comply with provisions of ASME B31 series "Code for Pressure Piping".

3. Certify that each welder and welding operator has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.

4. All welds shall be stamped according to the provisions of the AWS or ASME as required herein and by the associated code.

D. Electrical Characteristics for Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

E. Meet all Owner, OSHA, state, and local safety requirements.

F. To meet the Owner goals of safety, reliability, serviceability, and efficient operation.

G. All work to meet local plumbing code. In the case of discrepancies between the project contract documents and the local code, the most stringent shall govern.

H. Comply with most current edition of Owner Design Standards.

I. All materials and installations shall meet applicable FM Global requirements.

J. Complete Project Closeout list, Pre-Occupancy checklist, and Project Turnover checklist prior to project turnover to Owner.

K. Mechanical, electrical and associated systems shall be safe, reliable, efficient, durable, easily and safely operable and maintainable, easily and safely accessible, and in compliance with applicable codes as specified. The systems shall be comprised of high quality institutional-class and industrial-class products of manufacturers that are experienced specialists in the required product lines. All

construction firms and personnel shall be experienced and qualified specialists in industrial and institutional HVAC.

L. Equipment Vibration Tolerance:

1. Refer to Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT. Equipment shall be factory-balanced to this tolerance and re-balanced on site, as necessary.

2. After HVAC air balance work is completed and permanent drive sheaves are in place, perform field mechanical balancing and adjustments required to meet the specified vibration tolerance.

M. Products Criteria:

1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years (or longer as specified elsewhere). The design, model and size of each item shall have been in satisfactory and efficient operation on at least three installations for approximately three years. However, digital electronics devices, software and systems such as controls, instruments, computer work station, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least three years. See other specification sections for any exceptions and/or additional requirements.

2. Refer to all other sections for quality assurance requirements for systems and equipment specified therein.

3. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.

4. The products and execution of work specified in Division 23 shall conform to the referenced codes and standards as required by the specifications. Local codes and amendments shall be enforced, along with requirements of local utility companies. The most stringent requirements of these specifications, local codes, or utility company requirements shall always apply. Any conflicts shall be brought to the attention of the COR.

5. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be of the same manufacturer and model number, or if different models are required they shall be of the same manufacturer and identical to the greatest extent possible (i.e., same model series).

6. Assembled Units: Performance and warranty of all components that make up an assembled unit shall be the responsibility of the manufacturer of the completed assembly.

7. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.

8. Use of asbestos products or equipment or materials containing asbestos is prohibited.

N. HVAC Equipment Service Providers: Service providers shall be authorized and trained by the manufacturers of the equipment supplied. These providers shall be capable of responding onsite and provide acceptable service to restore equipment operations within 8 hours of receipt of notification by phone, e-mail or fax in event of an emergency, such as the shutdown of equipment; or within 24 hours in a non-emergency. Submit names, mail and e-mail addresses and phone numbers of service personnel and companies providing service under these conditions for (as applicable to the project): fans, air handling units, chillers, cooling towers, control systems, pumps, critical instrumentation, computer workstation and programming.

O. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the COR with submittals. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material and removal by the Contractor and no additional cost or time to the Government.

P. Execution (Installation, Construction) Quality:

1. Apply and install all items in accordance with manufacturer's written instructions. Refer conflicts between the manufacturer's instructions and the contract documents to the COR for resolution. Provide written hard copies and computer files on CD or DVD of manufacturer's installation instructions to the COR with submittals prior to commencing installation of any item. Installation of the item will not be allowed to proceed until the recommendations are received and approved by the Owner. Failure to furnish these recommendations is a cause for rejection of the material.

2. All items that require access, such as for operating, cleaning, servicing, maintenance, and calibration, shall be easily and safely accessible by persons standing at floor level, or standing on permanent platforms, without the use of portable ladders. Examples of these items include, but are not limited to, all types of valves, filters and strainers, transmitters, control devices. Prior to commencing installation work, refer conflicts between this requirement and contract documents to the COR for resolution. Failure of the Contractor to resolve or point out any issues will result in the Contractor correcting at no additional cost or time to the Owner.

3. Complete coordination/shop drawings shall be required in accordance with Article, SUBMITTALS. Construction work shall not start on any system until

the coordination/shop drawings have been approved by the Owner/Engineer.

4. Workmanship/craftsmanship will be of the highest quality and standards. The Owner reserves the right to reject any work based on poor quality of workmanship this work shall be removed and done again at no additional cost or time to the Government.

Q. Upon request by the Owner, provide lists of previous installations for selected items of equipment. Include contact persons who will serve as references, with current telephone numbers and e-mail addresses.

1.3 STANDARD AND REGULATORY REQUIREMENTS

A. All materials, design, fabrication, assembly and test procedures shall be in accordance with the requirements of all applicable codes, standards or regulations having jurisdiction over the work.

B. Reference to any code, standard or regulation shall mean the latest published editions, including addenda, supplements and revisions thereto, which are in effect when the purchase order is awarded.

C. In the event of conflict between codes, standards or regulations, the conflict shall be referred to the Engineer for resolution.

D. The organizations having jurisdiction include, but are not limited to, the following:

1. ANSI American National Standards Institute

2. ASME American Society of Mechanical Engineers

3. EPA Federal, State and Local Environmental Protection Agencies

4. IBC International Building Code, New Jersey Edition

5. ISA Instrument Society of America.

6. NEC National Electrical Code.

7. NEMA National Electric Manufacturer's Association.

8. NFPA National Fire Protection Association.

9. OSHA Regulations of the Occupations Safety and Health Administration.

10. UL Underwriter's Laboratories Inc.

11. The state, county or municipal laws and regulations governing the location where the equipment is to be installed.

E. Equipment indicated within this specification section shall comply with all applicable national, state and local codes and regulations, including seismic and fire codes and regulations. Additional, more specific compliance requirements may be listed under individual equipment headings.

F. 'Buy America' Requirements: All manufactured products listed within this specification section are part of a federally assisted procurement involving funds granted by the Federal Transit Administration (FTA), and shall comply with Buy America requirements as delineated by Title 49 Code of Federal Regulations (CFR) Subsection 661.

1.4 SUBMITTALS

A. Refer to Drawing Q9.06 Shop Equipment Schedule for submittal requirements listed in the "Submittals" column of the equipment list. In the event of conflict between Drawing Q9.06 Shop Equipment Schedule and the following expanded submittal descriptions, Drawing Q9.06 Shop Equipment Schedule is to govern.

B. Product Data:

1. Submit Product Data in accordance with Division 1 - General Requirements of these specifications.

2. All Product Data submittals shall identify proposed project specific items marked by arrow, circle, underline, reproducible highlight, or other markings clearly discernable by the reviewer, to show which specific items, parts and accessories are being submitted for the project product data review. Non-marked or generic product data submittals with no marks indicating specific items, parts and accessories will be a cause for rejection.

3. Restrict submitted material to pertinent data. For instance, do not include manufacturer's complete catalog when pertinent information is contained on a single page.

C. Operation and Maintenance Manual:

1. Provide a Complete parts list, operating instructions, and maintenance manual covering equipment at time of installation including, but not limited to:

a. Description of system and components.

b. Schematic diagrams of electrical, plumbing and compressed air systems.

c. Manufacturer's printed operating instructions.

d. Printed listing of periodic preventive maintenance items and recommended frequency required to validate warranties. Failure to

provide maintenance information will indicate that preventive maintenance is not a condition for validation of warranties.

e. List of original manufacturer's parts, including suppliers' part numbers and cuts, recommended spare parts stockage quantity and local parts and service source.

2. Assemble and provide copies of manual in 8-1/2 by 11 inch format. Foldout diagrams and illustrations are acceptable. Manual to be reproducible by dry copy method. Provide copies per provisions of Division 1 - General Requirements.

D. Shop Drawings: Submit in accordance with Division 1 -General Requirements of these specifications. Refer to Drawing Q9.06 Shop Equipment Schedule for the equipment mark numbers requiring shop drawings.

1. Submitted shop drawings shall be project specific and shall include a minimum 1/8 inch to 1 foot scaled (or larger standard architectural imperial scale), dimensioned, graphical representation of the size, orientation, and location for the submitted equipment. The drawings shall further include dimensions from structural elements or architectural grid lines, operational clearances, locations of any utility service connection points, mounting requirements, and structural supports required for the submitted equipment.

E. ’Buy America’ Certificates: ‘Buy America’ certificates required during bidding shall also be required as part of each product submittal. Certificates shall be complete and accurate. Certificates shall indicate either compliance or non-compliance with the ‘Buy America’ regulations. Certificates of non-compliance shall also include copies of any granted waivers. Waivers still being applied for or being processed at the time of submittal shall be indicated as such.

1.5 PRODUCT SUBSTITUTIONS

A. Follow requirements specified in Division 1 - General Requirements.

B. Additional costs resulting from substitution of products other than those specified, including drawing changes and construction, will be at the expense of the Contractor.

C. Substitution Approval: Manufacturers listed for each equipment item may bid without submittal for that item. Manufacturers not listed shall submit for approval in accordance with "Instructions to Bidders". Prior to installation, submittals for each equipment item by Mark Number shall be provided in accordance with Division 1 - General Requirements.

1.6 WARRANTY

A. The Manufacturer shall warrant that all materials and equipment furnished under this contract will be new and of good quality, free from defects in design, workmanship, and materials.

B. Each item of equipment, or part thereof, proving to be defective within the specified period of the warranty shall be replaced, free of defect, without cost to the Owner.

C. The warranty period shall be the Manufacturer's standard warranty period, but not less than a minimum of twelve (12) months after startup, or 18 months after delivery of the equipment at the site (whichever comes first)..

D. Warranty shall include materials and labor necessary to correct defects.

E. Defects shall include, but not be limited to noisy, rough, or substandard operation; loose, damaged, and missing parts; and abnormal deterioration of finish.

F. Submit warranties in accordance with Division 1 - General Requirements of these specifications.

G. All parts shall be readily available locally in the United States.

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Piping, duct, equipment, and associated accessories kept on-site should be stored off the ground on skids, ends should be capped or sealed, and these items should be covered with plastic to prevent fouling or contact with excessive moisture. Piping, duct, and equipment should be cleaned of debris inside and out before installation and should be kept clean and protected throughout construction.

B. Indelibly label all containers, including those contained in others, on outside with item description(s) per title and Mark Number of this specification.

C. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.8 LABELING

A. Manufacturer shall securely attach in a prominent location on each major item of equipment a non-corrosive nameplate showing manufacturer's name, address, model number, serial number, and pertinent utility or operating data.

B. All electrical equipment and materials shall be new and shall be listed by Underwriter's Laboratories, Inc. (U.L.), or other National Recognized Testing Laboratory (NRTL), in categories for which standards have been set by that agency and labeled as such in the manufacturer's plant.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers, subject to compliance with requirements of this specification, are as follows:

1. Miratech

2. Steuler

3. Johnson Matthey

4. Peerless Mfg.

2.2 Selective Catalytic Reduction System

A. SCR Reactor Vessel

1. The SCR catalyst reactor housing shall be fabricated from non-scaling heat resistant stainless steel, of rigid reinforced construction. The SCR catalyst reactor housing shall be equipped with ANSI flanges at both ends. The SCR housing and all components in contact with engine exhaust shall be suitable for continuous operation at the maximum engine exhaust temperature without scaling, deformation or any other physical damage for the life of the system.

2. The SCR reactor housing shall be equipped with insulation supports. Insulation shall be supplied and installed by others.

3. The SCR reactor housing shall be designed to be mounted horizontally in the engine exhaust gas duct and be supported from overhead. The SCR supporting steel shall be provided by Supplier.

4. The reactor housing shall be equipped with sample gas ports, maintenance and inspection doors for easy access and catalyst bed loading and unloading, instrumentation connections and other connections as deemed necessary by the Supplier.

5. The SCR vessel catalyst core shall consist of an adequate number of layers of catalyst material, with room for one (1) additional layer of material in the reactor housing. Each layer of catalyst material shall be of a modular design. Catalyst modules shall be of size and weight to facilitate manual loading.

6. The catalyst shall be type as recommended by the SCR manufacturer and shall be designed for operation at the maximum and minimum exhaust temperatures achievable by the engine.

B. Catalytic System Accessories

1. The SCR system shall include a static exhaust gas mixer to be mounted upstream of the SCR catalyst reactor housing. The mixer shall insure full and complete mixing of the atomized injected reducing agent with the

engine exhaust gas under all engine load conditions. The static mixer shall be fabricated from non-scaling heat resistant stainless steel. The static mixer shall be equipped with a stainless steel injection lance, through which the atomized reducing agent is introduced into the exhaust stream. The static mixer shall be equipped with ANSI flanges at both ends.

2. The static mixer shall be equipped with insulation supports. Insulation shall be supplied and installed by others.

3. The SCR system shall be supplied with a reducing agent storage, injection and control system which shall included but not necessarily limited to the follow: Urea storage tank, metering/injection pump, dosing box, atomizing air compressor, and all appurtenances required to form a complete and operable system. The capacity shall by as recommended by the SCR supplier.

4. The reducing agent metering and control system shall be capable of insuring, that the maximum ammonia slip to atmosphere from the SCR system does not exceed the limits specified in Attachment No. 2 under all engine operation conditions. Use of an oxidation catalyst mounted downstream of the SCR catalyst to eliminate excess ammonia slip to atmosphere is prohibited.

5. Compressed air system, for urea atomization shall be provided by the Supplier.

6. The Urea/water solution shall be directed into the exhaust gas stream by means of a metered injection nozzle system.

7. The Supplier shall provide one (1) 6500 gallon, polyethylene storage tank for urea/water solution. The tank shall be installed outdoors and be of vertical design. The Urea tank should be manufactured from High Density Cross linked Polyethylene. It should be one piece seamless molded designed with wall thicknesses conforming to ASTMD-1998 standards for liquid storage. Must have low temperature impact resistance and U.V. stabilized. Insulation should be at least 2" thick and the heat tracing should be monitored by a separate control panel. The control panel shall operate through the use of dual 115V thermostats. The urea mixture must be maintained above 40 degrees F at all times to avoid the potential for crystallization. Accessories included with the tank:

   a. Ultrasonic Level Indication

   b. High/Low Level Alarms

   c. Integrated Heat Tracing and Insulation for outdoor installation

   d. Fill system with vacuum break

C. Piping/Tubing

1. All Urea solution and compressed air pipe/tube materials and components shall be stainless steel. Minimum tube size shall be 1/2 inch nominal. Minimum tubing thickness is 0.063 of an inch.

2. Stainless steel tubing sizes shall be limited to 1" and below. Carbon steel, cast, ductile, or malleable iron piping material shall not be used

3. All stainless steel Urea piping shall be welded. Threaded connections shall be minimized. Pipe threads shall conform to ANSI B2.1, Taper Pipe Threads. Taper threaded connections are unacceptable in stainless steel.

2.3 INSTRUMENTATION AND CONTROLS

A. PLC based, closed loop analysis and reactant injection system to maximize reactant injection efficiency by continuously sampling and analyzing the treated exhaust gas.

B. The SCR control system shall be equipped with an interface display and with a serial interface to permit communication and monitoring of the SCR system from the CUP master control system (MCS). The Supplier shall provide and configure the Modbus communications interface, provide programming of all parameters required to effectively monitor the SCR system from the MCS.

C. Completely pre-wired Control panel, built in accordance to manufacturer standards, with UL listed components, shall be provided.

D. The SCR control system shall be equipped to provide the following functions:

1. Continuous monitoring of the temperature downstream of the SCR (SCR discharge connection)

2. Continuous monitoring of the urea flow rate (gal/hr)

E. The Temperature and Urea flow information shall be continuously stored in an electronic data storage for the EPA compliance record.

2.4 FINISHES

A. All carbon steel surface and equipment shall be primed and finished painted in accordance with manufacturer's standards. In the absences of specific manufacturer's standards, prime paint with a Zinc rich primer (dry film thickness - 2.0 mils min, 2.5 mils max), finish coat shall be of Aliphatic Polyurethane (dry film thickness - 2.0 mils min, 2.5 mils max) or standard manufacturer epoxy paint.

B. Stainless steel components shall not be painted.

PART 3 - EXECUTION

3.1 INSPECTION

A. Coordinate location of rough-in work and utility stub-outs to assure match with equipment to be installed.

B. Inspect delivered equipment for damage from shipping and exposure to weather. Compare delivered equipment with packing lists and specifications to assure receipt of all items.

3.2 INSTALLATION

A. Perform work under direct supervision of Foreman or Construction Superintendent with authority to coordinate installation of scheduled equipment with Engineer.

B. Install equipment in accordance with plans, shop drawings and manufacturer's instructions:

1. Positioning: Place equipment in accordance with any noted special positioning requirements generally level, plumb and at right angles to adjacent work.

2. Fitting: Where field cutting or trimming is necessary, perform in a neat, accurate, professional manner without damaging equipment or adjacent work.

3. Anchorage: Attach equipment securely to floor, per manufacturer's instructions and as directed, specified, or detailed by the Structural Engineer for general anchorage and seismic bracing conditions, to prevent damage resulting from inadequate fastening. Installation fasteners shall be installed to avoid scratching or damaging adjacent surfaces.

4. Upon completion of work, finish surfaces shall be free of tool marks, scratches, blemishes, and stains.

3.3 TESTING

A. After final connections are made and prior to authorizing payment, specified equipment shall be tested for compliance with all specified features in the presence of the Engineer using acceptance procedures provided by the manufacturer.

3.4 CLEANUP

A. Touch-up damage to painted finishes.

B. Wipe and clean equipment of any oil, grease, and solvents, and make ready for use.

C. Clean area around equipment installation and remove packing or installation debris from job site.

D. Notify Engineer for acceptance inspection.

3.5 TRAINING

A. Direct the technical representative to provide specified hours of training to designated Owner's maintenance personnel in operation and maintenance of the following equipment. Coordinate, with Owner, training schedule and list of personnel to be trained.

1. VAULT/RECEIVER, FAREBOX, MOBILE BIN
Equipment Mark Number: 7800
Hours Required: 1

2. DATA COLLECTION AND REPORTING SYSTEM, FAREBOX
Equipment Mark Number: 7820
Hours Required: 1

B. Obtain, from technical representative, a list of Owner's personnel trained in equipment operations and maintenance.

END OF SECTION

SECTION 23 05 19

METERS AND GAUGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The General Provisions of the Contract, including General and Special Conditions and the requirements of Division 1, apply to the Work in this Section.

B. Equipment and all necessary accessories as designated in this section shall include the following.

1. Bimetallic-actuated thermometers

2. Thermowells.

3. Dial-type pressure gauges.

4. Gauge attachments.

5. Test plugs.

6. Test plug kit.

1.2 QUALITY ASSURANCE

A. Instruments shall be factory calibrated for the temperature and pressure of the systems in which they are installed.

B. B. Pressure gauges shall be manufactured in accordance with ANSI Specification B-40-1 Grade 2A.

1.3 STANDARD AND REGULATORY REQUIREMENTS

A. All materials, design, fabrication, assembly and test procedures shall be in accordance with the requirements of all applicable codes, standards or regulations having jurisdiction over the work.

B. Reference to any code, standard or regulation shall mean the latest published editions, including addenda, supplements and revisions thereto, which are in effect when the purchase order is awarded.

C. In the event of conflict between codes, standards or regulations, the conflict shall be referred to the Engineer for resolution.

D. The organizations having jurisdiction include, but are not limited to, the following:

1. AGA American Gas Association
2. ANSI American National Standards Institute
3. ASME American Society of Mechanical Engineers
4. ASTM American Society for Testing and Materials
5. AWS American Welding Society
6. AWWA American Water Works Association
7. NFPA National Fire Protection Association.
8. OSHA Regulations of the Occupations Safety and Health Administration.
9. UL Underwriter's Laboratories Inc.
10. The state, county or municipal laws and regulations governing the location where the equipment is to be installed.

E. Equipment indicated within this specification section shall comply with all applicable national, state and local codes and regulations, including seismic and fire codes and regulations. Additional, more specific compliance requirements may be listed under individual equipment headings.

A. 'Buy America' Requirements: All manufactured products listed within this specification section are part of a federally assisted procurement involving funds granted by the Federal Transit Administration (FTA), and shall comply with Buy America requirements as delineated by Title 49 Code of Federal Regulations (CFR) Subsection 661.

1.4 SUBMITTALS

A. Manufacturers Installation Instructions: Submit installation instructions for material and equipment.

B. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

C. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

D. Shop Drawings - Submit in accordance with Division 1 -General Requirements of these specifications.

1. Submitted shop drawings shall be project specific and shall include a minimum 1/8 inch to 1 foot scaled (or larger standard architectural imperial scale), dimensioned, graphical representation of the size, orientation, and location for the submitted equipment. The drawings shall further include

operational clearances, mounting requirements, and structural supports required for the submitted equipment.

a. Wiring Diagrams: For power, signal, and control wiring.

2. Product Data: For each type of product indicated.

3. All Product Data submittals shall identify proposed project specific items marked by arrow, circle, underline, reproducible highlight, or other markings clearly discernable by the reviewer, to show which specific items, parts and accessories are being submitted for the project product data review. Non-marked or generic product data submittals with no marks indicating specific items, parts and accessories will be a cause for rejection.

4. Restrict submitted material to pertinent data. For instance, do not include manufacturer's complete catalog when pertinent information is contained on a single page.

5. Project Record Documents: Record actual locations of components and instrumentation.

E. Operation and Maintenance Manual:

1. Provide operating instructions, and maintenance manual covering equipment at time of installation including, but not limited to:

a. Manufacturer's printed operating instructions.

b. Printed listing of periodic preventive maintenance items and recommended frequency required to validate warranties. Failure to provide maintenance information will indicate that preventive maintenance is not a condition for validation of warranties.

c. List of original manufacturer's parts, including suppliers' part numbers and cuts, recommended spare parts stockage quantity and local parts and service source.

2. Assemble and provide copies of manual in 8-1/2 by 11 inch format. Foldout diagrams and illustrations are acceptable. Manual to be reproducible by dry copy method. Provide copies per provisions of Division 1 - General Requirements.

F. ’Buy America’ Certificates: ‘Buy America’ certificates required during bidding shall also be required as part of each product submittal. Certificates shall be complete and accurate. Certificates shall indicate either compliance or non-compliance with the ‘Buy America’ regulations. Certificates of non-compliance shall also include copies of any granted waivers. Waivers still being applied for or being processed at the time of submittal shall be indicated as such.

1.5 WARRANTY

A. The Manufacturer shall warrant that all materials and equipment furnished under this contract will be new and of good quality, free from defects in design, workmanship, and materials.

B. Each item of equipment, or part thereof, proving to be defective within the specified period of the warranty shall be replaced, free of defect, without cost to the Owner.

C. The warranty period shall be the Manufacturer's standard warranty period, but not less than a minimum of twelve (12) months after startup, or 18 months after delivery of the equipment at the site (whichever comes first).

D. Defects shall include, but not be limited to noisy, rough, or substandard operation; loose, damaged, and missing parts; and abnormal deterioration of finish.

E. Submit warranties in accordance with Division 1 - General Requirements of these specifications.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers, subject to compliance with requirements of this specification, are as follows:

1. Bimetallic-actuated thermometers

a. Ashcroft Inc.

b. Trerice, H. O. Co., EI Series

c. Weiss Instruments, Inc.

2. Direct-Mounted, Metal-Case, Dial-Type Pressure Gauges:

a. AMETEK, Inc.; U.S. Gauge.

b. Ashcroft Inc.

c. Trerice, H. O. Co.

d. Weiss Instruments, Inc.

3. Test Plugs:

   a. Flow Design, Inc.

   b. Peterson Equipment Co., Inc.

   c. Trerice, H. O. Co.

   d. Weiss Instruments, Inc.

4.

2.2 BIMETALLIC-ACTUATED THERMOMETERS

A. Standard: ASME B40.200.

B. Case: Sealed types; stainless steel with 3-inch nominal diameter.

C. External adjustment.

D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F.

E. Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.

F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.

G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.

H. Window: Plain glass or plastic.

I. Ring: Stainless steel.

J. Element: Bimetal coil.

K. Pointer: Dark-colored metal.

L. Accuracy: Plus or minus 1 percent of scale range.

2.3 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.

2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.

3. Material for Use with Copper Tubing: CNR or CUNI.

4. Material for Use with Steel Piping: CRES.

5. Type: Stepped shank unless straight or tapered shank is indicated.

6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.

7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.

8. Bore: Diameter required to match thermometer bulb or stem.

9. Insertion Length: Length required to match thermometer bulb or stem.

10. Lagging Extension: Include on thermowells for insulated piping and tubing.

11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin

2.4 PRESSURE GAUGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gauges:

1. Standard: ASME B40.100.

2. Case: Liquid-filled type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.

3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.

4. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.

5. Movement: Mechanical, with link to pressure element and connection to pointer.

6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.

7. Pointer: Dark-colored metal.

8. Window: Glass or plastic.

9. Ring: Metal.

10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.5 GAUGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

B. Siphons: Loop-shaped section of brass pipe with NPS 1/4 or NPS 1/2 pipe threads.

C. Valves: Brass ball, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

2.6 TEST PLUGS

A. Description: Test-station fitting made for insertion into piping tee fitting.

B. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

C. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.

D. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

E. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber

2.7 TEST PLUG KIT

A. Furnish one test-plug kit containing two thermometer(s), one pressure gauge and adapter, and carrying case. Thermometer sensing elements, pressure gauge, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

B. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch-diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F.

C. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch-diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F.

D. Pressure Gauge: Small, Bourdon-tube insertion type with 2- to 3-inch- diameter dial and probe. Dial range shall be at least 0 to 200 psig.

E. Carrying Case: Metal or plastic, with formed instrument padding.

PART 3 - EXECUTION

3.1 FIELD CONDITIONS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install thermowells with socket to center of pipe and in vertical position in piping tees.

C. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

D. Install thermowells with extension on insulated piping.

E. Fill thermowells with heat-transfer medium.

F. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

G. Pack thermometers in a thermal conductive compound. Preferred products are: Honeywell Part No. 107408; Jonson Controls F-1000-182; York 013-00898-000.

H. Install direct-mounted pressure gauges in piping tees with pressure gauge located on pipe at the most readable position.

I. Install valve and snubber in piping for each pressure gage for fluids (except steam).

J. Install valve and syphon fitting in piping for each pressure gauge for steam.

K. Install test plugs in piping tees.

L. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters according to manufacturer's written instructions.

M. Install flowmeter elements in accessible positions in piping systems, and per manufacturer's requirements.

N. Install wafer-orifice flowmeter elements between pipe flanges.

O. Install differential-pressure-type flowmeter elements, with at least minimum straight lengths of pipe, upstream and downstream from element according to manufacturer's written instructions.

P. Install permanent indicators on walls or brackets in accessible and readable positions.

Q. Install connection fittings in accessible locations for attachment to portable indicators.

R. Install thermometers in the following locations:

1. Inlet and outlet of each hydronic zone.
2. Inlet and outlet of each hydronic boiler.
3. Two inlets and two outlets of each hydronic heat exchanger.
4. Inlet and outlet of each thermal-storage tank.

S. Install pressure gauges in the following locations:

1. Discharge of each pressure-reducing valve.
2. Inlet and outlet of each heat exchanger-water connection.
3. Suction and discharge of each pump.

3.3 CONNECTIONS

A. Install meters and gauges adjacent to machines and equipment to allow service and maintenance of meters, gauges, machines, and equipment.

B. Connect flowmeter-system elements to meters.

C. Connect flowmeter transmitters to meters.

D. Connect thermal-energy meter transmitters to meters.

3.4 ADJUSTING

A. After installation, calibrate meters according to manufacturer's written instructions.

B. Adjust faces of meters and gauges to proper angle for best visibility.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Heating and Glycol, Hot-Water Piping: 30 to 250 deg F or 30 to 300 deg F.

3.6 PRESSURE-GAUGE SCALE-RANGE SCHEDULE

A. Scale Range for Hydronic Water Piping: As best suited for final project conditions.

3.7 FLOWMETER SCHEDULE

A. Flowmeters for Hydronic Piping: Electromagnetic type.

END OF SECTION

SECTION 23 05 23

GENERAL DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The General Provisions of the Contract, including General and Special Conditions and the requirements of Division 1, apply to the Work in this Section.

B. Equipment and all necessary accessories as designated in this section shall include the following.

1. Bronze ball valves.

2. Iron, butterfly valves.

3. High-performance butterfly valves.

4. Bronze lift check valves.

5. Bronze swing check valves.

6. Iron swing check valves.

7. Iron, grooved-end swing-check valves.

8. Bronze gate valves.

9. Iron gate valves.

10. Bronze globe valves.

11. Iron globe valves.

1.2 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

2. ASME B31.1 for power piping valves.

3. ASME B31.9 for building services piping valves.

1.3 STANDARD AND REGULATORY REQUIREMENTS

A. All materials, design, fabrication, assembly and test procedures shall be in accordance with the requirements of all applicable codes, standards or regulations having jurisdiction over the work.

B. Reference to any code, standard or regulation shall mean the latest published editions, including addenda, supplements and revisions thereto, which are in effect when the purchase order is awarded.

C. In the event of conflict between codes, standards or regulations, the conflict shall be referred to the Engineer for resolution.

D. The organizations having jurisdiction include, but are not limited to, the following:

1. ANSI American National Standards Institute

2. ASME American Society of Mechanical Engineers

3. ASTM American Society for Testing and Materials

4. AWS American Welding Society

5. AWWA American Water Works Association

6. MSS Manufacturers Standardization Society of the Valve and Fittings Industry

7. NFPA National Fire Protection Association.

8. OSHA Regulations of the Occupations Safety and Health Administration.

9. UL Underwriter's Laboratories Inc.

10. The state, county or municipal laws and regulations governing the location where the equipment is to be installed.

E. Equipment indicated within this specification section shall comply with all applicable national, state and local codes and regulations, including seismic and fire codes and regulations. Additional, more specific compliance requirements may be listed under individual equipment headings.

F. ‘Buy America’ Requirements: All manufactured products listed within this specification section are part of a federally assisted procurement involving funds granted by the Federal Transit Administration (FTA), and shall comply with Buy America requirements as delineated by Title 49 Code of Federal Regulations (CFR) Subsection 661.

1.4 SUBMITTALS

A. Design Data: Indicate pipe size. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Submit data on all materials, fittings, accessories and equipment.

B. Manufacturers Installation Instructions: Submit installation instructions for material and equipment.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

D. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

E. Shop Drawings - Submit in accordance with Division 1 -General Requirements of these specifications.

1. Submitted shop drawings shall be project specific and shall include a minimum 1/8 inch to 1 foot scaled (or larger standard architectural imperial scale), dimensioned, graphical representation of the size, orientation, and location for the submitted equipment. The drawings shall further include dimensions from structural elements or architectural grid lines, operational clearances, locations of any utility service connection points, mounting requirements, and structural supports required for the submitted equipment.

2. Provide product data for each type of the following:

a. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.

3. All Product Data submittals shall identify proposed project specific items marked by arrow, circle, underline, reproducible highlight, or other markings clearly discernable by the reviewer, to show which specific items, parts and accessories are being submitted for the project product data review. Non-marked or generic product data submittals with no marks indicating specific items, parts and accessories will be a cause for rejection.

4. Restrict submitted material to pertinent data. For instance, do not include manufacturer's complete catalog when pertinent information is contained on a single page.

F. Operation and Maintenance Manual:

1. Provide a Complete parts list, operating instructions, and maintenance manual covering equipment at time of installation including, but not limited to:

a. Description of system and components.

b. Manufacturer's printed operating instructions.

c. Printed listing of periodic preventive maintenance items and recommended frequency required to validate warranties. Failure to provide maintenance information will indicate that preventive maintenance is not a condition for validation of warranties.

d. List of original manufacturer's parts, including suppliers' part numbers and cuts, recommended spare parts stockage quantity and local parts and service source.

2. Assemble and provide copies of manual in 8-1/2 by 11 inch format. Foldout diagrams and illustrations are acceptable. Manual to be reproducible by dry copy method. Provide copies per provisions of Division 1 - General Requirements.

G. ’Buy America’ Certificates: ‘Buy America’ certificates required during bidding shall also be required as part of each product submittal. Certificates shall be complete and accurate. Certificates shall indicate either compliance or non-compliance with the ‘Buy America’ regulations. Certificates of non-compliance shall also include copies of any granted waivers. Waivers still being applied for or being processed at the time of submittal shall be indicated as such.

1.5 WARRANTY

A. The Manufacturer shall warrant that all materials and equipment furnished under this contract will be new and of good quality, free from defects in design, workmanship, and materials.

B. Each item of equipment, or part thereof, proving to be defective within the specified period of the warranty shall be replaced, free of defect, without cost to the Owner.

C. The warranty period shall be the Manufacturer's standard warranty period, but not less than a minimum of twelve (12) months after startup, or 18 months after delivery of the equipment at the site (whichever comes first).

D. Warranty shall include materials and labor necessary to correct defects.

E. Defects shall include, but not be limited to noisy, rough, or substandard operation; loose, damaged, and missing parts; and abnormal deterioration of finish.

F. Submit warranties in accordance with Division 1 - General Requirements of these specifications.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.

2. Protect threads, flange faces, grooves, and weld ends.

3. Set ball valves open to minimize exposure of functional surfaces.

4. Set butterfly valves closed or slightly open.

5. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.

2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers, subject to compliance with requirements of this specification, are as follows:

1. Bronze Ball Valves, Three-Piece with Full Port Stainless-Steel Trim

a. Conbraco Industries, Inc.; Apollo Valves.

b. Neles-Jamesbury, Inc.

c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Butterfly Valves

a. Bray Controls; a division of Bray International.

b. Crane Co.; Crane Valve Group; Stockham Division.

c. DeZurik Water Controls.

d. Hammond Valve.

e. Milwaukee Valve Company

3. High-Performance Butterfly Valves

a. Bray Controls; a division of Bray International.

b. Crane Co.; Crane Valve Group; Flowseal.

c. Crane Co.; Crane Valve Group; Stockham Division.

d. DeZurik Water Controls.

e. Milwaukee Valve Company

f. Jamesbury, Inc

4. Bronze Lift Check Valves

a. Nibco

b. Crane Co.; Crane Valve Group; Crane Valves.

c. Mueller.

5. Bronze Horizontal Swing Check Valves

a. Nibco

b. Crane Co.; Crane Valve Group; Crane Valves.

c. Mueller

6. Iron Swing Check Valves

a. Nibco

b. Crane Co.; Crane Valve Group; Crane Valves.

c. Mueller

7. Iron Grooved End Swing Check Valves

a. Nibco

b. Crane Co.; Crane Valve Group; Crane Valves.

c. Mueller

8. Bronze Gate Valves

a. Crane Co.; Crane Valve Group; Crane Valves.

b. Crane Co.; Crane Valve Group; Stockham Division.

c. Hammond Valve.

d. Milwaukee Valve Company.

e. NIBCO INC.

f. Conbraco Industries, Inc.; Apollo Valves.

9. Iron Gate Valves

a. Crane Co.; Crane Valve Group; Crane Valves.

b. Crane Co.; Crane Valve Group; Stockham Division.

c. Hammond Valve.

d. Milwaukee Valve Company.

e. NIBCO INC.

f. Conbraco Industries, Inc.; Apollo Valves.

10. Bronze Globe Valves

a. Crane Co.; Crane Valve Group; Crane Valves.

b. Crane Co.; Crane Valve Group; Stockham Division.

c. Hammond Valve.

d. Milwaukee Valve Company.

e. NIBCO INC.

f. Conbraco Industries, Inc.; Apollo Valves.

11. Iron Globe Valves

a. Crane Co.; Crane Valve Group; Crane Valves.

b. Crane Co.; Crane Valve Group; Stockham Division.

c. Hammond Valve.

d. Milwaukee Valve Company.

e. NIBCO INC.

f. Conbraco Industries, Inc.; Apollo Valves.

2.2 GENERAL REQUIREMENTS FOR VALVES

A. Refer to HVAC valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 8 and larger.

2. Handwheel: For valves other than quarter-turn types.

3. Hand lever: For quarter-turn valves NPS 6 and smaller.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

2. Butterfly Valves: With extended neck.

3. Gate Valves: With rising stem.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.

2. Grooved: With grooves according to AWWA C606.

3. Solder Joint: With sockets according to ASME B16.18.

4. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45

2.3 BRONZE BALL VALVES

A. Bronze Ball Valves, Three-Piece with Full Port Stainless-Steel Trim:

1. Description:

a. Standard: MSS SP-110.

b. SWP Rating: 150 psig (1035 kPa).

c. CWP Rating: 600 psig (4140 kPa).

d. Body Design: Three piece.

e. Body Material: Bronze.

f. Ends: Threaded.

g. Seats: PTFE.

h. Stem: 316L Stainless steel.

i. Ball: 316L Stainless steel, vented.

j. Port: Full.

2.4 IRON, BUTTERFLY VALVES

A. Class 150B, Iron, Mechanical Joint or Flanged End Butterfly Valves:

1. Description:

a. Standard: ANSI Class 150B tested to 200 psi.

b. Body Material: Coated, cast iron.

c. Mechanical Joint or Flanged end.

d. Stem: Two-piece stainless steel.

e. Disc: Coated, ductile iron.

f. Seal: EPDM.

g. Shaft: 304 stainless steel.

2.5 HIGH-PERFORMANCE BUTTERFLY VALVES

A. Class 150, Single-Flange, High-Performance Butterfly Valves:

1. Description:

a. Standard: ANSI Class 150 lugged design.

b. CWP Rating: 275 psig at 100 deg F.

c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange, double offset design.

d. Body Material: Carbon steel, or stainless steel.

e. Seat: Reinforced PTFE or metal.

f. Stem: Stainless steel; offset from seat plane, one piece stem.

g. Disc: Carbon steel.

h. Service: Bidirectional.

i. Packing: PTFE V-ring.

2.6 BRONZE LIFT CHECK VALVES

A. Class 150, Lift Check Valves with Bronze Disc:

1. Description:

a. Standard: MSS SP-80, Type 1.

b. CWP Rating: 250 psig (1380 kPa) wog.

c. Body Design: Vertical flow.

d. Body Material: ASTM B 61 or ASTM B 584, bronze.

e. Ends: Threaded.

f. Disc: Bronze.

2.7 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Horizontal Swing Check Valves with Bronze Disc:

1. Description:

a. Standard: MSS SP-80, Type 3.

b. CWP Rating: 200 psig.

c. Body Design: Horizontal flow.

d. Body Material: ASTM B 62, bronze.

e. Ends: Threaded.

f. Disc: Bronze.

B. Class 150, Bronze Swing Check Valves with Bronze Disc:

1. Description:

a. Standard: MSS SP-80, Type 3.

b. CWP Rating: 300 psig.

c. Body Design: Horizontal flow.

d. Body Material: ASTM B 62, bronze.

e. Ends: Threaded.

f. Disc: Bronze.

2.8 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

1. Description:

a. Standard: MSS SP-71, Type I.

b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.

c. NPS 14 to NPS 24, CWP Rating: 150 psig.

d. Body Design: Clear or full waterway.

e. Body Material: ASTM A 126, gray iron with bolted bonnet.

f. Ends: Flanged.

g. Trim: Bronze.

h. Gasket: Asbestos free.

B. Class 250, Iron Swing Check Valves with Metal Seats:

1. Description:

a. Standard: MSS SP-71, Type I.

b. NPS 2-1/2 to NPS 12, CWP Rating: 500 psig.

c. NPS 14 to NPS 24, CWP Rating: 300 psig.

d. Body Design: Clear or full waterway.

e. Body Material: ASTM A 126, gray iron with bolted bonnet.

f. Ends: Flanged.

g. Trim: Bronze.

h. Gasket: Asbestos free.

2.9 IRON, GROOVED-END SWING CHECK VALVES

A. 300 CWP, Iron, Grooved-End Swing Check Valves:

1. Description:

a. CWP Rating: 300 psig.

b. Body Material: ASTM A 536, ductile iron.

c. Seal: EPDM.

d. Disc: Spring operated, ductile iron or stainless steel.

2.10 BRONZE GATE VALVES

A. Class 125, RS Bronze Gate Valves:

1. Description:

a. Standard: MSS SP-80, Type 2.

b. CWP Rating: 200 psig (1380 kPa).

c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.

d. Ends: Threaded or solder joint.

e. Stem: Bronze.

f. Disc: Solid wedge; bronze.

g. Packing: Asbestos free.

h. Handwheel: Malleable iron.

B. Class 150, RS Bronze Gate Valves:

1. Description:

a. Standard: MSS SP-80, Type 2.

b. CWP Rating: 300 psig (2070 kPa).

c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.

d. Ends: Threaded.

e. Stem: Bronze.

f. Disc: Solid wedge; bronze.

g. Packing: Asbestos free.

h. Handwheel: Malleable iron

2.11 IRON GATE VALVES

A. Class 125, OS&Y, Iron Gate Valves:

1. Description:

a. Standard: MSS SP-70, Type I.

b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.

c. NPS 14 to NPS 24, CWP Rating: 150 psig.

d. Body Material: ASTM A 126, gray iron with bolted bonnet.

e. Ends: Flanged.

f. Trim: Bronze.

g. Disc: Solid wedge.

h. Packing and Gasket: Asbestos free.

B. Class 250, OS&Y, Iron Gate Valves:

1. Description

a. Standard: MSS SP-70, Type I.

b. NPS 2-1/2 to NPS 12, CWP Rating: 500 psig.

c. NPS 14 to NPS 24, CWP Rating: 300 psig.

d. Body Material: ASTM A 126, gray iron with bolted bonnet.

e. Ends: Flanged.

f. Trim: Bronze.

g. Disc: Solid wedge.

h. Packing and Gasket: Asbestos free.

2.12 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc:

1. Description

a. Standard: MSS SP-80, Type 1.

b. CWP Rating: 200 psig.

c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.

d. Ends: Threaded or solder joint.

e. Stem and Disc: Bronze.

f. Packing: Asbestos free.

g. Handwheel: Malleable iron.

2.13 IRON GLOBE VALVES

A. Class 125, Iron Globe Valves:

1. Description:

a. Standard: MSS SP-85, Type I.

b. CWP Rating: 200 psig.

c. Body Material: ASTM A 126, gray iron with bolted bonnet.

d. Ends: Flanged.

e. Trim: Bronze.

f. Packing and Gasket: Asbestos free.

B. Class 250, Iron Globe Valves:

1. Description:

a. Standard: MSS SP-85, Type I.

b. CWP Rating: 500 psig.

c. Body Material: ASTM A 126, gray iron with bolted bonnet.

d. Ends: Flanged.

e. Trim: Bronze.

f. Packing and Gasket: Asbestos free

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 INSTALLATION

A. General: Comply with the ICC IMC, ICC IPC.

1. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

2. Locate valves for easy access and provide separate support where necessary.

3. Install valves in horizontal piping with stem at or above center of pipe.

4. Install valves in position to allow full stem movement.

5. Install chainwheels on operators for butterfly valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.

6. Install check valves for proper direction of flow and as follows:

a. Swing Check Valves: In horizontal position with hinge pin level.

b. Lift Check Valves: With stem upright and plumb.

B. If valve applications are not indicated, use the following:

1. Shutoff Service:

a. NPS 2 and Smaller: Ball

b. NPS 2-1/2 and Larger: Butterfly

2. Dead-End Service: Single-flange (lug) type butterfly valves.

3. Throttling Service except Steam: Ball whenever allowable by size, and globe or butterfly if larger required.

4. Pump-Discharge Check Valves:

a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.

b. NPS 2-1/2 and Larger: Iron swing check valves with lever and weight or with spring or iron, center-guided, metal or resilient-seat check valves.

C. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

D. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solderjoint valve-end option is indicated in valve schedules below.

2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

3. For Copper Tubing, NPS 5 and Larger: Flanged ends.

4. For Steel Piping, NPS 2 and Smaller: Threaded ends.

5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

6. For Steel Piping, NPS 5 and Larger: Flanged ends.

7. For Grooved-End Copper Tubing and Steel Piping except Steam and Steam Condensate Piping: Valve ends may be grooved.

3.3 LOW TEMPERATURE COLD WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.

2. Ball Valves: Two piece, full port, bronze with stainless-steel trim.

3. Bronze Swing Check Valves: Class 150, bronze disc.

B. Pipe NPS 2-1/2 and Larger:

1. Iron, Grooved-End Butterfly Valves, NPS 2-1/2 to NPS 12: 175 CWP.

2. High-Performance Butterfly Valves: Class 300, single flange.

3. Iron Swing Check Valves: Class 250, metal seats.

4. Iron, Grooved-End Check Valves, NPS 3 to NPS 12: 300 CWP.

3.4 LOW TEMPERATURE HOT WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.

2. Ball Valves: Two piece, full port, bronze with stainless-steel trim.

3. Bronze Swing Check Valves: Class 150, bronze disc.

B. Pipe NPS 2-1/2 and Larger:

1. Iron, Grooved-End Butterfly Valves, NPS 2-1/2 to NPS 12: 175 CWP.

2. High-Performance Butterfly Valves: Class 300, single flange.

3. Iron Swing Check Valves: Class 250, metal seats.

4. Iron, Grooved-End Check Valves, NPS 3 to NPS 12: 300 CWP.

3.5 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

B. Install underground valves with valve boxes.

C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

D. Install earthquake valves aboveground outside buildings according to listing.

E. Install anode for metallic valves in underground PE piping.

3.6 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The General Provisions of the Contract, including General and Special Conditions and the requirements of Division 1, apply to the Work in this Section.

B. Equipment and all necessary accessories as designated in this section shall include the following.

1. Metal pipe hangers and supports.

2. Trapeze pipe hangers.

3. Metal framing systems.

4. Thermal-hanger shield inserts.

5. Fastener systems.

6. Pipe stands.

7. Equipment supports.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.3 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Hangers and Supports for mechanical and plumbing piping shall be in accordance with MSS Standards.

1. MSS SP-58 – Pipe Hangers and Supports – Materials, Design and Manufacturer

2. MSS SP-69 – Pipe Hangers and Supports – Selection and Application

3. MSS SP-89 – Pipe Hangers and Supports – Fabrication and Installation Practices

D. Hangers and Supports for fire protection piping shall be in accordance with NFPA Standards.

E. Provide products which are UL listed and FM approved.

1. NFPA 13 – Standard for the Installation of Sprinkler Systems.

1.4 STANDARD AND REGULATORY REQUIREMENTS

A. All materials, design, fabrication, assembly and test procedures shall be in accordance with the requirements of all applicable codes, standards or regulations having jurisdiction over the work.

B. Reference to any code, standard or regulation shall mean the latest published editions, including addenda, supplements and revisions thereto, which are in effect when the purchase order is awarded.

C. In the event of conflict between codes, standards or regulations, the conflict shall be referred to the Engineer for resolution.

D. The organizations having jurisdiction include, but are not limited to, the following:

1. ANSI American National Standards Institute

2. ASME American Society of Mechanical Engineers

3. ASTM American Society for Testing and Materials

4. AWS American Welding Society

5. AWWA American Water Works Association

6. MSS Manufacturers Standardization Society of the Valve and Fittings Industry

7. NFPA National Fire Protection Association.

8. OSHA Regulations of the Occupations Safety and Health Administration.

9. UL Underwriter's Laboratories Inc.

10. The state, county or municipal laws and regulations governing the location where the equipment is to be installed.

E. Equipment indicated within this specification section shall comply with all applicable national, state and local codes and regulations, including seismic and fire codes and regulations. Additional, more specific compliance requirements may be listed under individual equipment headings.

F. 'Buy America' Requirements: All manufactured products listed within this specification section are part of a federally assisted procurement involving funds granted by the Federal Transit Administration (FTA), and shall comply with Buy America requirements as delineated by Title 49 Code of Federal Regulations (CFR) Subsection 661.

1.5 SUBMITTALS

A. Design Data: Indicate pipe size. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Submit data on all materials, accessories and equipment.

B. Manufacturers Installation Instructions: Submit installation instructions for material and equipment.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

D. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

E. Shop Drawings - Submit in accordance with Division 1 -General Requirements of these specifications.

1. Submitted shop drawings shall be project specific and shall include a minimum 1/8 inch to 1 foot scaled (or larger standard architectural imperial scale), dimensioned, graphical representation of the size, orientation, and location for the submitted equipment. The drawings shall further include dimensions from structural elements or architectural grid lines, mounting requirements, and structural supports required for the submitted equipment.

2. Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

   a. Trapeze pipe hangers.

   b. Metal framing systems.

   c. Pipe stands.

   d. Equipment supports.

3. All Product Data submittals shall identify proposed project specific items marked by arrow, circle, underline, reproducible highlight, or other markings clearly discernable by the reviewer, to show which specific items, parts and accessories are being submitted for the project product data review. Non-marked or generic product data submittals with no marks indicating specific items, parts and accessories will be a cause for rejection.

4. Restrict submitted material to pertinent data. For instance, do not include manufacturer's complete catalog when pertinent information is contained on a single page.

F. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.

2. Design Calculations: Calculate requirements for designing trapeze hangers.

G. Operation and Maintenance Manual:

1. Provide a Complete parts list, operating instructions, and maintenance manual covering equipment at time of installation including, but not limited to:

   a. Description of system and components.

   b. Manufacturer's printed operating instructions.

   c. Printed listing of periodic preventive maintenance items and recommended frequency required to validate warranties. Failure to provide maintenance information will indicate that preventive maintenance is not a condition for validation of warranties.

d. List of original manufacturer's parts, including suppliers' part numbers and cuts, recommended spare parts stockage quantity and local parts and service source.

2. Assemble and provide copies of manual in 8-1/2 by 11 inch format. Foldout diagrams and illustrations are acceptable. Manual to be reproducible by dry copy method. Provide copies per provisions of Division 1 - General Requirements.

H. 'Buy America' Certificates: 'Buy America' certificates required during bidding shall also be required as part of each product submittal. Certificates shall be complete and accurate. Certificates shall indicate either compliance or non-compliance with the 'Buy America' regulations. Certificates of non-compliance shall also include copies of any granted waivers. Waivers still being applied for or being processed at the time of submittal shall be indicated as such.

1.6 WARRANTY

A. The Manufacturer shall warrant that all materials and equipment furnished under this contract will be new and of good quality, free from defects in design, workmanship, and materials.

B. Each item of equipment, or part thereof, proving to be defective within the specified period of the warranty shall be replaced, free of defect, without cost to the Owner.

C. The warranty period shall be the Manufacturer's standard warranty period, but not less than a minimum of twelve (12) months after startup, or 18 months after delivery of the equipment at the site (whichever comes first).

D. Warranty shall include materials and labor necessary to correct defects.

E. Defects shall include, but not be limited to noisy, rough, or substandard operation; loose, damaged, and missing parts; and abnormal deterioration of finish.

F. Submit warranties in accordance with Division 1 - General Requirements of these specifications.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers, subject to compliance with requirements of this specification, are as follows:

1. Supports, General

a. Anvil

b. Cooper B-Line, Inc.

c. Atkore Power-Strut.

d. Superstrut

e. Atkore Unistrut Corporation.

2. Metal Framing Systems

a. Allied Tube & Conduit.

b. Cooper B-Line, Inc.

c. Atkore Power-Strut.

d. Atkore Unistrut Corporation.

3. Thermal Hanger Shields Inserts

a. Carpenter & Paterson, Inc.

b. Clement Support Services.

c. National Pipe Hanger Corporation.

d. PHS Industries, Inc.

e. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.

f. Piping Technology & Products, Inc.

g. Rilco Manufacturing Co., Inc.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components, coated.

2. Galvanized Metallic Coating: Hot dip galvanized.

3. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel with either electro-plated zinc or hot dipped galvanized finish.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper, factory-fabricated components.

2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

C. Stainless Steel Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, stainless steel, factory-fabricated components.

2. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop or field-fabricated pipe-support assembly made from structural hot-dip galvanized, carbon-steel shapes with MSS SP-58 hot-dip galvanized or electro-coated zinc, carbon-steel hanger rods, nuts, saddles, and U-bolts. If used, they cannot impede serviceability of equipment.

B. See delegated design requirements in 1.4 above.

2.4 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.

2. Standard: MFMA-4.

3. Channels: Continuous slotted steel channel with in-turned lips.

4. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.

5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

6. Metallic Coating: Hot dip galvanized or electroplated zinc.

2.5 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.7 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.

2. Base: Stainless steel.

3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous thread rods.

4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.

2. Bases: One or more; plastic.

3. Vertical Members: Two or more protective-coated-steel channels.

4. Horizontal Member: Protective-coated-steel channel.

5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon steel shapes, with hot dip galvanized coating.

2.9 MISCELLANEOUS MATERIALS AND REQUIREMENTS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and hot dip galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Non-staining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi, 28-day compressive strength.

a. Hangers are required to be specific to pipe and ductwork independently and not shared.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers. Multiple, stacked trapezes are not allowed.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Supports and hangers shall not interfere with equipment access.

I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

J. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

K. Install lateral bracing with pipe hangers and supports to prevent swaying.

L. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, strainers, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

M. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

O. Insulated Piping:

1. Attach clamps and spacers to piping.

   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.

   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.

   c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight- distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight- distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

   b. NPS 4: 12 inches long and 0.06 inch thick.

   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.

   d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.

6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

7. Un-insulated Piping:

a. Where insulation is not required, use similar metal hangers such as copper hangers for copper piping, stainless steel for stainless steel piping, etc.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

5. Re-galvanize if galvanizing affected.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for

shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099100 "Painting"."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use coated carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

E. Use copper pipe hangers and copper attachments for copper piping and tubing. Likewise for stainless steel piping and tubing, use stainless steel hangers.

F. Use padded hangers for piping that is subject to scratching.

G. Use thermal-hanger shield inserts for insulated piping and tubing.

H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30.

2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.

3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.

4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.

5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.

6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of non-insulated, stationary pipes NPS 3/4 to NPS.

7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.

8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.

9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.

10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 8.

11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 3.

12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.

13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.

15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.

16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.

18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.

19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.

21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.

2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.

2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.

4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.

3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.

4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.

6. C-Clamps (MSS Type 23): For structural shapes.

7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.

8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.

9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.

10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.

11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.

12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.

    b. Medium (MSS Type 32): 1500 lb.

    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.

2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.

3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

M. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.

2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.

3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.

4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.

5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.

6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.

8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.

    b. Vertical (MSS Type 55): Mounted vertically.

    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

P. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.7 HANGER SUPPORT INSTALLATION

A. Hanger Spacing: Provide hangers at minimum spacing in accordance with Chapter 41, ASHRAE Guide and as follows:

1. Steel Pipe, Copper Tubing: For straight runs of horizontal piping with no concentrated loads such as valves, flanges, expansion joints, or other components. Sections of piping with concentrated loads will have to be considered carefully and a determination made as to appropriate spacing and rod size for the given situation.

Pipe Size	Max. Span Steel	Max. Span Copper	Rod Size
1" and smaller	7 feet	5 feet	3/8"
1-1/4" to 2"	8 feet	8 feet	3/8"
2-1/2" to 3"	11 feet	9 feet	1/2"
4" to 5"	14 feet	10 feet	1/2"
6"	17 feet	12 feet	5/8"
8"	19 feet	14 feet	7/8"
10"	20 feet	N/A	7/8"
12"	20 feet	N/A	7/8"
14"	20 feet	N/A	1"
16"	20 feet	N/A	1"
18"	20 feet	N/A	1 1/4"
20"	20 feet	N/A	1 1/4"
24"	20 feet	N/A	1 1/2"

B. Install seismic restraints on piping as required.

END OF SECTION

SECTION 23 11 23

FACILITY NATURAL GAS PIPING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The General Provisions of the Contract, including General and Special Conditions and the requirements of Division 1, apply to the Work in this Section.

B. Fuel gas systems, including piping, equipment and all necessary accessories as designated in this section shall include the following.

1. Natural gas piping buried.

2. Natural gas piping above grade.

3. Unions and flanges.

4. Strainers.

5. Natural gas pressure regulators.

6. Natural gas pressure relief valves.

7. Underground pipe markers.

8. Bedding and cover materials.

1.2 QUALITY ASSURANCE

A. Manufacturer's Representative:

1. Installation: Provide a qualified manufacturer's representative at site to supervise work related to equipment installation, check out and start up.

B. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

D. Pipe Fusion Qualifications: Qualify procedures according to ASTM

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.3 STANDARD AND REGULATORY REQUIREMENTS

A. All materials, design, fabrication, assembly and test procedures shall be in accordance with the requirements of all applicable codes, standards or regulations having jurisdiction over the work.

B. Reference to any code, standard or regulation shall mean the latest published editions, including addenda, supplements and revisions thereto, which are in effect when the purchase order is awarded.

C. In the event of conflict between codes, standards or regulations, the conflict shall be referred to the Engineer for resolution.

D. The organizations having jurisdiction include, but are not limited to, the following:

1. AGA American Gas Association

2. ANSI American National Standards Institute

3. ASME American Society of Mechanical Engineers

4. ASTM American Society for Testing and Materials

5. AWS American Welding Society

6. AWWA American Water Works Association

7. MSS Manufacturers Standardization Society of the Valve and Fittings Industry

8. NFPA National Fire Protection Association.

9. OSHA Regulations of the Occupations Safety and Health Administration.

10. UL Underwriter's Laboratories Inc.

11. The state, county or municipal laws and regulations governing the location where the equipment is to be installed.

E. Equipment indicated within this specification section shall comply with all applicable national, state and local codes and regulations, including seismic and fire codes and regulations. Additional, more specific compliance requirements may be listed under individual equipment headings

F. ‘Buy America’ Requirements: All manufactured products listed within this specification section are part of a federally assisted procurement involving funds granted by the Federal Transit Administration (FTA), and shall comply with Buy America requirements as delineated by Title 49 Code of Federal Regulations (CFR) Subsection 661.

1.4 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, provide compatible system components and joints.

B. Provide flanges, unions, or couplings at locations requiring servicing. Use unions, flanges, or couplings downstream of valves and at equipment connections. Do not use direct welded connections to valves, equipment.

C. Provide pipe hangers and supports in accordance with other sections.

D. Use plug, ball, or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.

1.5 SUBMITTALS

A. Design Data: Indicate pipe size. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Submit data on all materials, fittings, accessories and equipment.

B. Manufacturers Installation Instructions: Submit installation instructions for material and equipment.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

D. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

E. Shop Drawings - Submit in accordance with Division 1 -General Requirements of these specifications.

1. Submitted shop drawings shall be project specific and shall include a minimum 1/8 inch to 1 foot scaled (or larger standard architectural imperial scale), dimensioned, graphical representation of the size, orientation, and location for the submitted equipment. The drawings shall further include dimensions from structural elements or architectural grid lines, operational clearances, locations of any utility service connection points, mounting requirements, and structural supports required for the submitted equipment.

2. Provide product data for each type of the following:

a. Piping.

b. Fittings.

c. Joints.

d. Piping specialties.

e. Corrugated, stainless-steel tubing with associated components.

f. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.

g. Pressure regulators. Indicate pressure ratings and capacities.

h. Service meters including supports.

i. Mechanical sleeve seals.

j. Escutcheons.

k. Supports.

l. Remote meter reading accessories.

m. Seismic gas shut off valves.

3. All Product Data submittals shall identify proposed project specific items marked by arrow, circle, underline, reproducible highlight, or other markings clearly discernable by the reviewer, to show which specific items, parts and accessories are being submitted for the project product data review. Non-marked or generic product data submittals with no marks indicating specific items, parts and accessories will be a cause for rejection.

4. Restrict submitted material to pertinent data. For instance, do not include manufacturer's complete catalog when pertinent information is contained on a single page.

F. Seismic-Design Submittal: Provide for natural-gas piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of seismic restraints.

2. Design Calculations: Calculate requirements for selecting seismic restraints.

G. Operation and Maintenance Manual:

1. Provide a Complete parts list, operating instructions, and maintenance manual covering equipment at time of installation including, but not limited to:

a. Description of system and components.

b. Manufacturer's printed operating instructions.

c. Printed listing of periodic preventive maintenance items and recommended frequency required to validate warranties. Failure to provide maintenance information will indicate that preventive maintenance is not a condition for validation of warranties.

d. List of original manufacturer's parts, including suppliers' part numbers and cuts, recommended spare parts stockage quantity and local parts and service source.

2. Assemble and provide copies of manual in 8-1/2 by 11 inch format. Foldout diagrams and illustrations are acceptable. Manual to be reproducible by dry copy method. Provide copies per provisions of Division 1 - General Requirements.

H. ’Buy America’ Certificates: ‘Buy America’ certificates required during bidding shall also be required as part of each product submittal. Certificates shall be complete and accurate. Certificates shall indicate either compliance or non-compliance with the ‘Buy America’ regulations. Certificates of non-compliance shall also include copies of any granted waivers. Waivers still being applied for or being processed at the time of submittal shall be indicated as such.

1.6 WARRANTY

A. The Manufacturer shall warrant that all materials and equipment furnished under this contract will be new and of good quality, free from defects in design, workmanship, and materials.

B. Each item of equipment, or part thereof, proving to be defective within the specified period of the warranty shall be replaced, free of defect, without cost to the Owner.

C. The warranty period shall be the Manufacturer's standard warranty period, but not less than a minimum of twelve (12) months after startup, or 18 months after delivery of the equipment at the site (whichever comes first).

D. Warranty shall include materials and labor necessary to correct defects.

E. Defects shall include, but not be limited to noisy, rough, or substandard operation; loose, damaged, and missing parts; and abnormal deterioration of finish.

F. Submit warranties in accordance with Division 1 - General Requirements of these specifications.

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating and protect from direct sunlight.

D. Protect stored PE pipes and valves from direct sunlight.

1.8 LABELING

A. Manufacturer shall securely attach in a prominent location on each major item of equipment a non-corrosive nameplate showing manufacturer's name, address, model number, serial number, and pertinent utility or operating data.

B. All electrical equipment and materials shall be new and shall be listed by Underwriter's Laboratories, Inc. (U.L.), or other National Recognized Testing Laboratory (NRTL), in categories for which standards have been set by that agency and labeled as such in the manufacturer's plant.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers, subject to compliance with requirements of this specification, are as follows:

1. Strainers

a. Mueller Steam Specialty.

b. O.C. Keckley Company.

c. Spirax Sarco, Inc.

2. Natural Gas Pressure Regulators

a. Emerson Fisher.

b. Sensus Equimeter.

c. American Meter.

d. Maxitrol.

3. Natural Gas Relief Valves

a. Emerson Fisher.

b. American Meter.

c. Or Approved Equal

4. Dielectric Unions

a. Capitol Manufacturing Company.

b. Central Plastics Company.

c. Hart Industries International, Inc.

d. McDonald, A. Y. Mfg. Co.

e. Watts Regulator Co.; Division of Watts Water Technologies, Inc.

f. Wilkins; Zurn Plumbing Products Group.

5. Dielectric Flange Kits

a. Advance Products & Systems, Inc.

b. Calpico Inc.

c. Central Plastics Company.

d. Pipeline Seal and Insulator, Inc.

e. Or approved equal.

6. Main Shut-off Valves

a. Nordstrom.

b. Fisher

c. Dresser Industries Inc.

d. Walworth Company

e. Grinnel

7. Ball Valves

a. Apollo.

b. Contromatics.

c. Conbraco

d. NIBCO

8. Bronze Plug Valves
    a. Hammond.
    b. Lee Brass Company.
    c. McDonald.
    d. NIBCO.
9. Cast Iron Non-Lubricated Plug Valves
    a. McDonald.
    b. Mueller Co.
    c. Xomox Corporation.
10. Cast Iron Lubricated Plug Valves
    a. Nordstrom.
    b. Fisher
    c. Dresser Industries Inc.
    d. Walworth Company
11. Earthquake Valves
    a. Pacific Seismic Products, Inc.
    b. Quake Defense, Inc.
    c. Strand Earthquake.
12. Gas Safety Shut-off Valves
    a. Maxon Corporation.
    b. Or Approved Equal.

2.2 NATURAL GAS PIPING, BURIED

A. Pipe: Black steel, ASTM A53/A53M, Schedule 40. Shop-applied pipe coating shall be one of the following types:

1. Coal Tar Enamel Coating: Exterior of pipe and fittings shall be cleaned, primed with Type B primer and coated with hot-applied coal tar enamel with bonded layer of felt wrap in accordance with AWWA C203. Asbestos felt

shall not be used; felt material shall be fibrous glass mat in accordance with AWWA C203.

B. Holiday Inspections: Procedure for holiday inspection: Holiday Inspection shall be conducted on all coatings to determine the presence and number of discontinuities in those coatings using an applicable NACE standard such as SP0274 or SP0490 in the case thermosetting epoxy coating. Holiday Detectors shall be calibrated and supplied with a certificate of calibration from the factory. A calibration of the Holiday Detector shall be performed once every 6 months to verify output voltages are true and correct.

C. Steel Fittings:

1. Butt weld fittings, wrought steel, ASME B16.9.

2. Socket weld and threaded fittings forged steel, ASME B16.11.

3. Grooved End: Ductile iron (ASTM A536, Grade 65-45-12), malleable iron (ASTM A47/A47M, Grade 32510), or steel (ASTM A53/A53M, Type F or Type E or S, Grade B).

D. Steel Joints: Welded, ASME B31.8.

E. Thermoplastic (Polyethylene PE): PE pipe and heat fusion fittings shall conform to ASTM D2513, SDR 11 and manufactured for 125 psig working pressure. Pipe and fittings shall have heat fusion joints PE pipe and fitting materials for heat fusion shall be compatible to ensure uniform melting and a proper bond.

F. Fittings:

1. Socket Fusion Fittings: ASTM D2683.

2. Butt Fusion Fittings: ASTM D3261, molded and matching pipe dimensions.

G. Risers: Manufacturer's standard anodeless type riser, transition from plastic to steel pipe with fusion bonded epoxy coating. Inlet connection socket or butt weld or swaged gas tight construction with O ring seals, metal insert, and protective sleeve. Outlet or above ground connection end shall be threaded or flanged. Riser shall comply with ASTM A53/A53M, Type F and E, Grade A, Schedule 40.

H. Polyethylene ball valves, ASME B16.40 shall be manufactured and rated for underground gas service. Operating pressure to 125 psig. Valve shall be maintenance and corrosion free. Polyethylene valves shall be full port opening type. Valves shall be wrench operated. Wrench operated valves shall have a 2 inch square adaptor securely fastened to the valve stem. Polyethylene valves shall be installed by butt fusion method.

2.3 NATURAL GAS PIPING, ABOVE GRADE

A. Pipe: Black steel, ASTM A53/A53M, Schedule 40.

B. Nipples: Steel, ASTM A733, Schedule 40.

C. Fittings:

1. 2 inch under ASME B16.3 threaded malleable iron.

2. 2 inch and up to 4 inch ASME B16.11 socket welded.

3. 4 inch ASME B16.9 butt welded.

D. Joints: Provide welded or threaded joints.

E. Threaded Metallic Joints: Threaded joints in metallic pipe shall have tapered threads evenly cut. Metal screwed pipe joints shall be made leak-tight by applying pipe thread sealant to all threaded joints. Care must be taken to prevent the pipe dope compound from getting inside the internal pipeline. Teflon tape type sealant is prohibited.

2.4 PIPING

A. Inside steel piping:

1. For low pressure 0.5 psig or less use standard weight black steel pipe with 150 psig threaded malleable iron fittings for piping 4 in. and smaller.

2. For pressure above 5 psig, all piping shall be welded.

B. Underground piping:

1. Steel pipe with Dresser type and steel welding fittings. Pre-wrap with Mill-wrapped corrosion protection extruded polyolefin coating in accordance with Gas Company requirements, equal to Energy Coating Co. or PlexCo.

2. High density polyethylene pipe and fittings in accordance with ASTM D-2513, Grades 2306, 3306, and 3408 with fusion joints only, equal to Driscopipe 8100-DRII Series.

C. Underground drips shall be AGA and local gas company approved and shall be cast iron or tar coated welded steel pots with adjustable tar coated cast iron extension shaft and flush box with lock type extra heavy cast iron cover marked GAS DRIP.

D. In no case shall any gas pipe be less than ¾ inch.

2.5 REGULATOR VENT PIPING, ABOVE GRADE

A. Indoors: Same as natural gas piping, above grade.

B. Outdoors: PVC pipe, tubing, and fittings, UL 651.

2.6 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:

1. Ferrous Piping: Class 150, malleable iron, threaded.

2. Copper Piping: Class 150, bronze unions with soldered brazed joints.

B. Flanges for Pipe 2-1/2 inches and Larger:

1. Ferrous Piping: Class 150, forged steel, slip-on flanges.

2. Copper Piping: Class 150, slip-on bronze flanges.

3. Gaskets: 1/16 inch thick preformed neoprene gaskets.

2.7 STRAINERS

A. 2 inch and Smaller: Screwed brass or iron body for 175 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

B. 2-1/2 inch to 4 inch: Flanged iron body for 175 psig working pressure, Y pattern with 3/64 inch stainless steel perforated screen.

C. 5 inch and Larger: Flanged iron body for 175 psig working pressure, basket pattern with 1/8 inch stainless steel perforated screen.

2.8 NATURAL GAS PRESSURE REGULATORS

A. Product Description: Spring loaded, general purpose, self-operating service regulator including internal relief type diaphragm assembly and vent valve. Diaphragm case can be rotated 360 degrees in relation to body.

1. Comply with ANSI Z21.80.

2. Temperatures: minus 20 degrees F to 150 degrees F.

3. Body: Cast iron with neoprene gasket.

4. Spring case, lower diaphragm casing, union ring, seat ring and disk holder: Aluminum.

5. Disk, diaphragm, and O-ring: Nitrile.

6. Minimum Inlet Pressure: 5 psi.

7. Furnish sizes 2 inches and smaller with threaded ends. Furnish sizes 2-1/2 inches and larger with flanged ends.

B. Service Pressure Regulators: Comply with ANSI Z21.80.

1. Body and Diaphragm Case: Cast iron or die-cast aluminum.

2. Springs: Zinc-plated steel; interchangeable.

3. Diaphragm Plate: Zinc-plated steel.

4. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.

5. Orifice: Aluminum; interchangeable.

6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.

7. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.

8. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.

9. Overpressure Protection Device: Factory mounted on pressure regulator.

10. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.

11. Maximum Inlet Pressure: 60 psig.

2.9 NATURAL GAS PRESSURE RELIEF VALVES

A. Product Description: Spring loaded type relief valve.

1. Body: Aluminum.

2. Diaphragm: Nitrile.

3. Orifice: Stainless steel.

4. Maximum operating temperature: 150 degrees F.

5. Inlet Connections: Threaded.

6. Outlet or Vent Connection: Same size as inlet connection.

2.10 UNDERGROUND LABELING

A. Detectable Warning Tape: Acid and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with

metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

2.11 DIELECTRIC FITTINGS

A. Provide dielectric couplings or unions between ferrous and non-ferrous pipe.

B. Dielectric Unions:

1. Minimum Operating-Pressure Rating: 150 psig.

2. Combination fitting of copper alloy and ferrous materials.

3. Insulating materials suitable for natural gas.

4. Combination fitting of copper alloy and ferrous materials with threaded, brazed joint, plain, or welded end connections that match piping system materials.

C. Dielectric-Flange Kits:

1. Minimum Operating-Pressure Rating: 150 psig.

2. Companion-flange assembly for field assembly.

3. Include flanges, full-face or ring-type neoprene or phenolic gasket, phenolic or PE bolt sleeves, phenolic washers, and steel backing washers.

4. Insulating materials suitable for natural gas.

5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

2.12 GAS VENT TERMINALS

A. ¾ in. and one (1) in. aluminum threaded vent terminal with 16 x 16 mesh 0.018 gauge stainless steel screen.

B. 1¼ in. to 4 in. standard pipe threaded elbow with 12 x 12 mesh stainless steel screen.

1. Equal to Upsco Inc.

C. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.

2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.

3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.

4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

   a. Material Group: 1.1.

   b. End Connections: Threaded or butt welding to match pipe.

   c. Lapped Face: Not permitted underground.

   d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.

   e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.

5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.

   a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

2.13 VALVES

A. Manual Shut-off Valves Inside Building.

1. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

   a. CWP Rating: 125 psig.

   b. Threaded Ends: Comply with ASME B1.20.1.

   c. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.

   d. Tamperproof Feature: Locking feature for valves where required by the SDG&E.

   e. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.

   f. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

g. Threaded cast iron body, 125 PSIG WOG.

2. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.

a. CWP Rating: 125 psig.

b. Flanged Ends: Comply with ASME B16.5 for steel flanges.

c. Tamperproof Feature: Locking feature for valves where required by Con. Ed.

d. Service Mark: Initials "WOG" shall be permanently marked on valve body.

e. 2½ in. to 4-in.: Flanged cast iron body lubricated tapered plug type, 175 psig WOG.

f. 6 in. and larger: Flanged cast iron body lubricated tapered plug type, 200 psig WOG, worm gear operated.

3. Provide 2 wrenches for each size used.

a. Attach wrench to each valve.

B. Ball Valves

1. On local branches three inches and smaller, provide threaded three piece full port wafer-type ball valve with bronze body, ball stem, Teflon seats, and level handles, 300 psig WOG.

C. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. 2 inch and smaller: Threaded brass ball valves with full port TFE sears and blowout proof stem, 600 psig WOG.

2. Body: Bronze, complying with ASTM B 584.

3. Ball: Chrome-plated bronze.

4. Stem: Bronze; blowout proof.

5. Seats: Reinforced TFE; blowout proof.

6. Packing: Threaded-body packnut design with adjustable-stem packing.

7. Ends: Threaded, flared, or socket.

8. CWP Rating: 600 psig.

9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.

10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

D. Bronze Plug Valves: MSS SP-78.

1. Body: Bronze, complying with ASTM B 584.

2. Plug: Bronze.

3. Ends: Threaded, socket, or flanged.

4. Operator: Square head or lug type with tamperproof feature where indicated.

5. Pressure Class: 125 psig.

6. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.

7. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Cast-Iron, Non-lubricated Plug Valves: MSS SP-78.

1. Body: Cast iron, complying with ASTM A126, Class B.

2. Plug: Bronze or nickel-plated cast iron.

3. Seat: Coated with thermoplastic.

4. Stem Seal: Compatible with natural gas.

5. Ends: Threaded or flanged as indicated.

6. Operator: Square head or lug type with tamperproof feature where indicated.

7. Pressure Class: 125 psig.

8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.

9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. Cast Lubricated Plug Valves Inside Building:

1. 2-inch and smaller: Cast iron body, threaded, equal to Nordstrom Valves, Inc. Figure 114.

2. 2½ inch to 4-inch: Flanged cast iron body lubricated tapered plug type, 175 psig WOG, equal to Nordstrom Valves, Inc. Figure 115.

3. 6 inch and larger: Flanged cast iron body lubricated tapered plug type, 200 psig WOG, worm gear operated, equal to Nordstrom Valves, Inc. Figure 165.

4. Valves 2 ½ inch and larger shall be flanged.

5. Provide 2 wrenches for each size used.

6. Attach wrench to each valve.

7. Gas Cocks:

   a. Gas cocks shall be for use only as manual gas shut-off valves at each piece of gas burning equipment; shall be of the plug type, bronze construction with check, nut and washer bottom and tee handle.

   b. Gas cocks shall be Figure 10596 as manufactured by A.Y. McDonald Mfg. Co., or Series 52 as manufactured by Conbraco Industries, Inc.

   c. Gas cocks shall only be used on piping 1 inch and smaller.

G. Valves Underground (Curb Type)

1. Provide welding end steel body tapered lubricated plug type with iron plug high head extension.

   a. 2 inch to 4 inch: 200 psig WOG, equal to Nordstrom No. 1943.

   b. 6 inch and larger: 275 psig WOG, equal to Nordstrom No. 4185.

2. Provide with adjustable tar coated cast iron extension shaft and flush box with lock type extra heavy cast iron cover marked GAS. Provide two operating wrenches.

H. Valve Boxes:

1. Cast-iron, two-section box. Each cast iron box shall be given a heavy coat of bituminous paint.

2. Top section with cover with "GAS" lettering.

3. A metal tag or label shall be installed on top or inside of each valve box lid. The tag shall designate the appropriate location number, valve size, and other pertinent information.

4. Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.

5. Adjustable cast-iron extensions of length required for depth of bury.

6. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.14 EARTHQUAKE VALVES

A. Earthquake Valves: Comply with ASCE 25.

1. Listing: Listed and labeled by the an NRTL acceptable to authorities having jurisdiction.

2. Maximum Operating Pressure: 60 psi.

3. Cast-aluminum body with stainless-steel internal parts.

4. Nitrile-rubber, reset-stem o-ring seal.

5. Valve position, open or closed, indicator.

6. Composition valve seat with clapper held by spring or magnet locking mechanism.

7. Level indicator.

8. End Connections: Threaded for valves NPS 2 inches and smaller; flanged for valves NPS 2-1/2 inches and larger.

2.15 GAS SAFETY SHUTOFF VALVES

A. Gas safety shut-off valves shall be FM & UL listed, electric motor operated, normally closed, manual reset type. Valves shall be rising stem design with a straight through flow path with metal-to-metal seat and disc arrangement. The valve seat shall be stainless steel and the disc ductile iron. Valves shall be provided with a NEMA 4 enclosure modified for Class I, Division II hazardous locations, be provided with an electrical terminal block and shall operate on 120 V AC., 60 Cycles, single phase. Valves shall meet ANSI Class VI leakage standard and shall be provided with a visual indicator to note the position of the valve whether "OPEN" or "SHUT".

B. Gas safety shut-off valves 2 inches and smaller shall be threaded, 2 1/2 inches and larger shall be flanged. Flanged valves shall be provided with companion flange set by valve manufacturer.

C. Gas safety shut-off valves shall be installed in the following locations:

1. On the firm gas line downstream of its meter and before any branch take-offs.

D. Gas safety shut-off valves shall be wired to the gas leak detection system and shall function to shut off all gas supply to the building upon:

1. Action of the gas leak detection system (alarm condition), and,

2. Loss of normal electrical power.

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect delivered equipment for damage from shipping and exposure to weather. Compare delivered equipment with packing lists and specifications to assure receipt of all items.

3.2 INSTALLATION

A. General: Comply with the ICC IFGC, ICC IPC and the following:

1. Install branch piping for fuel gas and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.

2. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, shall be reamed to full size after cutting.

3. All pipe runs shall be laid out to avoid interference with other work.

4. Install valves with stem in horizontal position whenever possible. All valves shall be easily accessible.

5. Install union and shut-off valve on pressure piping at connections to equipment.

6. Pipe Hangers, Supports and Accessories:

a. All piping shall be supported per the ICC IFGC.

b. Shop Painting and Plating: Hangers, supports, rods, inserts and accessories used for Pipe supports shall be shop coated with red lead or zinc Chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.

c. Floor, Wall and Ceiling Plates, Supports, Hangers:

1) Solid or split unplated cast iron, chrome plated in finished areas.

2) All plates shall be provided with set screws.

3) Pipe Hangers: Height adjustable clevis type.

4) Adjustable Floor Rests and Base Flanges: Steel.

5) Concrete Inserts: "Universal" or continuous slotted type.

6) Hanger Rods: Mild, low carbon steel, fully threaded or Threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.

7) Riser Clamps: Malleable iron or steel.

8) Rollers: Cast iron.

9) Self-drilling type expansion shields shall be "Phillips" type, with case hardened steel expander plugs.

10) Miscellaneous Materials: As specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories.

7. Install cast chrome plated escutcheon with set screw at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.

8. Penetrations:

a. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING. Completely fill and seal clearances between piping and openings with the fire stopping materials.

b. Waterproofing: At floor penetrations, completely seal clearances around the pipe and make watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS.

B. Fuel gas piping shall conform to the following:

1. Entire fuel gas piping installation shall be in accordance with requirements of NFPA 54.

2. Provide fuel gas piping with plugged drip pockets at low points.

3. Seismic Data: Refer to Division 13 and Contract Drawings. Install automatic shutoff valve (earthquake valve) on discharge side of meter. Valve shall positively shut off supply of gas in case of pressure failure, remain shut off until manually reopened, and be provided with outside adjustment for reset.

C. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government

D. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

E. Remove scale and dirt, on inside and outside, before assembly.

F. Prepare piping connections to equipment with flanges or unions.

G. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

H. Field verify that connection to existing piping systems sizes, locations, and invert are as required.

I. Establish elevations of buried piping with not less than allowed per code.

J. Establish minimum separation of from other piping services in accordance with code.

3.3 NATURAL GAS SYSTEM INSTALLATION

A. Install piping free from traps and with drain pocket consisting of nipple and cap at low points for inside building and drip pot for underground piping.

B. Install shut-off valves at connection to each piece of equipment. Provide union or right and left nipple and coupling at equipment side of individual shut-off valve.

C. Install strainers on high pressure side of pressure reducing valves, on inlet side of indicating and control instruments and equipment subject to sediment damage and where shown on drawings. Strainer element shall be removable without disconnection of piping.

D. Install gas meter in a well ventilated and accessible location. Gas meter room (3 hr. rated enclosure) with explosion-proof fixtures.

E. Threaded Joints:

1. Make-up joints with U.L. listed gas resistant Teflon tape or Teflon paste, suited for gas piping.

F. Provide a two elbow-swing on all branches taken from a riser.

G. Provide valve tags for piping systems indicating the operating system pressure.

H. Color code piping at different pressures within the gas meter room. Paint fifteen (15) to five (5) psi system brown and reduced pressure piping yellow.

I. Welders must be qualified in accordance with either API 1104 or ASME IX Boiler and Pressure Vessel Code and as required by local code.

J. Provide sign on the exterior of the gas meter door shall be provided with bold lettering at least 1 in. high and properly spaced with lettering and background in contrasting colors reading “Gas Meter Room - No Storage Permitted.”

K. Support horizontal gas piping as follows:

1. ½ in. - 6 ft. on center.

2. ¾ in. or 1 in. - 8 ft. on center.

3. 1¼ in. or larger - 10 ft. on center.

4. Vertical piping at every floor.

L. Provide remote meter reading communication wiring to connect to building automation system. Wire gauge per manufacturer recommendation for distance required.

3.4 PIPING INSTALLATION, OUTDOOR

A. Comply with NFPA 54 Fuel Gas Code for installation and purging of natural-gas piping.

B. Install underground, natural-gas piping buried at least 22 inches below finished grade as required.

1. If natural-gas piping is installed less than 72 inches below finished grade, install it in ductile iron pipe containment conduit.

2. Coordinate with site paving contractor for finished grade location.

3. Protect exterior underground pipe from damage due to heavy equipment traffic during construction.

C. Install underground, PE, natural-gas piping according to ASTM D2774.

3.5 PIPING INSTALLATION, INDOOR

A. Comply with NFPA 54 Fuel Gas Code for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

1. Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.

b. Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.

c. Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.

d. Piping in Unfinished Service Spaces: One-piece, stamped-steel type with set screw.

e. Piping in Equipment Rooms: One-piece, cast-brass type.

f. Piping in Equipment Rooms: One-piece, stamped-steel type with set screw.

g. Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

H. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials as required.

I. Verify final equipment locations for roughing-in.

J. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

K. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

L. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

M. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

N. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.

1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.

2. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.

a. Exception: Tubing passing horizontally through partitions or walls does not require striker barriers.

3. Prohibited Locations:

a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or ventilating ducts, or dumbwaiter or elevator shafts.

b. Do not install natural-gas piping embedded in concrete walls or partitions.

O. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

P. Connect branch piping from top or side of horizontal piping.

Q. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

R. Do not use natural-gas piping as grounding electrode.

S. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

T. Install pressure gauge upstream and downstream from each line regulator as required.

3.6 UTILITY SERVICE METER INSTALLATION

A. Install service-meter assemblies aboveground, on concrete bases.

B. Install metal shutoff valves upstream from service regulators.

C. Install strainer on inlet of service-pressure regulator and meter set.

D. Install service regulators mounted outside with vent outlet horizontal or facing down. Install screen in vent outlet if not integral with service regulator.

E. Install metal shutoff valves upstream from service meters.

F. Install service meters downstream from pressure regulators.

G. Install metal bollards to protect meter assemblies as required.

H. Install meters on full size gas headers.

3.7 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

B. Install underground valves with valve boxes.

C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

D. Install earthquake valves aboveground outside buildings according to listing.

E. Install anode for metallic valves in underground PE piping.

3.8 HANGER & SUPPORT INSTALLATION

A. Install seismic restraints on piping as required.

B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.

2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.

3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.

4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.

5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

C. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:

1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.

2. NPS 1/2: Maximum span, 72 inches; minimum rod size, 3/8 inch.

3. NPS 3/4 and Larger: Maximum span, 96 inches; minimum rod size, 3/8 inch

3.9 IDENTIFICATION

A. Identify new natural gas piping systems in accordance with requirements for CSA-B149.1.

B. Above ground natural gas piping to be primed and painted yellow along its entire length. All below ground propane piping to be covered with plastic yellow identification marker tape suitable for direct burial.

C. Supply and install "Natural Gas" pipe identification markers along length of natural gas piping installation in accordance with CSA-B149.1 and Section 23 05 53 01 - Mechanical Identification. Maximum spacing along straight length of pipe to be 20 feet.

D. Maintain minimum depth of burial of underground natural gas piping of 24 inches, unless otherwise noted.

3.10 TESTING

A. General: Test system either in its entirety or in sections after system is installed or cleaned.

B. Test shall be made in accordance with the International Fuel Gas Code. The system shall be tested at a minimum of 1.5 times maximum working pressure, but not less than 3 psig.

C. Comply with requirements of the local Authority Having Jurisdiction and the California Fuel Gas Code.

D. Minimum test pressure shall be 10 psi and test shall show no drop in pressure. Test duration shall not be less than 30 minutes in duration.

E. Record test pressure over the duration of the test with an automatic recording/printing gauge.

F. System Purging: After completing pressure tests, and before testing a gas-contaminated line, purge line with nitrogen at junction with main line to remove all air and gas. Clear completed line by attaching a test pilot fixture at capped stub-in line at building location and let gas flow until test pilot ignites. Procedures shall conform to NFPA 54 and ASME B31.8.

3.11 CLEANING

A. Clean all piping systems to remove all dirt, coatings and debris. Remove all valves, controls etc., and reinstall after piping system has been cleaned.

END OF SECTION

SECTION 26 05 05

GENERAL PROVISIONS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall provide all labor, materials, equipment, and incidentals shown, specified, and required to complete the electrical Work.

2. Contractor shall be responsible for all electrical demolition.

3. Common electrical installation requirements

B. Coordination:

1. Review installation procedures and schedules under other Specification Sections and coordinate with other trades the installation of electrical items that will be installed with or within formwork, walls, partitions, ceilings, panels, and site work.

2. Coordinate arrangement, mounting, and support of electrical equipment:

a. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.

b. To provide for ease of disconnecting the equipment with minimum interference to other installations.

c. To allow right of way for piping and conduit installed at required slope.

d. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

3. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

4. Coordination and Intent of Electrical Drawings:

a. Dimensions on Drawings related to equipment are based on equipment of certain manufacturers. Verify the dimensions of equipment furnished to space available at the Site and allocated to the equipment.

b. Drawings show the principal elements of the electrical Work, and are not intended as detailed working drawings for the electrical Work. Drawings supplement and complement the Specifications and other Contract Documents relative to principal features of electrical systems.

c. Equipment and devices provided under this Contract shall be properly connected and interconnected with other equipment and devices for successful operation of complete systems, whether or not all connections and interconnections are specifically mentioned or shown in the Contract Documents.

d. Drawings are provided for Contractor's guidance in fulfilling the intent of the Contract Documents. Contractor shall comply with Laws and Regulations, including safety and electrical codes, and provide materials, equipment, appurtenances, and specialty items necessary for complete and operable systems.

5. Obtain from Owner record drawings required to execute the Work.

6. Field Coordination:

a. Provide materials, equipment, and services to interface with existing circuits. Field-verify system and equipment requirements prior to modifying existing systems.

b. Coordinate the interface of equipment with field condition and Engineer.

c. Field-compare existing starter and panel control circuit terminations from record documents with existing circuits.

d. Field-trace existing circuits as required to interface the equipment provided.

e. Field-identify terminations for starters and panel controls for follow function for re-connection.

C. Area Classifications:

1. Materials, equipment, and incidentals shall be suitable for the area classification(s) shown, specified, and required.

2. Wet Locations: Comply with NEC and NEMA requirements for wet locations. Enclosures in wet locations shall be stainless steel and comply with NEMA 4X unless specified otherwise.

3. Corrosive Locations: Comply with NEC and NEMA requirements for corrosive locations. Enclosures in corrosive locations shall be stainless steel and conform to NEMA 4X requirements unless specified otherwise.

4. Hazardous Locations: Comply with NEC requirements for the Class and Division designated.

5. Dusty Locations: Indoor areas not designated as hazardous, corrosive, or wet are dusty locations. Comply with NEC and NEMA 12 requirements unless specified otherwise.

1.2 QUALITY ASSURANCE

A. Qualifications:

1. Electrical Subcontractor:

a. Electrical Subcontractor shall possess a valid electricians' and contractors' license in the jurisdiction where the Site is located.

b. If requested by Engineer, submit the following information for not less than three successful, completed projects: project name and location; year completed; name and contact information for: prime Contractor for whom electrical Subcontractor worked, project Owner, and project Engineer or architect, including addresses and telephone numbers.

2. Wiring Coordination:

a. Contractor shall be responsible for preparing complete point-to-point interconnection wiring diagrams. Diagrams shall identify all external interconnecting wiring associated with new or modified existing equipment.

b. Develop diagrams for performing the Work and to document terminations. Prepare diagrams in accordance with this Section and the example wiring diagram accepted by Engineer

B. Component Supply and Compatibility:

1. Materials and equipment similar to each other shall be from the same manufacturer for uniformity.

2. 'Buy America' Requirements: All manufactured products listed within the electrical specifications are part of a federally assisted procurement involving funds granted by the Federal Transit Administration (FTA),and shall comply with Buy America requirements as delineated by Title 49 Code of Federal Regulations (CFR) Subsection 661.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Method of Delivery

1. If delivery is by truck, Bidder shall specify the anticipated type of vehicle: box truck, van, flatbed, stake bed, semitrailer, etc.

2. Bidder shall include information regarding special conditions such as over-sized dimensions or heavy axial loading.

B. Delivery Off-Loading

1. Bidder shall describe the off-loading process at the point of delivery including equipment requirements such as, but not limited to, powered-lift gate, fork-lift, crane (lift hooks, slings, spreaders, etc.).

2. Bidder shall include the time allowed for off-loading.

C. Installation

1. Bidder shall provide a full description of installation and assembly services provided by Bidder, including manpower, and an inclusive list of trades to be provided by Purchaser to complete the installation and assembly process.

1.4 SUBMITTALS

A. Action Submittal. Submit the following:

1. Product Data

a. Electrical Systems - Product Data

1) Manufacturer's name and product designation or catalog number.

2) Electrical ratings.

3) Manufacturer’s technical data and specifications.

4) Manufacturer’s indication of compliance with applicable reference standards.

5) Painting and coating systems proposed.

2. Shop Drawings

a. Internal Wiring Diagram and Drawings

1) Must indicate all connections to components and numbered terminals for external connections.

b. Dimensioned Plan, Section, Elevations, and Panel Layouts

1) Show means for mounting, conduit connection, and grounding.

c. Components List

1) Include manufacturer's name and catalog number (or part number) for each.

d. Point-to point Interconnection Wiring Diagrams.

B. Informational Submittals. Submit the following:

1. Certificates

a. Manufacturer's Certificate of Compliance with Applicable Reference Standards.

b. 'Buy America' Certificates: 'Buy America' certificates required during bidding shall also be required as part of each product submittal. Certificates shall be complete and accurate. Certificates shall indicate either compliance or non-compliance with the 'Buy America' regulations. Certificates of non-compliance shall also include copies of any granted waivers. Waivers still being applied for or being processed at the time of submittal shall be indicated as such.

2. Test and Evaluation Reports

a. Electrical Systems - Test Procedures

1) Proposed testing procedures and testing limitations for source quality control testing and field quality control testing.

3. Manufacturers' Instructions

a. Electrical Systems - Manufacturer's Instructions

1) Installation data and instructions.

2) Instructions for handling, starting-up, and troubleshooting.

4. Source Quality Control Submittals

a. Electrical Systems - Source Quality Control Test Results

1) Results for required shop testing.

5. Field Quality Control Submittals

a. Electrical Systems Field Quality Control Test Results

1) Results for required field testing

6. Qualifications Statements

a. Electrical Subcontractor Qualification Statement

C. Closeout Submittals. Submit the following:

1. Record Documentation

a. Electrical System Record Drawings

1) One-line wiring diagram of the electrical distribution system.

2) Actual, in-place conduit and cable layouts with schedule of conduit sizes and number, and size of conductors.

3) Layouts of the power and lighting arrangements and the grounding system.

4) Control schematic diagrams, with terminal numbers and control devices identified, for all equipment.

5) Panel Schedules with circuit numbers and loads.

6) Record documents shall indicate final equipment and field installation information.

7) Instrumentation and Control Wiring Diagrams shall include the following:

a) electrical schematics of, but not be limited to; electrical enclosures, instrumentation, and interconnects to field devices.

8) Point-to-Point Interconnection Wiring Diagram Drawings: Include the following:

a) External control wiring for each piece of equipment, panel, instrument, and other devices and wiring to control stations and motor controllers.

b) Numbered terminal block identification for each wire termination.

c) Identification of the assigned wire numbers for all interconnections.

d) Identification of wiring by the conduit tag in which the wire is installed.

e) Terminal, junction, and pull boxes through which wiring is routed.

f) Identification of equipment and the submittal transmittal number for equipment from which wiring requirements and termination information was obtained.

9) Submittals shall be Editable AutoCAD file (.dwg format) of installed Wiring Diagram. AutoCAD file shall be in the current version of AutoCAD used by the Owner.

PART 2 PRODUCTS

2.1 Performance Criteria:

A. Electrical equipment shall be capable of operating successfully at full-rated load, without failure, with ambient outside air temperature of (--1--) degrees F to (--2--) degrees F and an elevation of (--3--) feet above mean sea level.

B. Unless specified otherwise, electrical equipment shall have ratings based on 75 degrees C terminations.

2.2 Testing Laboratory Labels: Electrical material and equipment shall bear the label of Underwriters' Laboratories, Inc. or other nationally recognized, independent testing laboratory, where standards have been established and label service applies.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine conditions under which Work will be performed and notify Engineer in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. General:

1. Install materials and equipment in accordance with the Contract Documents, Laws and Regulations, approved (and accepted, as applicable) Shop Drawings and other Contractor submittals, and manufacturer’s recommendations.

2. Define and identify all wiring, circuit terminations, and equipment to be modified to ensure proper interface of components. The Contract Price includes all costs associated with field services specified for a complete and functional system.

3. Perform work in a neat and workmanlike manner.

B. Common Requirements for Electrical Installation

1. Comply with NECA 1.

2. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

3. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

4. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

5. Right of Way: Give to piping systems installed at a required slope.

C. Staging, Sequencing, and Coordination with Existing Facilities:

1. Schedule, sequence, and install materials and equipment in accordance with Section 01 11 00, Summary of Work.

2. Perform the Work in a manner that will not interfere with the existing equipment and facilities or cause interruption of the functions of the Site, unless specified otherwise or otherwise allowed by Engineer.

3. When operation of existing facilities and Site is to be disrupted due to Contractor's operations, coordinate with Engineer.

4. Where the Work ties in with existing installations, take precautions and provide safeguards in connecting the Work to existing operating circuits to prevent interruption to existing circuits. Connection of Work to existing circuits shall be performed in the presence of Engineer.

5. Interruptions of existing circuits shall be coordinated with the Engineer who will determine the length of time a circuit may be de-energized to maintain processes in dependable and safe operation.

3.3 FIELD QUALITY CONTROL

A. Field Quality Control – General:

1. Perform field quality control for electrical Work in accordance with the Contract Documents.

B. Site Tests:

1. Prior to requesting certificate of Substantial Completion, demonstrate to Engineer that electrical systems and electrically-operated equipment installed or modified under the Contract operates in accordance with the Contract Documents and operates as required.

2. Perform the following operational tests on electrical systems:

a. Operate power circuits to verify proper operation and connection to electrical systems materials and equipment.

b. Operate control circuits, including pushbuttons, indicating lights, and similar devices, to verify proper connection and function. Operate all devices, such as pressure switches, flow switches, and similar devices, to verify that shutdowns and control sequences operate as required.

3. Prepare and submit report on the equipment demonstration and operating field quality control tests. Report shall include complete information on the tests performed and results.

C. Manufacturer's Services:

1. Furnish at the Site qualified, factory-trained representative(s) of equipment manufacturers for the services indicated in the Contract Documents.

END OF SECTION

SECTION 26 05 13

MEDIUM VOLTAGE CABLES

PART 1 GENERAL

1.1 SCOPE

A. The work under this section includes furnishing and installing medium voltage cable including pulling, racking, splicing, and terminating. Included are the following topics:

1.2 Definition

A. Manufacturer: The company which owns controlling interest in the factory actually producing the cable being furnished for this project.

1.3 MEASUREMENT AND PAYMENT

A. This item is to be included in lump sum cost for Division 26 Electrical Equipment & Installation.

1.4 Submittals

A. Submit product data indicating cable and accessory construction, materials, ratings, and all other parameters identified in Part 2 - Products below.

B. Submit manufacturer's installation instructions.

C. Submit manufacturer's certificate stating approval for field acceptance testing per National Electrical Testing Association standards (at least 35 kV DC for 5 kV rated cable and 64 kV DC for 15 kV rated cable).

D. Submit manufacturer's certificate stating that medium voltage cable meets or exceeds all requirements specified below.

1.5 Project Record Documents

A. Accurately record exact sizes, lengths, types, locations, and quantities of cables. Also show where all splices are located for each cable.

1.6 Quality Assurance

A. The manufacturer shall be a company specializing in the manufacture of medium voltage cable and/or accessories with minimum five years documented experience in producing cable and/or accessories similar to those specified below.

B. The cable materials and manufacture shall meet or exceed all applicable requirements of the latest editions of ICEA Standard S-93-639, UL 1072 and NEMA standards.

C. The cable shall be manufactured using a triple extrusion process in which the conductor shield, insulation, and insulation shield are installed at essentially the same time without an intervening storage period on reels or other storage devices.

D. The Contractor shall be a company with experience in the installation of medium voltage cable, medium voltage equipment and components. The company shall have documented history with a minimum of two similar medium voltage projects.

E. The Contractor shall have a minimum of two qualified electricians trained and experienced (Minimum of two similar medium voltage projects) in the installation of medium voltage cable, medium voltage equipment and components.

F. At the discretion of the Engineer, documentation of experience, and relevant projects shall be furnished by the contractor.

G. Workmen involved in splicing and termination of cables shall have been specifically trained in the procedures required for the splices and terminations used in this project.

H. At the discretion of the Engineer, documentation of experience and/or training in medium voltage cable splicing and termination shall be furnished by the Contractor.

1.7 Delivery, Storage and Handling

A. Cable shall be stored according to manufacturer's recommendations as a minimum. In addition, cable must be stored in a location protected from vandalism and weather. If cable is stored outside, it must be covered with opaque plastic or canvas with provision for ventilation to prevent condensation and for protection from weather. If air temperature at cable storage location will be below 32 degrees F., the cable shall be moved to a heated (50 degrees F minimum) location. If necessary, cable will be stored off site at the Contractor's expense.

PART 2 - PRODUCTS

2.1 General

A. All cable shall be new, delivered to the site, and be less than two years since manufacture. It shall be from manufacturer's stock; not suppliers' warehouse stock. Manufacturer's certification of factory test values shall be submitted for all cable furnished. All specified dimensions are nominal.

B. Provide a 600 volt insulated copper ground conductor in all conduits with medium voltage cable. This ground conductor shall be the same size as the phase

conductors unless indicated on the drawings. See Section 26 05 26 for more grounding requirements.

2.2 MEDIUM VOLTAGE CABLE – SHIELDED

A. Usage: This cable shall be used for all above and underground applications (except for jumper cable applications, see JUMPER CABLE below) and shall be contained in conduit or other raceways.

B. Cable: Single conductor, insulated cable rated 15 KV, 133% insulation level, ungrounded, NEC-UL Type MV-105. Sizes as indicated on the Drawings.

C. Conductor shield: extruded semiconductor with resistivity requirements of section 3.3 of ICEA S-93-639 for discharge-free designs and nonconducting high permittivity compound for discharge-resistant designs. Material shall be clean stripping from the conductor and firmly bonded to the overlying insulation.

D. Insulation: Extruded EPR (ethylene propylene rubber), rated at 15 KV, 133% insulation level, nominal thickness of .220 inches.

E. Insulation Shield: The insulation shield shall consist of an extruded semiconducting layer directly over the insulation and a copper tape over the semiconducting covering. The tape shall be at least 5 mils (0.127 mm) thick and be spiral wrapped with a minimum 12.5 per cent overlap. The insulation shield shall meet all requirements of section 5 of ICEA S-93-639.

F. Jacket: Polyvinyl Chloride (PVC), black color with a jacket thickness meeting all requirements of ICEA S-93-639

G. Cable Rating: Continuous duty at 105 degrees C., wet or dry locations, suitable for underground duct installations, UL type MV-105.

2.3 JUMPER CABLE

A. Cable Rating: Continuous duty at 105 degrees C., wet or dry locations, suitable for underground duct installations, UL type MV-105.

B. Cable: Single conductor, flexible, non-shielded, insulated cable rated 15 KV, ungrounded. Size as indicated on the Drawings.

C. Conductor: Stranded, soft annealed copper.

D. Conductor shield: extruded semiconductor, clean stripping from the conductor and firmly bonded to the overlying insulation.

E. Insulation: Extruded EPR (ethylene propylene rubber), rated at 15 KV, minimum thickness of .175 inches

F. Cable Rating: Continuous duty at 105 degrees C., dry locations.

2.4 CABLE TERMINATIONS

A. Modular Molded Shrink Type Termination: IEEE 48; Class 1; 15 KV. Kit form, suitable for use with cable specified, including copper shield tape, and slip-on type flexible skirted polymer or silicon rubber insulator. All terminations shall be skirted type. Termination shall be hot or cold shrink type with internal stress relief tube to distribute electric field (10% to 90% equipotential lines) over entire length of skirted insulator.

B. Submittal for approval shall show electric field distribution (via equipotential lines) of termination device.

C. Lugs shall be copper, long barrel, two hole or four hole and rated for the voltage applied. The lugs shall match the pads on the equipment to which the cable will be mounted.

D. If there will be more than one cable on an equipment pad approved spiders (or spacers) must be used. Cable attachment to equipment must match the equipment manufacturers UL labeling requirements (if the equipment is UL Listed) as a minimum. Unless the equipment is designed or listed for it, cable lugs may not be placed back to back on the equipment pad. In all cases, the termination and equipment must be taped with approved anti-tracking tape.

2.5 CABLE SPLICES

A. Modular Molded Shrink Type Splice: IEEE 404-2022; Class 1; 15 KV. Kit form, suitable for use with cable specified, including slip-on type flexible polymer or silicon rubber insulator. Splice shall be hot or cold shrink type with internal stress relief tube to distribute electric field (10% to 90% equipotential lines) over entire length of insulating material.

B. Molded body shall contain a built-in internal semiconducting layer which covers and contacts the splice barrel and the cable insulation layer to prevent electrical stress buildup inside the body. This semiconducting layer shall be bonded to and covered with a cured EPDM rubber or polymer insulating layer which, in turn, shall be bonded to and covered with a semiconducting layer and metallic shield and jacket.

C. Splicing sleeves shall be long barrel type and rated for the voltage applied.

D. The completed splice shall be approved for underground direct burial and water immersion service.

E. Submittal for approval shall show electric field distribution (via equipotential lines) of termination device.

PART 3 – EXECUTION

3.1 CABLE PULLING

A. Pump all water out of the manholes prior to beginning work.

B. Prior to pulling cable, a mandrel/swab 1/4 inch smaller than the duct diameter shall be pulled through duct run to insure adequate opening of duct run. Thoroughly swab conduits to remove foreign material before pulling cables.

C. Cables shall not be pulled from an outdoor (exterior) location when the outdoor (exterior) air temperature is below 32 degrees F.

D. Contractor shall furnish all required installation tools to facilitate cable pulling without damage to the cable jacket. Such equipment is to include, but be not limited to, sheaves, winches, cable reels and/or cable reel jacks, duct entrance funnels, pulling tension gauge, and similar devices. All equipment shall be of substantial construction to allow steady progress once pulling has begun. Makeshift devices which may move or wear in a manner to pose a hazard to the cable shall not be used.

E. Cable ends shall be sealed and firmly held in the pulling device during the pulling operation.

F. Cable pulling shall be done in accordance with cable manufacturer's recommendations, except as modified herein, and ANSI/IEEE C2 standards. Manufacturer's recommendations shall be a part of the cable submittal. Recommended pulling tensions shall not be exceeded. Pulling bending radius shall not be less than that determined by the manufacturer or the NEC. Restrictions of pulling bending radius dimensions shall be strictly observed. Training bending radius shall not be less than 12 times cable diameter. Any cable bent or kinked to radius less than recommended dimension shall not be installed.

G. Actual pulling tensions shall be continuously monitored and permanently recorded in a log and submitted to the Engineer at the end of the project.

H. During pulling operation an adequate number of persons shall be present to allow cable observation at all points of duct entry and exit as well as to feed cable and operate pulling machinery.

I. Pulling lubricant shall be used to ease pulling tensions. Lubricant shall be water or silicone based of a type which is noninjurious to the cable material used. Wax based lubricants are not allowed. Lubricant shall not harden or become adhesive with age.

J. Avoid abrasion and other damage to cables during installation.

K. Where cables are left in manhole or switchgear overnight or more than 8 hours prior to termination, the cable ends shall be sealed with paraffin or shrink wrap caps and supported in a manner which will prevent entrance of moisture into the cable. Cable shall be terminated and energized as soon as possible.

3.2 CABLE ROUTING IN MANHOLES AND SWITCHGEAR

A. Certain manholes shall have the cable looped around the walls. If not indicated on drawings, the manhole nearest building plus every third manhole if feeder contains multiple manholes shall contain cable loop. In such cases, the cable shall circle the manhole at least 360 degrees. Where manholes are not to be looped, cable shall be routed on the walls with the longest distance between points of entry and exit. Arrange cables to avoid interference with duct entrances into manhole.

B. All new and existing cable in manholes shall be secured to racks on the manhole walls. Cables shall be secured to racks with split porcelain or polymer insulators and clamps or mounted on a heavy duty nonmetallic multi-mount cable support arm as manufactured by Underground Devices, Inc. Insulators shall be of adequate size to contain all three phases and the ground of a given circuit. Fastening cables directly to support channel will not be accepted.

C. Cables within switchgear shall be routed in a manner which will allow adequate room for bending and terminating cables. Cables must be secured in a manner which will not result in cable weight being placed on the termination electrical joint. Cable support shall be made in a manner that does not force cable against grounded metal or which compresses cable diameter. Cable training bending radius shall be at least 12 times cable diameter. Any cable bent to a radius less than recommended dimension will not be accepted.

D. Jumper cable shall be routed in a manner that maintains adequate through-air separation between adjacent conductors and between conductors and any metallic or grounded surface.

3.3 SPLICES AND TERMINATIONS INSTALLATION

A. Splices are to be held to a minimum. Splice locations shall be determined by cable lengths available, pulling conditions and termination points. Splice locations are to be listed by the Contractor prior to cable purchase and a listing of such locations submitted to the Engineer for approval before final cable lengths are determined.

B. Only experienced electricians shall be employed in this phase of the work. Refer to QUALITY ASSURANCE above.

C. Follow cable manufacturer's and splice or termination manufacturer's installation instructions and ANSI/IEEE C2 standards.

D. Clean, white lint-free gloves shall be used to handle end of cable during tape wrapping procedures.

E. Termination or splicing of the copper conductors (both power and ground conductors) shall be made only with tool applied compression (swaged) fittings.

F. Ground system connections:

1. Cable to bus: compression cable fitting bolted to bus with lock washers under nut.

2. Cable to ground rod: approved bolted fitting with backing plate between cable and rod.

G. Ground cable shield at each termination and splice.

H. Splice or termination failure upon high potential acceptance test will require complete reconstruction of the joint to manufacturer's specifications. Make sure that there is enough free cable at each termination or splice for two more terminations or splices to be performed.

I. Install Scotch #70 tape for anti-tracking on all exposed terminations.

J. All splices and terminations are to be tagged using embossed plastic tags with plastic attachment devices indicating date splice or termination was made, name of electrician involved, name of Contractor installing cable, feeder number and circuit to and from data.

K. All cable splices in manholes shall be supported on both sides of the splice within 2'0" of the splice. Splices shall not rely on cable for support.

L. Lugs shall be bolted to termination pads in equipment using corrosion resistant bolts, nuts, and washers. Use Belleville washers for bolting aluminum to aluminum, and lock washers for bolting copper to copper or as recommended by equipment manufacturer. Torque to manufacturer's recommendations.

3.4 FIREPROOFING OF MEDIUM VOLTAGE CABLES

A. Exposed cables in manholes, vaults, and cable trays shall be fireproofed. Additionally, cables shall be fireproofed in pull boxes, troughs, switchgear pull sections and pulling pits containing two or more sets of cable. Entire installation shall conform to manufacturer's recommendations.

B. Arc proofing material shall be Scotch #77 electrical arc and fireproofing tape or approved equal.

C. Install the fireproofing on the cables as follows:

D. Install tightly applied fireproofing tape, approximately 1/16 inch thick by 1-1/2 inches wide minimum, around each cable spirally in one half-lapped wrapping.

E. Install the tape with the coated side towards the cable and extend it not less than one inch into each duct.

F. Install random wrappings of Scotch #69 glass cloth tape around the installed fire proofing tape per manufacturer's instructions to prevent it from unraveling.

3.5 CABLE ACCEPTANCE TESTS

A. Acceptance tests will be performed by an independent Testing Consultant under separate contract with DFD. The Contractor shall coordinate the scheduling of the tests and provide labor and services necessary to allow the Testing Consultant to test each completed cable circuit. This includes opening and closing equipment, providing temporary light and power as needed, etc.

B. Acceptance tests will be performed on all cable after installation and prior to energization. All splices and terminations are to be completed and tested as part of the acceptance test.

C. In the event that test results are not satisfactory, the Contractor shall make repairs and replace components as necessary to correct faults. Following corrections, tests will be repeated to the extent required to prove the deficiencies are corrected.

3.6 CABLE IDENTIFICATION AND LABELING

A. Provide the following information on cable identification label:

1. Main feeder circuit number

2. To and From Data

B. Install cable labels on each conductor at each cable termination, each cable splice, in each manhole and in each pull box. Additionally, at these locations, provide one inch (1") colored vinyl plastic electrical tape wrap identification, (Scotch 35 or approved equal) around each conductor and cable as follows:

1. 15 KV individual conductor system

a. A - phase - one (1) red wrap

b. B - phase - two (2) red wraps with 1/2" space between wraps

c. C - phase - three (3) red wraps with 1/2" space between wraps

C. See paragraph above under SPLICES AND TERMINATIONS INSTALLATION for splice label requirements. This is in addition to identification labels.

D. During entire cable installation, phasing of conductors shall be maintained and identified. Where final connections to equipment are made, phasing shall be verified and proper phase rotation determined prior to connection.

3.7 CONSTRUCTION VERIFICATION

A. Contractor is responsible for construction verification in accordance with the procedures defined for construction verification in Section 01 91 01 or 01 91 02.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall provide all labor, materials, equipment, and incidentals shown, specified, and required to furnish and install low-voltage conductors and cabling.

2. Types of cabling required include:

a. Insulated cable for installation in raceways.

b. Cable for installation in cable trays.

B. Related Sections:

1. Section 26 05 53, Identification for Electrical Systems.

2. Section 31 00 05 Trenching and Earthwork

1.2 MEASUREMENT AND PAYMENT

A. This item is to be included in lump sum cost for Division 26 Electrical Equipment & Installation.

1.3 REFERENCES

A. Standards referenced in this Section are:

1. ANSI/NETA ATS, Acceptance Testing Specifications for Electrical Power Equipment and Systems.

2. ASTM B3, Specification for Soft or Annealed Copper Wire.

3. ASTM B8, Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard or Soft.

4. ASTM D3485, Specification for Smooth-Wall Coilable Polyethylene (PE) Conduit (Duct) for Preassembled Wire and Cable.

5. ASTM F2160, Solid Wall High Density Polyethylene (HDPE) Conduit Based on Controlled Outside Diameter (OD).

6. NEMA TC 7, Smooth Wall Coilable Electrical Polyethylene Conduit.

7. UL 44, Thermoset-Insulated Wires and Cables.

8. UL 1277, Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver wire and cable according to NEMA WC 26.

1.5 SUBMITTALS

A. Action Submittals. Submit the following:

1. Product Data:

a. Low-Voltage Electrical Power Conductors and Cables – Product Data

1) Manufacturer's literature, specifications, and engineering data for low voltage insulated cable proposed for use.

b. Cable Connectors & Terminations – Product Data

1) Manufacturer's literature, specifications and engineering data for terminations connectors proposed for use including but not limited to the following:

a) 1000V Rated Cable Terminations

b) 90 degrees C Rated Cable Terminations

c) Narrow Flange Cable Terminations

B. Informational Submittals. Submit the following:

1. Certificates

a. Low-Voltage Electrical Power Conductors and Cables –Certifications

1) Certification by the manufacturer that the conductors and cables conform to the requirements of the drawings and specifications.

2) Certification by the Contractor that the conductors and cables have been properly installed, adjusted, and tested.

2. Field Quality Control Submittals

a. Low-Voltage Electrical Power Conductors and Cables – Field Quality Control

1) Written results of field insulation resistance tests.

1.6 QUALITY ASSURANCE

A. Items provided under this Section shall be listed or labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).

1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.

2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.

B. Regulatory Requirements: Comply with the following:

1. NEC Article 300, Wiring Methods.

2. NEC Article 310, Conductors for General Wiring.

3. National Electrical Code (NEC): Components and installation shall comply with National Fire Protection Association (NFPA) 70.

PART 2 PRODUCTS

2.1 MATERIALS

A. BUILDING WIRES AND CABLES

1. UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating as required to meet application and NEC requirements.

2. Wire and cable for 1000 volts and below: Soft drawn, copper wire with 600 volt insulation (1000 volt insulation for DC cables).

a. Conductors:

1) Annealed, copper in accordance with ASTM B33.

2) Stranding: Class B in accordance with ASTM B8.

b. Insulations and Coverings:

1) Rubber: Conform to NEMA WC 3.

2) Thermoplastic: Conform to NEMA WC 5.

3) Cross-Linked Polyethylene: Conform to NEMA WC 7.

4) Ethylene Propylene Rubber: Conform to NEMA WC 8.

3. Feeders and service conductors: Single conductor Type XHHW-2.

4. Branch Circuits:

   a. Single Conductor Type THHN/THWN: Above ground and underfloor conduits.

   b. Single Conductor Type XHHW-2: Outdoor conduits and duct bank conduits.

   c. Single Conductor Type XHHW-2 Rated for use at 1000V: electric vehicle charger DC circuits in conduit and cable tray.

   d. No. 12 AWG minimum size (unless otherwise noted) for branch circuit wiring, including motor circuits.

   e. Size 120 v branch circuits for length of run on following basis.

      1) 0 to 50 ft Run from Panelboard to first outlet: No. 12 AWG minimum.

      2) 51 to 100 ft Run: Increase one wire size, i.e., No. 12 AWG becomes No. 10 AWG.

      3) 101 to 150 ft Run: Increase two wire sizes, i.e., No. 12 AWG becomes No. 8 AWG.

      4) 151 ft and above: Wiring sized for 3% maximum voltage drop.

   f. For other branch circuits, voltage drop for branch circuits and feeder circuit combined shall not exceed requirements of the NEC 215.

5. Control Circuits:

   a. Single conductor Type THHN/THWN: Above ground and underfloor conduits.

   b. No. 14 AWG stranded copper minimum size (unless otherwise noted).

   c. Multi-wire cable assembly: Duct bank conduits.

   d. UL listed for installation in cable trays in accordance with NEC Art. 318, Class I, Division 2 hazardous areas.

6. Non-shielded Instrumentation, Graphic Indication, and Other Control Wiring Operating at Less Than 120 v: No. 14 AWG stranded copper except as otherwise indicated with same insulation as control circuits.

a. Single conductor Type THHW/THWN, above ground and underfloor conduits.

b. Multi-wire cable assembly: Duct bank conduits.

7. Shielded instrumentation wiring, above ground and underfloor conduits:

a. PVC insulation, tinned copper (19 by 27) stranded, No. 16 AWG, twisted pair or triplet cabled with aluminum mylar shielding, stranded, tinned, No. 18 AWG copper drain wire, and overall black FR-PVC, 90^{O}C, 600 volt jacket.

b. Multi-wire cable assembly: duct bank conduits.

8. Multi-Wire Control and Instrumentation Cable Assemblies:

a. Multi-conductor, color-coded cable with number and size of conductors indicated.

b. Where spare conductors are not indicated provide 10% spare conductors. One pair minimum.

c. Control and non-shielded instrumentation.

1) Bare soft stranded No. 14 or 12 AWG copper in accordance with ASTM B3.

2) Class B stranded in accordance with ASTM B8.

3) Type THWN insulation also meeting requirements of NEMA WC-5 with armor-nylon in accordance with UL 83-THHN/THWN.

4) Color coded or numbered in accordance with NEMA WC-5 Method I Table K-2.

5) Cabled with suitable fillers.

6) Overall black FR-PVC, 90°C, 600 volt sunlight resistant jacket.

7) UL listed for installation in cable trays in accordance with NEC Art. 318, Class I, Division 2 hazardous areas and in accordance with NEC 340 and for direct burial.

d. Shielded Instrumentation:

1) Bare soft stranded No. 16 AWG copper in accordance with ASTM B3.

2) Class B stranded tinned copper in accordance with ASTM B8.

3) PVC with nylon armor insulation.

4) Twisted pairs color coded in accordance with NEMA WC-5 Method I Table K-2, and numbered.

5) Individual and overall aluminum mylar shields and seven strand tinned copper drain wires.

6) Overall black FR-PVC 90°C 600 volt sunlight resistant jacket.

7) UL listed for installation in cable trays in accordance with NEC 318, Class I, Division 2 hazardous areas in accordance with NEC 340 and for direct burial.

9. Fiber-optic cables:

a. OM1 multimode fiber, riser rated, UV resistant, crush resistant patch cables, with compatible connectors

B. Cable Connectors, Solderless Type:

1. For wire sizes No. 4 AWG and above, use either compression type or bolted type with silver-plated contact faces.

2. For wire sizes up to and including No. 6 AWG, use compression type. Alarm and control wire shall be terminated using forked type connectors at terminal boards.

3. For wire sizes No. 1/0 AWG and larger, use connectors with at least two cable clamping elements or compression indents and provision for at least two carbon steel bolts with Belleville Washer Nut or approved equal bolts for joining to apparatus terminal.

4. Properly size connectors to fit fastening device and wire size. Connectors shall be rated for minimum 75 degree C, 600 volts (1000 volts for DC cables).

5. Terminations shall be coordinated with specific installation requirements of procured equipment. 90 degree C rated, and narrow flange cable lugs shall be provided if required by equipment manufacturer installation documents.

C. Cable Splices:

1. For wire sizes No. 8 AWG and larger, splices shall be made up with compression type copper splice fittings. Splices shall be taped and covered with materials recommended by cable manufacturer to provide insulation equal to that on conductors.

2. For wire sizes No. 10 AWG and smaller, splices may be made up with pre-insulated spring connectors.

3. For wet locations, splices shall be waterproof. Compression type splices shall be waterproofed by sealant-filled, thick wall, heat shrinkable, thermosetting tubing or by pouring thermosetting resin into mold that surrounds the joined conductor. Spring connector splices shall be waterproofed with sealant filler.

4. Splices shall be suitably sized for cable, rated 75 degrees C, and 600 volts (1000V for DC cables).

5. Splices shall be in accordance with NEC and UL.

D. Wire and Cable Markers:

1. Provide wire and cable markers in accordance with Section 26 05 53, Identification for Electrical Systems.

2.2 SOURCE QUALITY CONTROL

A. Factory Tests:

1. Factory-test wire and cable in accordance with UL and/or NEMA standards.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install wires and cables as indicated, according to manufacturer's written instructions and NECA "Standard of Installation".

B. Identification:

1. Identify conductors in accordance with Section 26 05 53, Identification for Electrical Systems.

2. Identify power conductors by circuit number and phase at each terminal or splice location.

3. Identify control and status wiring using numeral tagging system.

C. Color-code cables as follows:

1. Colors for power:

System	Conductor	Color
All Systems	Equipment Grounding	Green

System	Conductor	Color
240/120 Volts Single-Phase, Three-Wire	Grounded Neutral One Hot Leg Other Hot Leg	White Black Red
208Y/120 Volts Three-Phase, Four-Wire	Grounded Neutral Phase A Phase B Phase C	White Black Red Blue
240/120 Volts Three-Phase, Four-Wire Delta, Center Tap Ground on Single-Phase	Grounded Neutral Phase A High (wild) Leg Phase C	White Black Orange Blue
480Y/277 Volts Three-Phase, Four-Wire	Grounded Neutral Phase A Phase B Phase C	Gray Brown Orange Yellow
DC Power	Positive Negative	Red Black

2. Colors for control wire
    a. AC hot conductor: Black.
    b. AC neutral conductor: White.
    c. Grounding conductor: Green.
    d. AC control conductor, powered from within panel: Red.
    e. AC control conductor, powered from remote source: Yellow.

f. DC (+) control conductor, discrete signal: Blue.

g. DC (-) control conductor, discrete signal: White with Blue Tracer.

h. DC control conductor, discrete signal: Blue.

i. Twisted pair cable (+) signal conductor, analog signal: White or Clear.

j. Twisted pair cable (-) signal conductor, analog signal: Black.

k. Twisted pair power, analog signal: Red

D. Remove existing wire from raceway before pulling in new wire and cable.

E. Bending Radius: Limit to minimum of six times cable overall diameter.

Slack: Provide maximum slack at all terminal points.

F. Run wire and cable in conduit or cable tray unless otherwise indicated on Drawings. Pull conductors into raceway simultaneously where more than 1 is being installed in same raceway.

1. Use pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation.

2. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

3. Do not draw conductor into conduits until building is enclosed, watertight, and work causing cable damage has been completed.

G. Install cable supports for vertical feeders in accordance with NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.

H. For panelboards, cabinets, wireways, switches, and equipment assemblies, neatly form, train, and tie cables in individual circuits.

I. Seal cable and wire entering building from underground or exterior between wire and conduit, where cable exits conduit, with non-hardening approved compound.

J. Install wire and cables in separate raceway systems as follows:

1. AC control.

2. DC control.

3. Shielded instrumentation.

4. Telephone cables.
5. Network Cables.
6. Fiber Optic Cables.
7. Emergency system.
8. Fire alarm system.
9. As required by NEC.

K. Where control or instrumentation cables are run in underground conduit and ducts provide multi-wire cable assemblies.

L. Where power cables and instrument/signal cables enter and pass through same manhole, handhole, or distribution box, or steel barrier, separate raceways shall continue through box manhole or handhole to avoid magnetic interaction between power cables and instrumentation conductors. In manholes and handholes, provide Type C raceway outlet body with 3/16 in. holes drilled in bottom for drainage.

M. Do not run instrumentation cables into control cabinets or MCC unless cables are terminated in cabinet or MCC.

N. Wiring at Outlets: Install with at least 12 in. (300 mm) of slack conductor at each outlet.

O. Do not use device as pass through for conductors. Pigtail conductors to device.

P. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL 486A.

Q. Drawings do not designate number of conductors in conduit nor does location of branch circuits and switch legs indicated on Drawings designate location or routing. Route branch circuits and switch legs as dictated by construction and these Specifications.

R. Neutral conductors SHALL NOT be shared.

3.2 TERMINATIONS AND SPLICES

A. Terminate control, instrumentation, and communication cables on terminal strips in separate terminal cabinets located near conduit entrances of buildings or as shown on Drawings.

B. Power Cable Splices (no splices in cables unless approved by Engineer):

1. Provide continuous lengths of cable without splices in motor circuits and feeders unless otherwise noted. Splices may be installed in motor circuits and feeders with prior approval by ENGINEER.

2. Install splices and taps that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.

3. Use splice and tap connectors that are compatible with conductor material.

4. Where pre-insulated spring connectors are used for equipment connections, tape connector to wire to prevent loosening under vibration.

5. Each tap, joint or splice in conductors No. 8 AWG and larger shall be taped with two half-lap layers of vinyl plastic electrical tape and finish wrap of color coding tape where required by code.

6. Cable splices shall be made only in manholes, handholes, wireways, distribution boxes, and junction boxes. Splices below grade, in manholes, handholes, and wet locations shall be waterproof.

C. Power Cable Terminations:

1. Termination of wires with full compression type lugs installed with appropriate hand or hydraulic tool. Use proper dies to achieve the desired compression.

2. For screw type terminal blocks, terminations for stranded conductors shall be made with T & B lock-on fork connector with insulated sleeves.

3. Motor lead conductor terminations shall be made with a T & B or approved equal, full compression lug, full ring type, bolted, and taped as required. For connecting motor lead to service wiring fasten full ring lugs together with cadmium plated steel cap screws, and cover with a minimum of 2 layers 1/2 lap, 3M Scotch No. 33 tape; option: T & B "Motor Stub Splice Insulator".

3.3 CONTROL CIRCUITS

A. Control circuit home runs from same area for the same system returning to same panel, (e.g., LCP, DPC, etc.,) may be combined provided signal and voltage types are not mixed.

B. Following types of home runs shall not be combined with other types:

1. 4-20 ma dc analog; Type 2 shielded cable.

2. 24 vdc discrete (e.g., field or LCP powered dry contacts).

3.4 BRANCH CIRCUITS

A. Motor branch circuits and branch circuits for 3 phase circuits shall not be combined.

B. Branch circuits for single phase equipment devices from same panel may be combined. Derating of conductors within conduit is not allowed.

3.5 FEEDERS:

A. Extend feeders at full capacity from origin to termination.

B. Each conduit raceway shall contain only those conductors constituting single feeder circuit.

C. Where multiple raceways are used for single feeder, each raceway shall contain conductor of each phase and neutral if used.

D. Where feeder conductors run in parallel, conductors shall be of same length, material, circular-mil area, insulation type, and terminated in same manner.

E. Where parallel feeder conductors run in separate raceways, raceways shall have same physical characteristics.

F. On network systems, neutral shall be run with phase wires. Unbalanced neutral current shall not exceed normal or derated conductor capacity.

3.6 MOTORS AND EQUIPMENT WIRING

A. Provide motor circuits in accordance with diagrams and schedules on Drawings and code requirements, from source of supply to associated motor starter and starter to motor terminal box, including necessary and required intermediate connections.

B. Do not include associated control conductors in same conduit with power conductors.

C. Provide branch circuits to conform with NEC requirements and nameplate ratings. CONTRACTOR responsible for verification of ratings of motors and installing proper branch circuits.

3.7 FIELD QUALITY CONTROL

A. Site Tests:

1. Test each electrical circuit after permanent cables are in place, to demonstrate that circuit and equipment are connected properly and will perform satisfactorily, free from improper grounds and short circuits.

2. Individually test 600-volt and 1000 volt cable mechanical connections after installation and before they are put in service, with calibrated torque wrench. Values shall be in accordance with manufacturer's recommendations.

3. Individually test 600-volt and 1000 volt cables for insulation resistance between phases and from each phase to ground. Test after cables are installed and before they are put in service, with Megger for one minute at voltage rating recommended by cable manufacturer or in accordance with ANSI/NETA ATS recommendations.

4. Insulation resistance for each conductor shall not be less than value recommended by cable manufacturer. Cables not meeting recommended value or that fail when tested under full load conditions shall be replaced with a new cable for full length.

5. Perform phase rotation test on all three-phase circuits.

3.8 CABLES (LOW VOLTAGE)

A. Inspect cables for physical damage and proper connection in accordance with single-line diagram.

B. Test cable mechanical connections to manufacturer's recommended values using calibrated torque wrench.

C. Check cable color coding with specifications and NEC standards.

D. Electrical Tests:

1. Perform insulation-resistance test on each conductor with respect to ground and adjacent conductors. Applied potential shall be 1000 volts dc for 1 min.

2. Perform continuity test to insure proper cable connection.

E. Test Values:

1. Evaluation results by comparison with cables of same length and type. Investigate any value less than 50 mega-ohms.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall provide labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install complete grounding for electrical systems, structures, and equipment.

2. Plus the following special applications:

a. Overhead cable trays grounding.

b. Underground distribution grounding.

c. Common ground bonding with lightning protection system

d. Grounding of steel structural columns

e. Grounding of unit substations, switchgear, and switchboards

f. Grounding of standby generators, solar PV inverter and battery storage inverters.

B. Related Sections:

1. 31 00 05 Trenching and Earthwork

1.2 MEASUREMENT AND PAYMENT

A. This item is to be included in lump sum cost for Division 26 Electrical Equipment & Installation.

1.3 REFERENCES

A. Standards referenced in this Section are:

1. ANSI/NETA ATS, Acceptance Testing Specifications for Electrical Power Equipment and Systems.

2. ASTM B8, Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard or Soft.

3. ASTM B 33, Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes.

4. UL 467, Grounding and Bonding Equipment.

5. National Fire Protection Association 70 (NFPA)

6. National Fire Protection Association 780 (NFPA)

B. Regulatory Requirements

1. National Fire Protection Association 70 (NFPA)

2. National Fire Protection Association 780 (NFPA)

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association (NETA) or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

a. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association (NETA) to supervise on-site testing specified in Part 3.

b. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

c. Comply with UL 467 for grounding and bonding materials and equipment.

1.5 SUBMITTALS

A. Action Submittals. Submit the following:

1. Product Data

a. Grounding and Bonding for Electrical Systems - Product Data

1) Manufacturer’s technical information for grounding materials proposed for use

2. Shop Drawings

a. Grounding and Bonding for Electrical Systems - Shop Drawings

1) Include listing of grounding connector types identifying where each will be used.

2) Include layouts of each structure's ground grid.

3) Include test point construction details.

B. Informational Submittals. Submit the following:

1. Certificates

a. Grounding and Bonding for Electrical Systems - Certificates

1) Certificates for field testing agency, signed by Contractor, certifying that agency complies with requirements specified in Quality Assurance Section Above.

2. Field Quality Control Submittals

a. Grounding and Bonding for Electrical Systems – Testing Plans

1) Ground resistance test procedures

b. Grounding and Bonding for Electrical Systems - Field Quality Control

1) Results of ground resistance tests at each test point.

C. Closeout Submittals. Submit the following:

1. Record Documentation

a. Grounding and Bonding for Electrical Systems - Record Documentation

D. Maintenance Material Submittals. (NOT USED)

PART 2 PRODUCTS

2.1 MATERIALS

A. Bare Ground Cable:

1. Material: Soft-drawn, bare copper stranded cable complying with ASTM B8. No. 4/0 AWG minimum size unless otherwise shown or indicated on the Drawings.

B. Conductors

1. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

2. Bare Copper Conductors:

   a. Solid Conductors: ASTM B 3.

   b. Stranded Conductors: ASTM B 8.

   c. Tinned Conductors: ASTM B 33.

   d. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.

   e. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.

   f. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

   g. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

3. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches (6 by 50 mm) in cross section, unless otherwise indicated; with insulators

C. Ground Rods:

1. Material: Copper-clad rigid steel rods, 3/4-inch diameter, ten feet long.

D. Grounding Connectors:

1. Products and Manufacturers: Provide one of the following:

   a. Pressure Connectors:

      1) O.Z./Gedney, Division of Emerson.

      2) Burndy Corporation.

      3) Erico Products, Incorporated.

   b. Welded Connections:

      1) Cadweld by Erico Products, Incorporated.

      2) Therm-O-Weld by Burndy Corporation.

2. Material:

a. Pressure connectors shall be copper or copper alloy castings, bolted pressure type, designed and fabricated specifically for items to be connected and assembled with Durium or silicone bronze bolts, nuts, and washers.

b. Welded connections shall be by exothermic process utilizing molds, cartridges, and hardware designed specifically for connection to be made or Burndy irreversible crimp types recommended by kit manufacturer for materials being joined and installation conditions

c. Pipe Connectors shall be clamp type, sized for pipe.

E. Ground Test Well

1. Provide heavy-duty test well suitable for heavy-duty traffic.

2. Diameter and Material: 12.75-inch outside diameter, Schedule 80 PVC.

3. Depth: Two feet.

4. Cover: Provide test well with cast iron cover marked, “Ground” with cast iron ring to support lid.

F. Ground system components shall comply with UL 467.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine conditions for the Work and notify Engineer in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with Work until unsatisfactory conditions are corrected.

3.2 APPLICATIONS

A. Equipment Grounding Conductors: Comply with NEC Article 250 for types, sizes, and quantities of equipment grounding conductors, except where specific types, larger sizes, or more conductors than required by NEC are indicated.

1. Install equipment grounding conductor with circuit conductors for items below in addition to those required by Code:

a. Feeders and branch circuits.

b. Lighting circuits.

c. Receptacle circuits.

d. Single-phase motor or appliance branch circuits.

e. Three-phase motor or appliance branch circuits.

f. Flexible raceway runs.

g. Armored and metal-clad cable runs.

2. Busway Supply Circuits: Install separate equipment grounding conductor from grounding bus in switchgear, switchboard, or distribution panel to equipment grounding-bar terminal on busway.

3. Isolated Grounding-Receptacle Circuits: Install separate insulated equipment grounding conductor connected to receptacle grounding terminal. Isolate grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding-conductor terminal of applicable derived system or service, except as otherwise indicated.

4. Isolated Equipment Enclosure Circuits: For designated equipment supplied by branch circuit or feeder, isolate equipment enclosure from supply raceway with nonmetallic raceway fitting listed for purpose. Install fitting where raceway enters enclosure, and install separate equipment grounding conductor. Isolate equipment grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding-conductor terminal of applicable derived system or service, except as otherwise indicated.

5. Nonmetallic Raceways: Install equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

6. Air-Duct Equipment Circuits: Install equipment grounding conductor to duct-mounted electrical devices operating at 120 V and above, including air cleaners and heaters. Bond conductor to each unit and to air duct.

7. Water Heater, Heat-Tracing, and Antifrost Heater Circuits: Install separate equipment grounding conductor to each electric water heater, heat-tracing assembly, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.

B. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding-electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on 1/4 by 2 by 12 in. (6 by 50 by 300 mm) grounding bus.

2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

C. Separately Derived Systems: Where NEC requires grounding, ground according to NEC 250.20 (D) and NEC 250.30.

D. Metal Poles Supporting Outdoor Lighting Fixtures: Ground pole to grounding electrode in addition to separate equipment grounding conductor run with supply branch circuit.

E. Common Ground Bonding with Lightning Protection System: Bond electric power system ground directly to lightning protection system grounding conductor at closest point to electric service grounding electrode. Use bonding conductor sized same as system grounding conductor and install in conduit.

F. Piping Systems and Other Equipment: Comply with NEC Article 250 for bonding requirements.

G. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 4/0 AWG minimum.

1. Bury at least 24 inches (600 mm) below grade.

2. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation.

3. Install metal warning tape 12” above conductor.

H. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

I. Grounding Bus: Install in electrical and communication equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 1 inch (25 mm), minimum, from wall 6 inches (150 mm) above finished floor, unless otherwise indicated.

2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.

J. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.

2. Underground Connections: Welded connectors or irreversible crimp, except at test wells and as otherwise indicated.

3. Connections to Ground Rods at Test Wells: Bolted connectors.

4. Connections to Structural Steel: Welded connectors.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.

2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 26 Section 26 05 43, "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches (300 mm) deep, with cover.

1. Test Wells: Install at least one test well for each service, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through lengths of conduit less than 12 inches.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.

2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.

3. Use exothermic-welded connectors or irreversible crimp connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

F. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal

water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.

I. When performing exothermic weld to building steel, prepare surface to accept weld.

J. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each exterior wall steel column and rebar mat, extending around the perimeter of building.

1. Install tinned-copper conductor not less than No. 4/0 AWG for ground ring and for taps to building steel.

2. Buried ground ring shall be not less than 24 inches (600 mm) from building or equipment foundation.

3. Concrete-encased ground mat bonded to ground ring and equipment ground terminals.

K. Weld all buried connections except for test points.

L. GROUNDING OVERHEAD LINES

1. Comply with IEEE C2 grounding requirements.

2. Install two (2) parallel ground rods if resistance to ground by a single, ground-rod electrode exceeds 25 ohms.

3. Drive ground rods until tops are 12 inches (300 mm) below finished grade in undisturbed earth.

4. Ground-Rod Connections: Install bolted connectors for underground connections and connections to rods.

5. Lightning Arrester Grounding Conductors: Separate from other grounding conductors.

6. Secondary Neutral and Transformer Enclosure: Interconnect and connect to grounding conductor.

7. Protect grounding conductors running on surface of wood poles with molding extended from grade level up to and through communication service and transformer spaces.

M. GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

1. Comply with IEEE C2 grounding requirements.

2. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.

3. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

4. Pad-Mounted Transformers and Switches: Install four ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 4 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches (150 mm) from the foundation.

N. EQUIPMENT GROUNDING

1. Ground electrical equipment in compliance with Laws and Regulations and the Contract Documents.

2. Equipment grounding conductors shall be bare stranded copper cable of adequate size installed in metal conduit where required for mechanical protection. Ground conductors, pulled into conduits with non-grounded conductors, shall be insulated. Insulation shall be green.

3. Control panels grounding conductors shall be bare stranded copper cable of adequate size to ground grid from AC ground bus, and an insulated stranded copper cable of adequate size to ground grid from DC ground bus.

4. Connect ground conductors to conduit with copper clamps, straps, or with grounding bushings.

5. Connect to equipment by means of lug compressed on cable end. Bolt lug to equipment frame using holes or terminals provided on equipment specifically for grounding. Do not use hold-down bolts. Where grounding provisions are not included, drill suitable holes in locations recommended by equipment manufacturer or designated by Engineer.

6. Connect to motors by bolting directly to motor frames, not to soleplates or supporting structures.

7. Connect to service water piping by means of copper clamps. Use copper bonding jumpers on gasketed joints.

8. Scrape bolted surfaces clean and coat with conductive oxide-resistant compound.

9. Install insulated equipment grounding conductors with all feeders and branch circuits.

10. Air-Duct Equipment Circuits: NOT USED

11. Water Heater, Heat-Tracing, and Antifrost Heating Cables: NOT USED

12. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

13. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

14. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

    a. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch (6-by-50-by-300-mm) grounding bus.

    b. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

15. Metal and Wood Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

O. CORROSION INHIBITORS

1. When making grounding and bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used after scraping bolted surfaces clean and coat with conductive oxide resistant compound.

3.4 GROUND FAULT SYSTEMS

A. Visual and Mechanical Inspection:

1. Inspect for physical damage and compliance with Drawings and Specifications.

2. Inspect neutral main bonding connection to ensure following.

    a. Zero sequence system grounded upstream of sensor.

    b. Ground strap systems grounded through sensing device.

    c. Ground connection made ahead of neutral disconnect link.

3. Inspect control power transformer to ensure adequate capacity for system.

4. Manual operate monitor panels (if present) for following:

    a. Trip test.

    b. No trip test.

    c. Non-automatic reset.

5. Record proper operation and test sequence.

6. Inspect zero sequence systems for symmetrical alignment of core balance transformers about current carrying conductors.

7. Verify ground fault device circuit nameplate identification by actuation observation.

8. Pickup and time delay settings shall be set in accordance with settings developed through coordination study and as approved by ENGINEER.

B. Electrical Tests:

1. Test in accordance with manufacturer's instructions.

2. Measure system neutral insulation resistance to ensure no shunt ground paths exist, neutral-ground disconnect link removed, neutral insulation resistance measured, and link replaced.

3. Relay pickup current shall be determined by primary injection at sensor and circuit interrupting device operated.

4. Relay timing shall be tested by injecting 150% and 300% of pickup current into sensor. Total trip time shall be electrically monitored.

5. System operation shall be tested at 55% rated voltage.

6. Zone interlock system shall be tested by simultaneous sensor current injective and monitoring blocking function.

C. Test Parameters:

1. System neutral insulation shall be minimum of 100 ohms, preferably 1 megohm or larger.

2. Relay pickup current shall be within 10% of device dial or fixed setting, and in no case greater than 1,200 amp.

3. Relay timing shall be in accordance with manufacturer's published time-current characteristic curves, but in no case longer than 1 sec.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal[,

at ground test wells][, and at individual ground rods]. Make tests at ground rods before any conductors are connected.

a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.

b. Perform tests by fall-of-potential method according to IEEE 81.

B. Report measured ground resistances that exceed the following values: ****NOTE: Check IEEE Standards.

1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.

2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.

3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.

4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm.

5. Substations and Pad-Mounted Equipment: 5 ohms.

6. Manhole Grounds: 10 ohms.

C. Testing Agency: Provide services of qualified independent testing agency to perform specified acceptance testing.

D. Testing: Upon completion of installation of ground-fault protection system and after electrical circuits have been energized, demonstrate capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.

E. Excessive Ground Resistance: Where resistance to ground exceeds specified values, notify ENGINEER promptly and include recommendations to reduce ground resistance and to accomplish recommended work.

F. Correct malfunctioning units at site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

G. Report: Prepare certified test reports, of ground resistance at each test location. Include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

3.6 RESTORATION

1. Restore surface features, including vegetation, at areas disturbed by work of this Section.

2. Re-establish original grades, except as otherwise indicated.

3. Where sod has been removed, replace it as soon as possible after backfilling is completed.

4. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition.

5. Restored soil shall be compacted as required in 31 00 05 Trenching and Earthwork.

6. Include topsoil, fertilizer, lime, seeding, sodding, sprigging, and mulching as required in 32 92 00 Lawns and Grasses.

7. Maintain restored surfaces as required in Division 32 Paving Specifications.

8. Restore disturbed paving as required in Division 32 Paving Specifications.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 Description

A. Scope:

1. Supports from building structure for electrical items by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fastenings.

2. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install hangers and supports for electrical systems.

3. Area Classifications: Materials shall by suitable for the area classification(s) shown or indicated on the Drawings, and specified in Section 26 05 05, General Provisions for Electrical Systems.

4. Provide complete support system to comply with seismic requirements. The support system shall be reviewed by a structural engineer.

B. Related Sections:

1. Section 26 05 05, General Provisions for Electrical Systems.

2. Section 26 05 33, Raceways and Boxes for Electrical Systems.

1.2 MEASUREMENT AND PAYMENT

A. This item is to be included in lump sum cost for Division 26 Electrical Equipment & Installation.

1.3 REFERENCES

A. Standards referenced in this section are:

1. ASTM A123/A123M, Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

2. ASTM E84, Test Method for Surface Burning Characteristics of Building Materials

B. Regulatory Requirements:

1. National Electrical Code (NEC): Components and installation shall comply with National Fire Protection Association (NFPA) 70.

1.4 QUALITY ASSURANCE

A. Items provided under this section shall be listed and labeled by UL or other Nationally Recognized Testing laboratory (NRTL).

1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.

2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.

1.5 SUBMITTALS

A. Action Submittals. Submit the following:

1. Product Data

a. Hangers and Supports for Electrical Systems - Product Data

1) Manufacturer’s name, product designation, and catalog number of each material item proposed for use.

2) Manufacturer’s specifications including material, dimensional and weight data, and load capacity for each supporting system component proposed for use.

3) Manufacturer’s Instructions: manufacturer’s installation instructions, including recommended tightening torque values for all nuts and bolts.

4) Pictorial views and corresponding identifying text of each component proposed for installation.

2. Shop Drawings

a. Hangers and Supports for Electrical Systems - Shop Drawings

1) Detailed installation drawings showing dimensions and compatibility with proposed layout.

3. Delegated Design Submittal

a. Contractor is required to submit stamped final structural drawings showing hangers and supports to withstand seismic event.

B. Informational Submittals. Submit the following:

1. Certificates

a. Hangers and Supports for Electrical Systems - Certificates

1) Submit certifications required under this Section.

PART 2 PRODUCTS

2.1 MATERIALS

A. Strut, Fittings, and Accessories:

1. General

a. Unless otherwise shown or indicated, strut shall be 1-5/8 inches by 1-5/8 inches unless load permits use of 7/8 inches by 1-5/8 inches. Double struts shall be two pieces of the same strut, welded back-to-back at the factory.

b. Attachment holes, when required, shall be factory-punched on hole centers approximately equal to the cross-sectional width and shall be 9/16-inch diameter.

c. Fittings, braces, brackets, hardware, and accessories shall be Type 316 stainless steel.

d. Strut nuts shall be spring captured Type 316 stainless steel.

e. Square and round washers shall be Type 316 stainless steel.

2. Strut materials shall be suitable for area classifications indicated in Section 26 05 05, General Provisions for Electrical Systems, and shown or indicated on the Drawings.

a. Dusty Locations:

1) Strut shall be 12-gauge carbon steel, hot-dip galvanized after fabrication, complying with ASTM A123/A123M.

b. Wet Locations:

1) Strut shall be 12-gauge aluminum (Alloy 6063-T6).

c. Corrosive Locations:

1) Strut shall be 12-gauge Type 316 stainless steel.

B. Hanger Rods:

1. Material:

a. Dry Locations: All-thread, zinc-coated

b. Wet, Corrosive, or Hazardous Areas: Stainless steel.

2. Size: Not less than 3/8-inch diameter, unless otherwise shown on the Drawings or specified.

C. Beam Clamps for Attaching Threaded Rods or Bolts to Beam Flanges for Hanging Struts or Conduit Hangers:

1. Beam clamps shall be stainless steel equipped with stainless steel square-head set screw, and shall include threaded hole sized for attaching the all-thread rod or threaded bolt.

D. Recycled rubber conduit supports for electrical systems

1. Dimensions: 6-inches wide by 4 inches tall by 30.8 inches long

2. Steel frame: steel, strut galvanized per ASTM A653

3. Attaching hardware: zinc-plated threaded rod, nuts, and attaching hardware per ASTM B633.

E. Miscellaneous Hardware:

1. Bolts, screws, and washers shall be stainless steel.

2. Hex Nuts: Shall be stainless steel

3. Expansion Anchors: Stainless steel wedge or sleeve type.

4. Toggle Bolts: All stainless steel springhead type.

F. Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports. Comply with Section 05 50 00.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine conditions under which the Work will be installed and notify Engineer in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. The equipment shall be seismically qualified per the requirements of the California Building Code.

B. Install supporting devices to fasten electrical components securely and permanently in accordance with NEC requirements.

C. Provide hangers and supports for electrical systems with necessary channels, fittings, brackets, and related hardware for mounting and supporting materials and equipment. Provide anchor systems, concrete inserts, and associated hardware for proper support of electrical systems.

D. Install equipment and devices on hangers and supports as shown on the Drawings, as specified, and as required.

E. Install hangers and supports level, true, free of rack, and parallel and perpendicular to building walls and floors, so that the hangers and supports are installed in a neat, professional, workmanlike manner.

F. Holes in suspended ceilings for rods for hangers and supports and other equipment shall be provided adjacent to bars, where possible, to facilitate removal of ceiling panels.

G. Coordinate installation of hangers and supports with equipment, cabinets, consoles, panels, enclosures, boxes, conduit, cable tray, wireway, busway, cable bus, piping, ductwork, lighting fixtures, and other systems and equipment. Locate hangers and supports clear of interferences and access ways.

H. Mounting of Conduit:

1. Provide space of not less than 1/4-inch between conduit surfaces and abutting or near surfaces except struts, cable trays, steel beams, and columns.

2. Fasten conduit to struts, cable trays, steel beams, and columns using specified clamps and straps as shown, specified, and required.

3. Devices shall be compatible with size of conduit and type of support. Following installation, size identification shall be visible and legible.

4. Install conduit supports and fasteners in accordance with Section, 26 05 33.3.2, Rigid Conduits.

5. If supporting conduit to precast hollow core ceilings, install anchors in accordance with ceiling manufacturer.

I. Raceway and Cable Tray Supports:

1. Conform to manufacturer's recommendations for selection and installation of supports.

2. Strength of each support shall be adequate to carry present and future load multiplied by safety factor of at least four. Where this determination results in safety allowance of less than 200 lbs, provide additional strength until there is minimum of 200 lbs safety allowance in strength of each support.

3. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.

4. Support parallel runs of horizontal raceways together on trapeze-type hangers.

5. Support individual horizontal raceways by separate pipe hangers. Spring steel fasteners may be used in lieu of hangers only for 1 in. and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings only. For hanger rods with spring steel fasteners, use 1/4 in. dia or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.

6. In vertical runs, arrange support so load produced by weight of raceway and enclosed conductors is carried entirely by conduit supports with no weight load on raceway terminals.

J. Supports for Cabinets, Consoles, Panels, Enclosures, and Boxes:

1. Freestanding: Unless otherwise specified or shown on the Drawings, provide supports for floor-mounted equipment, cabinets, consoles, panels, enclosures, and boxes. Such supports shall be 3.5-inch high concrete equipment base with a 45 degree chamfered edge. Base shall extend two inches beyond outside dimensions of equipment on all sides.

2. Wall-Mounted: Stainless steel

   a. Provide space not less than 1/4-inch between cabinets, consoles, panels, enclosures, and boxes and the surface on which each is mounted. Provide non-metallic or stainless steel spacers as required.

   b. Do not mount equipment, enclosures, panels, and boxes directly to beams or columns. Mount struts to beams or columns using beam clamps, and mount equipment, enclosures, panels, and boxes to the struts.

3. Floor Stand Rack: Stainless steel

   a. Where equipment, cabinets, consoles, panels, enclosures, and boxes cannot be wall-mounted, provide an independent floor stand rack.

b. Floor stand rack shall consist of struts, plates, brackets, connection fittings, braces, accessories, and hardware assembled in a rigid framework suitable for mounting of intended materials and equipment.

c. Equip floor stand racks with brackets and bases for rigidly-mounting the framework to the ceiling or floor, as applicable; or equip floor stand racks with beam clamps, angle plates, washers, and bolts for fastening to beam flanges, as applicable.

d. When equipment, cabinets, consoles, panels, enclosures, and boxes weigh more than 100 pounds:

1) Main vertical supports of floor stand rack assemblies shall be back-to-back struts.

2) Bracing, clamping and anchoring of each floor stand rack shall be sufficient to ensure rigidity of the floor stand rack with the intended equipment, enclosures, conduit, cable tray, busway, cable bus, and wireway installed. Floor stand racks shall not be deflected more than 1/8-inch by a 100-pound force applied at any point on the floor stand rack in any direction.

K. Drilling into beams or columns is not allowed unless authorized by Engineer.

L. Tighten nuts and bolts to the manufacturer's recommended torque values.

M. Field Cutting:

1. Cut edges of strut and hanger rod shall have rounded corners, edges beveled, and burrs removed. If field cutting the strut is required, use clean, sharp, dedicated tools. Remove oil, shavings, burrs, and other residue of cuttings prior to installation.

2. Coatings: To prevent corrosion:

a. Coat cut edges with zinc-rich paint. Provide protective end cap.

b. Bitumatic paint shall be used for aluminum in concrete.

N. Miscellaneous Supports: Support miscellaneous electrical components as required to produce same structural safety factors as specified for raceway supports. Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices.

O. Fastening: Unless otherwise indicated, fasten electrical items and their supporting hardware securely to building structure, including but not limited to conduits, raceways, cables, cable trays, busways, cabinets, panelboards, transformers, boxes, disconnect switches, and control components in accordance with following:

1. Fasten by means of wood screws or screw-type nails on wood, toggle bolts on hollow masonry units, concrete inserts or expansion bolts on concrete or solid masonry, and machine screws, welded threaded studs, or spring-tension clamps on steel. Threaded studs driven by powder charge and provided with lock washers and nuts may be used instead of expansion bolts and machine or wood screws. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures. In partitions of light steel construction, use sheet metal screws.

2. Holes cut in concrete shall not cut main reinforcing bars. Fill holes that are not used.

3. Load applied to any fastener shall not exceed 25% of proof test load. Use vibration- and shock- resistant fasteners for attachments to concrete slabs.

END OF SECTION

SECTION 26 05 33

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall provide all labor, materials, equipment, and incidentals shown, specified, and required to furnish and install conduit and fittings to form complete, coordinated and grounded raceway systems.

2. When specific, detailed conduit routings for various systems within buildings and other areas are not be shown on the Drawings, Contractor shall establish routings based on single-line, riser, and interconnection diagrams and other information on the Drawings. Contractor shall provide for the proper installation of conduits in each system.

3. Conduit types and the installation methods shall comply with the following, unless otherwise shown or indicated in the Contract Documents:

a. Use rigid aluminum conduit for exposed indoor conduit runs in non-corrosive areas.

b. Use PVC-coated rigid steel for exposed exterior conduit runs in hazardous, wet, and corrosive locations.

c. Use PVC-coated rigid steel or rigid aluminum conduit for exposed interior conduit runs in hazardous, wet, and corrosive locations.

d. Use PVC-coated rigid steel conduit for individual conduits direct-buried in the ground.

e. Use Schedule 40 PVC conduit for concrete-encased duct bank runs.

f. Use PVC coated rigid steel conduit for transition from duct bank.

g. Use Schedule 40 PVC conduit for conduit runs embedded in structural concrete slabs. Use PVC coated rigid steel conduit for transition from duct bank.

B. Coordination:

1. Conduit runs shown are diagrammatic. Coordinate conduit installation with piping, ductwork, light fixtures, and other systems and equipment and locate to avoid interferences.

2. For conduits to be embedded in concrete slabs, confirm adequate slab thickness and coordinate location of conduits with placement of reinforcing steel, waterstops, expansion joints, and other features of the concrete slab.

C. Related Sections:

1. Section 26 05 05, General Provisions for Electrical Systems.

2. Section 26 05 29, Hangers and Supports for Electrical Systems.

3. Section 26 05 53, Identification for Electrical Systems.

4. Section 31 00 05 Trenching and Earthwork

5. Section 32 12 16, Asphalt Paving.

1.2 MEASUREMENT AND PAYMENT

A. This item is to be included in lump sum cost for Division 26 Electrical Equipment & Installation.

1.3 REFERENCES

A. Standards referenced in this Section are:

1. AASHTO, Standard Specifications for Highway Bridges.

2. ANSI C80.1, Standard for Rigid Electrical Steel Conduit (ERSC).

3. ANSI/NEMA FB1, Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable.

4. NEMA TC3, Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.

5. UL 514B, Conduit, Tubing, and Cable Fittings.

6. UL 886, Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations.

B. Regulatory Requirements: Comply with the following:

1. National Electrical Code: Components and installation shall comply with NFPA 70.

2. NEC Article 344, Rigid Metal Conduit.

3. NEC Article 350, Liquid-Tight Flexible Metal Conduit.

4. NEC Article 352, Rigid Nonmetallic Conduit.

5. NEC Article 358, Electrical Metallic Tubing.

C. Items provided under this section shall be listed or labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).

1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.

2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.

D. Comply with NECA "Standard of Installation."

1.4 SUBMITTALS

A. Action Submittals. Submit the following:

1. Product Data

a. Raceways and Boxes – Product Data

1) Manufacturer's catalog cuts and product data for conduit, fittings, and appurtenances.

2. Shop Drawings

a. Raceways and Boxes – Assembly Details

1) Assembly details of conduit racks and other conduit support systems.

b. Raceways and Boxes – Layout Drawings

1) Showing proposed routing of exposed conduits, conduits embedded in structural concrete, and conduits directly buried in the ground.

2) Show locations of pull and junction boxes and penetrations in walls and floors.

3) Shop Drawings of embedded conduits shall include cross-sections showing thickness of concrete slabs and locations of conduits relative to reinforcing steel, waterstops, and other features of the slab.

B. Informational Submittals. Submit the following:

1. Manufacturers' Instructions

a. Raceways and Boxes – Manufacturers' Instructions

1) When requested by Engineer, provide copies of manufacturer's recommendations for handling and installing products.

2. Field Quality Control Submittals

a. Raceways and Boxes – Field Quality Control

1) When requested by Engineer, provide copies of results of specified field quality control testing.

C. Closeout Submittals. Submit the following:

1. Record Documentation

a. Raceways and Boxes – Record Drawings

1) Show actual routing of exposed and concealed conduit runs in record documents in accordance with Section 01 78 39, Project Record Documents.

PART 2 PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Rigid Steel Conduit, Elbows, and Couplings:

1. Material: Rigid, heavy-wall, mild steel, hot-dip galvanized, smooth interior, tapered threads and carefully reamed ends; 3/4-inch NPS minimum size.

2. Galvanized Rigid Steel Conduit: ANSI C80.1.

B. PVC-coated Rigid Steel Conduit, Elbows, and Couplings:

1. Manufacturers: Provide products of one of the following:

a. Robroy Industries.

b. No “Or Equal”

2. Material: Rigid, heavy-wall, mild steel, hot-dip galvanized, smooth urethane interior coating, tapered threads, carefully reamed ends, 3/4-inch NPS minimum size with factory exterior coating of 40-mil thick PVC.

3. Color: Color of coating shall be the same on all conduit and fittings.

4. Plastic-Coated Steel Conduit and Fittings: NEMA RN 1.

C. Aluminum Conduit, Elbows, and Couplings:

1. Material: Rigid, heavy-wall aluminum, smooth interior, tapered threads and carefully reamed ends; 3/4-inch NPS minimum size.

2. Rigid Aluminum Conduit: ANSI C80.5.

D. IMC – intermediate conduit shall not be used.

2.2 METALLIC FITTINGS

A. Metallic Conduit Fittings, and Outlet Bodies:

1. Material and Construction: Cast gray iron alloy, cast malleable iron or aluminum bodies and covers consistent with conduit material. Units shall be threaded type with five full threads. Materials shall comply with ANSI/NEMA FB1 and be listed by UL. Do not use “LB” fittings. Use type “LBD” fittings where use of fittings is unavoidable.

2. Use: Conduits shall be gasketed and watertight in hazardous, wet, and corrosive locations.

3. The use of threadless couplings and connectors is prohibited.

B. PVC-coated Conduit Fittings, and Outlet Bodies:

1. Material and Construction: Cast gray iron alloy, cast malleable iron bodies and covers with factory coating of 40-mil thick PVC and smooth urethane interior coating. Units shall be threaded type with five full threads. Material shall comply with ANSI/NEMA FB1 and be listed by UL. Do not use “LB” fittings. Use type “LBD” fittings where use of fittings is unavoidable.

2. Use: Provide PVC-coated or aluminum conduit fittings and outlet bodies in hazardous, wet, and corrosive locations. Fitting material shall be consistent with conduit material.

C. Conduit Hubs:

1. Material: Threaded conduit hub, vibration-proof, weatherproof, with captive O-ring seal, zinc metal with insulated throat and bonding screw.

2. Use: Provide for all conduit terminations to boxes, cabinets, and other enclosures in areas designated as wet locations.

D. PVC-coated Conduit Hubs:

1. Manufacturers: Provide products one of the following:

a. Robroy Industries.

b. No “Or Equal”

2. Material: Threaded conduit hub, vibration-proof, weatherproof, with captive O-ring seal, zinc metal with insulated throat and bonding screw, and factory coating of 40-mil thick PVC and smooth urethane interior coating.

3. Use: Provide for PVC-coated steel or aluminum conduit terminations to boxes, cabinets, and other enclosures in areas designated as corrosive location.

E. Conduit Bushings and Locknuts:

1. Insulated Bushings: Malleable iron body with plastic liner. Threaded type with steel clamping screw. Provide with bronze grounding lug, as required.

2. Locknuts: Steel for sizes 3/4-inch through two-inch diameter and malleable iron for sizes 2.5-inch through four-inch diameter.

3. Use: Provide for all conduit terminations to boxes, cabinets and other enclosures except threaded type in areas designated as dusty locations.

F. Thru-wall Seals

1. For new construction through exterior subsurface walls and exterior concrete walls.

2. For new construction passing through concrete floors and floor slabs.

3. For conduits passing through new exterior masonry block walls or through core-drilled holes in existing exterior subsurface walls, exterior concrete walls, floor slabs ,and roof slabs, and for conduits passing through existing interior concrete walls or floors and interior masonry block walls.

a. Manufacturer: Provide one of the following:

1) Type CSMI sealing bushing at the inside of the structure and Type CSMC sealing bushing at the outside of the structure by O-Z/Gedney.

2) Or equal.

2.3 NONMETALLIC CONDUIT AND FITTINGS

A. Non-metallic Conduit and Fittings: Nonmetallic Conduit

1. Rigid Nonmetallic Polyvinyl Chloride (PVC) Conduit:

a. NEMA TC 2, Schedule 40 or 80 PVC.Rated for 90 degrees C, complying with UL 514B and 651.

b. Elbows and Fittings shall comply with NEMA TC3

c. Match conduit to type of material

d. Fittings: Form elbows, bodies, terminations, expansions, and fasteners of same material and manufacturer as base conduit. Provide cement by same manufacturer as base conduit.

2.4 FLEXIBLE CONDUIT

A. Flexible Conduit (Non-hazardous Areas and Class 1, Division 2, Hazardous Areas):

1. Material: Flexible galvanized steel core with smooth, abrasion-resistant, liquid-tight, polyvinyl chloride cover. Continuous copper ground built in for sizes 3/4-inch through 1.25-inch. Material shall be UL-listed.

B. Flexible Conduit (Class 1, Group D, Division 1, Hazardous Areas):

1. Material: Flexible brass inner core with bronze outer braid and protective neoprene plastic coating. Steel, brass, or bronze end fittings. Minimum of 12 inches long.

C. Flexible Metal Conduit: Zinc-coated steel.

D. Liquid-tight Flexible Metal Conduit: Flexible steel conduit with PVC jacket.

2.5 FLEXIBLE CONDUIT FITTINGS:

A. Metallic Flexible conduit fittings

1. Material and Construction:

a. Malleable iron with cadmium finish. Fittings shall adapt the conduit to standard threaded connections, shall have an inside diameter not less than that of the corresponding standard conduit size and shall be UL listed.

b. Conduit fittings shall be insulated throat type. Conduit shall be liquid-tight with one piece sealing "O" rings with connectors when entering boxes or enclosures

2. Use: Provide on flexible conduit in non-hazardous and Class 1, Division 2 hazardous areas.

B. PVC-Coated Flexible Conduit Fittings:

1. Material and Construction:

a. Malleable iron with standard finish and 40-mil PVC exterior coating. Fittings shall adapt the conduit to standard threaded connections, and shall have an inside diameter not less than that of the corresponding standard conduit size.

b. Conduit fittings shall be insulated throat type. Conduit shall be liquidtight with one piece sealing "O" rings with connectors when entering boxes or enclosures

2.6 WIREWAYS

A. Material: Sheet metal sized and shaped as indicated.

B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireway as required for complete system.

C. Select features where not otherwise indicated, as required to complete wiring system and to comply with NEC.

D. Wireway Covers:

1. Hinged type for dry locations.

2. Bolted cover with gasket for wet locations.

E. Finish: Manufacturer's standard enamel finish unless other wise noted.

2.7 PULL JUNCTION, AND TERMINAL BOXES:

A. General – Applicable to All Boxes:

1. Description and Performance Criteria:

a. Boxes shall be appropriate for each location in accordance with NEMA requirements and as required for area classifications specified in Section 26 05 05, General Provisions for Electrical Systems.

b. For flush-mounted pullboxes in slabs or pavement potentially subject to vehicular traffic, boxes and covers shall be constructed for H-20 loading in accordance with AASHTO Standard Specifications for Highway Bridges.

2. Materials: Pull boxes embedded in concrete slabs shall be polymer concrete.

3. Terminal strips and terminal blocks in terminal boxes shall be mounted on terminal box sub-panels.

4. Identification: Boxes shall be identified in accordance with Section 26 05 53, Identification for Electrical Systems.

B. Materials and Construction – Dusty Locations:

1. Material: NEMA 12 or fiberglass.

2. Gasket: Oil-resistant gasket.

3. Access: Lift-off hinges and quick-release latches.

C. Materials and Construction - Wet, Corrosive, or Hazardous Locations:

1. Material:

a. Pull boxes in wet, corrosive, or outdoor areas shall be NEMA 4X stainless steel.

b. Boxes for areas classified as hazardous locations, where required by NEC, shall be NEMA 7 explosion-proof and comply with UL 886.

c. In corrosive locations, where the conduit system is PVC-coated, boxes shall be cast metal with factory-applied 40-mil PVC coating, Type 316 stainless steel, or non-metallic thermoplastic or fiberglass reinforced plastic material.

2. Gasket:

a. Provide neoprene gaskets for wet and corrosive locations.

b. Gaskets shall be an approved type designed for the purpose. Improvised gaskets are not acceptable.

3. Access: Stainless steel cover bolts.

4. Features:

a. External mounting lugs.

b. Drilled and tapped conduit holes.

c. Boxes where conduits enter building or structure below grade shall have 1/4-inch drain hole at bottom of the box.

d. Provide threaded connections for explosion proof boxes.

D. Terminal Blocks:

1. Material and Construction:

a. NEMA-rated nylon modular terminal blocks.

b. 600-volt rated.

c. Terminals shall be screwed type with permanently affixed numeric identifiers beside each connection.

d. Power terminals shall be copper and rated for the circuit ampacity.

2.8 ACCESSORIES

A. Fasteners: To the extent possible, fastener material shall be consistent with conduit material. For PVC-coated rigid steel conduit runs, fasteners shall have factory applied PVC coating or be stainless steel. Fasten raceway systems to supporting structures using the following:

1. To Wood: Stainless steel screws

2. To Hollow Masonry Units: Toggle bolts and/or hollow wall anchors shall be stainless steel.

3. To Brick Masonry: Expansion bolts by Price, or equal shall be stainless steel.

4. To Concrete: Anchors shall be expansion anchors shall be stainless steel.

5. To Steel: Beam clamps in accordance with Section 26 05 29, Hangers and Supports for Electrical Systems which shall be stainless steel.

B. Duct Sealing Compound

1. Soft, fibrous, slightly tacky, non-hardening sealing compound.

2. Remains workable at all temperatures.

3. Compound shall not slump at temperature of 300°F and shall readily adhere to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.

C. Conduit Sealing Bushings: Factory-fabricated watertight conduit sealing bushing assemblies suitable for sealing around conduit passing through concrete floors, walls, or boxes. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.

D. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Provide plugs with number and size of conductor gripping holes as required to suit individual risers.

E. Pipe Sleeves: Provide pipe sleeves of one of following:

1. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate sleeves from following gauge metal for sleeve diameter noted:

a. 3 in. and smaller: 20 ga.

b. 4 in. to 6 in.: 16 ga.

c. Over 6 in.: 14 ga.

2. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe.

3. Plastic Pipe: Fabricate from Schedule 80 PVC plastic pipe.

2.9 FIRE RESISTANT JOINT SEALERS

A. Two-part, foamed-in-place, silicone sealant formulated for use in through-penetration fire-stopping around cables, conduit, pipes, and duct penetrations through fire-rated walls and floors.

B. Sealants and accessories shall have fire-resistance ratings indicated, as established by testing identical assemblies in accordance with ASTM E 814, by Underwriters' Laboratories, Inc., or other testing and inspection agency acceptable to authorities having jurisdiction.

2.10 IDENTIFICATION

A. Conduit Labels:

1. Provide conduit labels in accordance with Section 26 05 53, Identification for Electrical Systems.

B. Warning Tape:

1. Provide warning tape in accordance with Section 26 05 53, Identification for Electrical Systems.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine conditions under which the Work will be performed and notify Engineer in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Supports:

1. Rigidly support conduits by clamps, hangers, or Unistrut-type channels. Conduit supports and accessories shall be in accordance with Section 26 05 29, Hangers and Supports for Electrical Systems.

2. Support single conduits by means of one-hole pipe clamps in combination with one-screw back plates, to raise conduits from the support surface. Support multiple runs of conduits on trapeze type hangers.

B. Fastenings: Fasten raceway systems rigidly and neatly to supporting structures using specified materials. Follow NEC for support spacing.

C. Exposed Conduit:

1. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow surface contours as much as practical.

   a. Mount exposed horizontal runs as high above floor as possible, and in no case lower than 7 ft above floors, walkways, or platforms in passage areas.

   b. Run parallel or banked raceways together, on common supports where practical.

   c. Make bends in parallel or banked runs from same center line to make bends parallel. Use factory elbows only where they can be installed parallel; otherwise, provide field bends for parallel raceways.

2. Where possible, run in groups. Provide conduit racks of suitable width, length, and height, arranged to suit field conditions. Provide support every ten feet, minimum.

3. Install on structural members in protected locations.

4. Locate clear of interferences.

5. Provide six inches of clearance from hot fluid lines and 1/4-inch from walls.

6. Install vertical runs plumb. Unsecured drop length shall not exceed 12 feet.

7. Use temporary closures to prevent foreign matter from entering raceway.

D. Underground Conduits:

1. Install individual, underground conduits minimum of 36 inches below grade, unless otherwise shown or indicated.

2. Perform excavation, bedding, backfilling, and surface restoration, including pavement replacement where required, in accordance with Section 31 00 05 Trenching and Earthwork, and Section 32 16 00, Asphalt Paving.

3. Install traceable warning tape 12 inches below finished grade over buried conduits.

4. Installation shall be in accordance with requirements of section 26 05 43 Underground Ducts and Raceways for Electrical Systems

E. Empty Conduits:

1. Install nylon pull wire in each empty conduit and cap conduits not terminating in boxes with permanent fittings designed for the purpose.

2. Install two spare 1 in. conduits from top of each flush mounted panelboard to area above ceiling for future use. On flush mounted panelboards located on first and higher level floors, provide two spare 1 in. conduits from bottom of panelboard to ceiling area of floor below for future use.

F. Field Bends: No indentations. Diameter of conduit shall not vary more than 15 percent at bends.

G. Joints:

1. Apply conductive compound to joints before assembly.

2. Make up joints tight and ground thoroughly.

3. Use standard tapered pipe threads for conduit and fittings.

4. Cut conduit ends square and ream to prevent damaging wire and cable.

5. Use full threaded couplings. Split couplings are not allowed.

6. Use strap wrenches and vises to install conduit. Replace conduit with wrench marks.

7. Apply zinc-rich paint to exposed threads and other areas of galvanized conduit system where base metal is exposed.

H. Terminations:

1. Install insulated bushings on conduits entering boxes or cabinets, except when threaded hubs are used.

2. Provide locknuts on both inside and outside of enclosure, except when threaded hubs are used.

3. Use of bushings in lieu of locknuts is not allowed.

4. Install conduit hubs on conduits entering boxes or cabinets in wet and corrosive areas.

I. Moisture Protection:

1. Plug or cap conduit ends at time of installation to prevent entrance of moisture and foreign materials.

2. Underground and embedded conduit connections shall be watertight.

3. Thruwall Seals and Conduit Sealing Bushings: Install for conduits passing through concrete slabs, floors, walls, or concrete block walls.

4. Drainage: Conduit runs shall be fully drainable. Where possible install conduit runs to drain to one end and away from building. Avoid pockets or depressions in conduit runs.

5. Seal conduit openings within control and instrumentation panels and distribution equipment with duct sealing compound to provide watertight seal.

6. Use threaded hubs when entering top of enclosures.

7. Use sealing type locknuts when entering sides or bottom of enclosures.

J. Corrosion Protection:

1. Dissimilar Metals:

a. Prevent occurrence of electrolytic action between dissimilar metals.

b. Do not use copper products in connection with aluminum, and do not use aluminum in locations subject to drainage of copper compounds on bare aluminum.

c. Protect Aluminum conduit where in contact with concrete.

K. Core drill for individual conduits passing through existing concrete slabs and walls. Notify Engineer in writing in advance of core drilling. Prior to core drilling, drill sufficient number of small exploratory holes to establish that the area to be core drilled is free of existing embedded conduits. Seal spaces around conduit meeting moisture protection requirements of this section.

L. Non-metallic Conduit:

1. Install in accordance with manufacturer’s recommendations.

2. Provide manufacturer’s recommended adhesives or sealants for watertight connections.

3. Provide expansion fittings for expansion and contraction to compensate for temperature variations. Fittings shall be watertight and suitable for direct burial.

4. Use PVC coated rigid steel elbows in concrete encasements and duct banks.

5. Transition to PVC-coated rigid steel conduit before making turn up to enclosures.

M. PVC-coated Rigid Steel Conduit:

1. Install in accordance with manufacturer's recommendations.

2. Install with manufacturer's installation tools to avoid damage to PVC coating.

3. Repair damaged PVC coating with manufacturer's recommended touch-up compound.

4. Use only manufacturer approved threading equipment and tools

N. Telephone and Signal System Raceways 2 in. Trade Size and Smaller: In addition to above requirements, install in maximum lengths of 150 ft (45 m) and with maximum of two 90° bends or equivalent. Install pull or junction boxes where necessary to comply with these requirements.

O. Conduit bends

1. Make bends and offsets so inside diameter is not reduced. Unless otherwise indicated, keep legs of bend in same plane and straight legs of offsets parallel.

2. Provide NEMA standard conduit bends, except for conduits containing medium voltage cable, fiber optic cable, or conductors requiring large radius bends.

3. Provide large radius conduit bends for conduits containing 5 kV and 15 kV cables as follows:

Conduit Trade	Bend Radius
2 in. - 2-1/2 in.	36 in.
3 in. - 4 in.	48 in.
5 in.	48 in.

4. Where physical limitations do not permit use of above, conduit bends with radius of at 8 times diameter of largest cable passing through conduit may be used.

P. Identify conduits, including spares, in accordance with Section 26 05 53, Identification for Electrical Systems.

Q. Vertical Conductor Supports: Install simultaneously with installation of conductors.

R. Sleeves: Install in concrete slabs and walls and other fire-rated floors and walls for raceways and cable installations. For sleeves through fire rated-wall or floor

construction, apply UL listed firestopping sealant in gaps between sleeves and enclosed conduits and cables.

S. Conduit Seals: Install seals for conduit penetrations of slabs below grade and exterior walls below grade and where indicated. Tighten sleeve seal screws until sealing grommets have expanded to form watertight seal.

T. Conduit extending through roof shall be sealed and integrated into the roofing system and made water tight.

3.3 FLEXIBLE CONDUIT INSTALLATION

A. Use maximum of 6 ft (1830 mm) of flexible conduit for recessed and semi-recessed lighting fixtures.

B. Install at motors, transformers, field instruments, and equipment subject to vibration or require movement for maintenance purposes. Provide necessary reducer where equipment furnished cannot accept 3/4 inch diameter flexible conduit. Limit flexible conduit length to three feet maximum.

C. Use liquidtight flexible conduit in wet or damp locations.

D. Use approved flexible connections in hazardous locations.

E. Install separate ground conductor inside flexible conduit connections.

3.4 PULL JUNCTION AND TERMINAL BOXES INSTALLATION

A. Mount boxes so that sufficient access and working space is provided and maintain clearance of not less than 1/4-inch from walls.

B. Securely fasten boxes to walls or other structural surfaces on which boxes are mounted. Provide independent supports that comply with Section 26 05 29, Hangers and Supports for Electrical Systems, where boxes will not be mounted on walls or other structural surface.

C. Install pull boxes where shown or indicated, and provide pull boxes or conduit bodies where one or more of the following conditions exist:

1. Conduit runs containing more than three 90-degree bends.

2. Conduit runs exceeding 200 feet in length.

D. Provide removable, flame-retardant, insulating cable supports in boxes with any dimension exceeding three feet.

E. Field-apply PVC touch-up to scratched PVC boxes damaged during installation. Touch-up work shall be in accordance with manufacturer’s recommendations and instructions.

F. Size junction, pull, and terminal boxes in accordance with NEC Article 314 and other Laws and Regulations.

G. Provide terminal blocks in boxes where shown and where cable terminations or splices are required.

H. Do not locate boxes on handrails, unless directed by Engineer.

3.5 FITTINGS

A. Install raceway sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL-listed sealing compound. Install raceway sealing fittings at following points and elsewhere as indicated:

1. Where conduits enter or leave hazardous locations.

2. Where conduits pass from warm locations to cold locations, such as boundaries of refrigerated spaces and air-conditioned spaces.

3. Where otherwise required by NEC.

B. Use raceway fittings compatible with raceway and suitable for use and location. For GRS use threaded galvanized rigid steel conduit fittings, except as otherwise indicated.

C. Install automatic breather drain fittings according to manufacturer’s written instructions. Locate fittings to drain conduit system and prevent condensate from entering device enclosures. Install automatic breather drain fittings at following points and elsewhere as indicated.

1. Where vertical seals are installed.

2. Low points in conduit system.

3. Below field instruments at junction of flexible and rigid conduit.

4. Where otherwise required by NEC.

D. Install wall entrance seal as dictated by application where conduits pass through foundation walls below grade.

E. Install conduit expansion fittings complete with bonding jumper in following locations.

1. Conduit runs crossing structural expansion joint.

2. Conduit runs attached to 2 separate structures.

3. Conduit runs where movement perpendicular to axis of conduit may be encountered.

F. Where conduit passes from inside of building to outdoors, it shall be firmly packed at fitting nearest wall line with Johns-Manville Duxseal to depth of at least 1 in. after wires and cables are pulled in; or, if conduit enters directly into equipment, it shall be fitted with seal and drain fitting to prevent water entering equipment.

3.6 GROUNDING

A. Ground in accordance with Section 26 05 26.

B. Provide grounding connections for raceway, boxes, and components as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torque requirements are not indicated, tighten connectors and terminals according to torques requirements specified in UL 486A.

3.7 PROTECTION

A. Provide final protection and maintain conditions, in manner acceptable to manufacturer and Installer, to ensure that coatings, finishes, and cabinets are without damage or deterioration at Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC or paint finishes with matching touch-up coating recommended by manufacturer.

3.8 CLEANING

A. Upon completion of installation of system, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

3.9 FIELD QUALITY CONTROL

A. Site Tests:

1. Test conduits by pulling through each conduit a cylindrical mandrel with length not less than two pipe inside diameters, having an outside diameter equal to 90 percent of conduit’s inside diameter.

2. Maintain a record, by number, of all conduits successfully tested.

3. Repair or replace conduits that do not successfully pass testing, and re-test.

END OF SECTION

SECTION 26 05 36

CABLE TRAYS

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:

1. The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, tests and services to install complete cable tray systems as shown on the drawings.

2. Cable tray systems are defined to include but are not limited to straight sections of ladder type cable trays, bends, tees, elbows, drop-outs, supports, and accessories.

B. Coordination:

1. Coordinate location and elevation for cable tray installation with conduit, lighting fixture, steel frame, hangers and supports and equipment within the space specified in drawings where cable tray is indicated.

2. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before cable tray for electrical systems Work.

3. Notify other disciplines in advance of installing cable tray for electrical systems to provide others with sufficient time for installing items included in their scope that will be installed with or before cable tray for electrical systems work.

C. Related Sections:

1. Section 26 05 05, General Provisions For Electrical Systems

2. Section 26 05 19, Low-Voltage Electrical Power Conductors and Cables

3. Section 26 05 26, Grounding and Bonding for Electrical Systems.

4. Section 26 05 29, Hangers and Supports for Electrical Systems

5. Section 26 05 33, Raceways and Boxes for Electrical Systems

6. Section 26 05 53, Identification for Electrical Systems.

1.2 MEASUREMENT AND PAYMENT

A. This item is to be included in lump sum cost for Division 26 Electrical Equipment & Installation.

1.3 REFERENCES

A. Standards referenced in this Section are:

1. ANSI/NFPA 70 - National Electrical Code.

2. ASTM A123 - Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip.

3. ASTM A653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.

4. ASTM A1011 - Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High Strength Low Alloy with Improved Formability *(Formerly ASTM A570 &A607)*

5. ASTM A1008 – Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability *(Formerly ASTM A611)*

6. ASTM B633 - Specification for Electrodeposited Coatings of Zinc on Iron and Steel

7. NEMA VE 1-2017 – Metallic Cable Tray Systems

8. NEMA VE 2-2018 – Cable Tray Installation Guidelines

1.4 FIELD CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Engineer no fewer than fourteen (14) days in advance of proposed interruption of electrical service.

2. Do not proceed with interruption of electrical service without Engineer's written permission.

1.5 DRAWINGS

A. The drawings, which constitute a part of these specifications, indicate the general route of the cable tray systems. Data presented on these drawings are as accurate as preliminary surveys and planning can determine until final equipment selection is

made. Accuracy is not guaranteed and field verification, of all dimensions, routing, etc., is directed.

B. Specifications and drawings are for assistance and guidance, but exact routing, locations, distances and levels will be governed by actual field conditions. Contractor is directed to make field surveys as part of his work prior to submitting system layout drawings.

1.6 SUBMITTALS

A. Action Submittals. Submit the following:

1. Product Data: Include data indicating dimensions and finishes for each type of cable tray indicated.

B. Shop Drawings: For each type of cable tray.

1. Show fabrication and installation details of cable tray, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.

2. Seismic-Restraint Details: Signed and sealed by a qualified professional engineer, licensed in the state where Project is located, who is responsible for their preparation.

a. Design Calculations: Calculate requirements for selecting seismic restraints.

b. Detail fabrication, including anchorages and attachments to structure and to supported cable trays.

C. Coordination Drawings: Floor plans and sections, drawn to scale. Include scaled

cable tray layout and relationships between components and adjacent structural, electrical, and mechanical elements. Show the following:

a. Vertical and horizontal offsets and transitions.

b. Clearances for access above and to side of cable trays.

c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.

D. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of cable trays and fittings of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. NEMA Compliance: Comply with NEMA Standards Publications Number VE1, “Cable Tray Systems”

C. NEC Compliance: Comply with NEC, as applicable to construction and installation of cable tray and cable channel systems (Article 318, NEC).

D. UL Compliance: Provide products that are UL-classified and labeled.

E. NFPA Compliance: Comply with NFPA 70B, "Recommended Practice for Electrical Equipment Maintenance" pertaining to installation of cable tray systems.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Avoid breakage, denting and scoring finishes. Damaged products will not be installed. Store cable trays and accessories in original cartons and in clean dry space; protect from weather and construction traffic. Wet materials will be unpacked and dried before storage.

B. Method of Delivery

1. If deliver is by truck, Bidder shall specify the anticipated type of vehicle: box truck, van, flatbed, stake bed, semitrailer, etc.

2. Bidder shall include information regarding special conditions such as over-sized dimensions or heavy axial loading.

C. Delivery Off-Loading

1. Bidder shall describe the off-loading process at the point of delivery including equipment requirements such as, but not limited to, powered-lift gate, fork-lift, crane (lift hooks, slings, spreaders, etc.).

2. Bidder shall include the time allowed for off-loading.

D. Installation

1. Bidder shall provide a full description of installation and assembly services provided by Bidder, including manpower, and an inclusive list of trades to be provided by Purchaser to complete the installation and assembly process.

PART 2 PRODUCTS

2.1 CABLE TRAY SECTIONS AND COMPONENTS

A. General: Except as otherwise indicated, provide metal cable trays, of types, classes and sizes indicated; with splice plates, bolts, nuts and washers for connecting units. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards; and with the following additional construction features.

B. Project design is based on aluminum cable ladder. Any deviations from this require approval in writing.

C. Materials and Finish: Material and finish specifications for each tray type are as follows:

1. Aluminum: Straight section and fitting side rails and rungs shall be extruded from Aluminum Association Alloy 6063. All fabricated parts shall be made from Aluminum Association Alloy 5052.

2. Pre-galvanized Steel: Straight sections, fitting side rails, rungs, and covers shall be made from steel meeting the minimum mechanical properties and mill galvanized in accordance with ASTM A653 SS, Grade 33, coating designation G90.

3. Hot-dip Galvanized Steel: Straight section and fitting side rails and rungs shall be made from steel meeting the minimum mechanical properties of ASTM A1011 SS, Grade 33 for 14 gauge and heavier, ASTM A1008, Grade 33, Type 2 for 16 gauge and lighter, and shall be hot-dip galvanized after fabrication in accordance with ASTM A123. All covers and splice plates must also be hot-dip galvanized after fabrication; mill galvanized covers are not acceptable for hot-dipped galvanized cable tray. All hot-dip galvanized after fabrication steel cable trays must be returned to point of manufacture after coating for inspection and removal of all icicles and excess zinc. Failure to do so can cause damage to cables and/or injury to installers.

4. Stainless Steel: Straight section and fitting side rails and rungs shall be made of AISI Type 304 or Type 316 stainless steel. Transverse members (rungs) or corrugated bottoms shall be welded to the side rails with Type 316 stainless steel welding wire.

2.2 TYPE OF TRAY SYSTEM

A. Ladder type trays shall consist of two longitudinal members (side rails) with transverse members (rungs) welded to the side rails. Rungs shall be spaced 9 inches on center. Spacing in radiused fittings shall be 9 inches and measured at the center of the tray's width. Rungs shall have a minimum cable-bearing surface of 7/8 inch with radiused edges. No portion of the rungs shall protrude below the bottom plane of the side rails. **Each rung must be capable of supporting the maximum cable load, with a safety factor of 1.5 and a 200 pound concentrated load when tested in accordance with NEMA VE-1, section 5.4.

B. Tray Sizes shall have 6 inch minimum usable load depth, or as noted on the drawing.

C. Straight tray sections shall have side rails fabricated as I-Beams. All straight sections shall be supplied in standard 24 foot lengths, except where shorter lengths are permitted to facilitate tray assembly lengths as shown on drawings.

D. Tray widths shall be as shown on drawings

E. All fittings must have a minimum radius of 24 inches

F. Splice plates shall be the bolted type made as indicated below for each tray type. The resistance of fixed splice connections between adjacent sections of tray shall not exceed .00033 ohms. Splice plate construction shall be such that a splice may be located anywhere within the support span without diminishing rated loading capacity of the cable tray. Splice plates shall be furnished with straight sections and fittings.

1. Aluminum Tray - Splice plates shall be made of 6063-T6 aluminum, using four square neck carriage bolts and serrated flange locknuts. Hardware shall be zinc plated in accordance with ASTM B633, SC1. If aluminum cable tray is to be used outdoors then hardware shall be Type 316 stainless

2. Steel (including Pre-galvanized and Hot-dip galvanized) - Splice plates shall be manufactured of high strength steel, meeting the minimum mechanical properties of ASTM A1011 HSLAS, Grade 50, Class 1. Each splice plate shall be attached with four ribbed neck carriage bolts with serrated flange locknuts. Hardware shall be zinc plated in accordance with ASTM B633 SC1 for pre-galvanized cable trays, or Chromium Zinc in accordance with ASTM F-1136-88 for hot-dip galvanized cable trays.

G. Cable Tray Supports: Shall be placed so that the support spans do not exceed maximum span as determined by manufacturer load study for the calculated load (refer to section 2.3 below) or otherwise indicated on drawings. Supports shall be constructed from 12 gauge steel formed shape channel members 1-5/8 inch by 1-5/8 inch with necessary hardware such as Trapeze Support Kits (9G-55XX-22SH) as manufactured by Cooper B-Line, Inc. or engineer approved equal. Cable trays installed adjacent to walls shall be supported on wall mounted brackets such as B409 as manufactured by Cooper B-Line, Inc. or engineer approved equal.

H. Center hung supports shall be manufactured of 12 gauge, 1-5/8 inch by 1-5/8 inch B-Line B22 steel strut with a pipe welded at the middle of the support to provide eccentric loading stability. Support shall withstand 700 pounds in a 60 percent vs. 40 percent eccentric loading condition with a safety factor of 3.

I. Trapeze hangers and center-hung supports shall be supported by 1/2 inch (minimum) diameter rods.

J. Barrier Strips: Shall be placed as specified on drawings and be fastened into the tray with self-drilling screws.

K. Accessories - special accessories shall be furnished as required to protect, support, and install a cable tray system. Accessories shall consist of but are not limited to; section splice plates, expansion plates, blind-end plates, specially designed ladder dropouts, barriers, etc.

2.3 LOADING CAPACITIES

A. Cable tray shall be capable of carrying a uniformly distributed load sufficient to support the equipment indicated on the drawings as determined by cable tray vendor. A safety factor of 1.5 shall be included when supported as a simple span and tested per NEMA VE1 Section 5.2.

B. Cable Tray Vendor shall submit load calculations and installation drawings approved by a professional engineer licensed in the Project state.

PART 3 EXECUTION

3.1 INSPECTION

A. Install cable trays as indicated: Installation shall be in accordance with equipment manufacturer's instructions, and with recognized industry practices to ensure that cable tray equipment comply with requirements of NEC and applicable portions of NFPA 70B. Reference NEMA-VE2 for general cable tray installation guidelines.

B. Coordinate cable tray with other electrical work as necessary to properly integrate installation of cable tray work with other work.

C. Provide sufficient space encompassing cable trays to permit access for installing and maintaining cables.

D. Cable tray fitting supports shall be located such that they meet the strength requirements of straight sections. Install fitting supports per NEMA VE-2 guidelines, or in accordance with manufacturer's instructions.

3.2 TESTING

A. Test cable trays to ensure electrical continuity of bonding and grounding connections, and to demonstrate compliance with specified maximum grounding resistance. See NFPA 70B, Chapter 18, for testing and test methods.

B. Manufacturer shall provide test reports witnessed by an independent testing laboratory of the "worst case" loading conditions outlined in this specification and performed in accordance with the latest revision of NEMA VE-1; including test reports verifying rung load capacity in accordance with NEMA VE-1 Section 5.4.

END OF SECTION

SECTION 26 05 43

UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:

1. Provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install manholes, handholes, and underground ductbanks for electrical systems Work.

B. Coordination:

1. Coordinate manhole, handhole, and underground ductbank installation with piping, sheeting other excavation supports, and other Underground Facilities, and locate clear of interferences.

2. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before manhole, handhole, and underground ductbanks for electrical systems Work.

3. Coordinate locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Engineer.

C. Related Sections:

1. Section 03 20 00, Concrete Reinforcing.

2. Section 03 30 00, Cast in Place Concrete.

3. Section 26 05 26, Grounding and Bonding for Electrical Systems.

4. Section 26 05 53, Identification for Electrical Systems.

5. Section 26 05 33 Raceways and Boxes for Electrical Systems

6. Section 31 00 05, Trenching and Earthwork

7. Section 31 20 00, Excavation

1.2 MEASUREMENT AND PAYMENT

A. This item is to be bid per linear foot according to the bid sheet, and not included in overall lump sum cost for section 26 electrical equipment & installation.

1.3 REFERENCES

A. Standards referenced in this Section are:

1. AASHTO, Specifications for Highway Bridges.

2. ANSI/SCTE 77, Specification for Underground Enclosure Integrity.

3. ASTM A48/A48M, Specification for Gray Iron Castings.

4. ASTM C478, Specification for Precast Reinforced Concrete Manhole Sections

5. ASTM C 858, Specification for Underground Precast Concrete Utility Structures

6. ASTM C 1037, Standard Practice for Inspection of Underground Precast Concrete Utility Structures

1.4 FIELD CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Engineer no fewer than fourteen (14) days in advance of proposed interruption of electrical service.

2. Do not proceed with interruption of electrical service without Engineer's written permission.

1.5 SUBMITTALS

A. Action Submittals. Submit the following:

1. Product Data

a. Underground Ducts and Raceways - Manufacturer’s Technical Information

1) Specifications, and literature for manholes, handholes, castings, and accessories proposed for use.

2) Duct-Bank Materials - Include separators and miscellaneous components.

3) Ducts and Conduits and Their Accessories - Include elbows, end bells, bends, fittings, and solvent cement.

4) Warning Tape - Product information including markings and selected color.

2. Shop Drawings

    a. Layout of Manhole Electrical Systems

        1) Where manholes have extensive electrical systems and supports for electrical systems, submit for each plans, sections, and details indicating proposed layout of such materials and equipment in each manhole.

        2) Shop Drawings for Factory-Fabricated Handholes and Boxes Other Than Precast Concrete

            a) Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:

                - Duct entry provisions, including locations and duct sizes.
                - Cover design.
                - Grounding details.
                - Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

        3) Precast or Factory-Fabricated Underground Utility Structures

            a) Include plans, elevations, sections, details, attachments to other work, and accessories, including the following:

                - Duct entry provisions, including locations and duct sizes.
                - Reinforcement details.
                - Frame and cover design and manhole frame support rings.
                - Ladder and/or Step details.
                - Grounding details.
                - Dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
                - Joint details.

    b. Duct-Bank Coordination Drawings

        1) Show duct profiles and coordination with other utilities and underground structures.

2) Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.

3) Drawings shall be signed and sealed by a qualified professional engineer.

4) Typical cross sections for each ductbank.

B. Informational Submittals. Submit the following:

1. Certificates

a. Underground Ducts and Raceways – Product Certificates

1) Submit for concrete and steel used in precast concrete manholes and handholes, as required by ASTM C 858.

C. Closeout Submittals. Submit the following:

1. Record Documentation

a. Underground Ducts and Raceways – Record Drawings

1) Include actual routing of underground ductbank runs on record documents in accordance with Section 01 78 39, Project Record Documents.

D. Maintenance Material Submittals. Submit the following.

1. Extra Stock Materials

a. Underground Ducts and Raceways – Extra Stock Materials

1) Furnish cable-support stanchions, arms, insulators, and associated fasteners in quantities equal to ten (10) percent of quantity of each item installed.

1.6 QUALITY ASSURANCE

A. Component Supply and Compatibility:

1. Obtain all manholes and handholes furnished under this Section from a single Supplier, unless otherwise acceptable to Engineer.

2. Manhole and handhole Supplier shall review and approve the Shop Drawing submittals for the manholes and handholes furnished.

3. Comply with NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.

B. Store precast concrete and/or other factory-fabricated underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.

C. Lift and support precast concrete units only at designated lifting or supporting points.

PART 2 PRODUCTS

2.1 MATERIALS

A. Material and Construction:

1. Material shall be precast or cast-in-place reinforced concrete per Contract Drawings.

2. Provide minimum interior dimensions as shown or indicated.

3. Unless otherwise indicated on drawings provide a deep sump in manhole floor with gravel filled knockout for drainage.

4. Duct entrances shall be sized and located to suit the ductbanks.

5. Precast Manholes:

a. Except where otherwise specified, precast manhole components shall consist of reinforced concrete pipe sections specially designed and constructed for use as manholes and manufactured in accordance with ASTM C478, except as modified in this Section.

b. Precast, reinforced concrete manhole bases, riser sections, flat slabs, and other components shall be manufactured by wet-cast methods, using forms that provide smooth surfaces free of irregularities, honeycombing, and other imperfections.

c. Joints between manhole components shall be tongue-and-groove type employing a single, continuous rubber O-ring gasket. Circumferential and longitudinal steel reinforcing shall extend into bell and spigot ends of joint without breaking steel continuity. Joints between base sections, riser sections, and top slabs of manholes six feet in diameter and less shall be rubber and concrete joints. Joints for manhole components greater than six-foot diameter shall have steel bell and spigot rings.

d. Precast manhole components shall:

1) have sufficient strength to withstand loads imposed upon them; and

2) be constructed for minimum earth cover loading of 130 pounds per cubic foot, AASHTO H-20 wheel loading, and an allowance of 30 percent in roadways and 15 percent in rights-of-way for impact.

3) Manhole bases shall have two cages of reinforcing steel in the walls, each reinforcing cage shall be of area equal to that required in the riser sections.

4) Wall thickness shall be not less than five inches.

5) Concrete top slabs shall be not less than eight inches thick.

e. Lifting holes, when provided, shall be tapered. Not more than two lifting holes shall be cast into each section. Provide tapered, solid rubber plugs to seal lifting holes. Lifting holes shall be made to be sealed by plugs driven from the outside face of section only.

f. Point of intersection (P.I.) of ductbank centerlines shall be marked with 1/4-inch diameter steel pin firmly enclosed in floor of each manhole base and protruding approximately one-inch above finished floor of base.

g. Mark date of manufacture and name or trademark of manufacturer on inside of manhole barrel.

h. Barrel of manhole shall be constructed of various lengths of riser pipe manufactured in increments of one foot to provide correct height with the fewest joints. Provide not less than one foot clear between openings in barrel of manholes for ductbanks or other penetrations and the nearest joint. Provide special manhole base or riser sections as required.

i. Provide at top of manhole barrel a precast or cast-in-place slab, or precast eccentric cone, as shown or approved, to receive manhole frame and cover.

j. Comply with ASTM C 858 and with interlocking mating sections, complete with accessories, hardware, and features.

1) Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks plus an additional 12 inches (300 mm) vertically and horizontally to accommodate alignment variations.

a) Windows shall be located no less than 6 inches (150 mm) from interior surfaces of walls, floors, or roofs of manholes, but close enough to corners to facilitate racking of cables on walls.

b) Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.

c) Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.

2) Duct Entrances in Manhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.

a) Type and size shall match fittings to duct or conduit to be terminated.

b) Fittings shall align with elevations of approaching ducts and be located near interior corners of manholes to facilitate racking of cable.

k. Concrete Knockout Panels: 1-1/2 to 2 inches (38 to 50 mm) thick, for future conduit entrance and sleeve for ground rod.

l. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

6. Cast-In-Place Manholes

a. Description: Underground utility structures, constructed in place, complete with accessories, hardware, and features. Include concrete knockout panels for conduit entrance and sleeve for ground rod.

b. Materials: Comply with ASTM C 858 and with Division 03 Section "Cast-in-Place Concrete."

c. Structural Design Loading: As specified in Part 3 "Underground Enclosure Application" Article.

B. Accessories:

1. Frames and Covers:

a. Manufacturers: Provide products of one of the following:

1) Neenah Foundry Company.

2) East Jordan Iron Works.

b. Material: Cast iron complying with ASTM A48/A48M, Class 30A.

c. Covers: Watertight, sealed type marked “ELECTRICAL” in raised two-inch letters. Identify covers as shown or indicated on the Drawings.

d. Grout the frame to the manhole or handhole.

2. Pulling Irons:

a. Material: Galvanized steel.

b. Cast in the wall opposite to centerline of each incoming ductbank and 12 inches below centerline of bottom line of ducts.

3. Cable Racks:

a. Material: Galvanized steel cast in the wall.

b. Cable racks shall adequately support cables with space allowed for future cables.

c. Each rack shall be a vertical assembly of two-foot cable racks extending from within six inches of manhole roof slab to within six inches of manhole floor.

4. Cable Hooks:

a. Material: Galvanized steel.

b. Length: 7.5-inch minimum.

5. Insulators:

a. Material: Porcelain.

C. Duct: Provide conduit and fittings in accordance with Section 26 05 33, Raceways and Boxes for Electrical Systems. Conduit types shall be as follows:

1. Schedule 40 PVC conduits for power circuits.

2. Galvanized rigid steel conduits for the following types of circuits: low voltage status, analog, and communication.

D. Backfill: Provide backfill, including select backfill, in accordance with Section 31 00 05 Trenching and Earthwork.

E. Reinforcing: Provide Ductbank reinforcing in accordance with Section 03 20 00, Concrete Reinforcing.

F. Concrete: Provide ductbank concrete slurry in accordance with Section 31 20 00, Cast-in-Place Concrete.

G. Grounding: Provide ground cable in accordance with Section 26 05 26, Grounding and Bonding for Electrical Systems.

H. Conduit Spacers: Conduit spacers shall be nonmetallic, interlocking type to maintain spacing between conduits. Provide spacers suitable for all conduit types used in multiple sizes.

I. Duct Sealing Compound:

1. Products and Manufacturers: Provide one of the following:

a. 0-Z/Gedney, Type DUX.

b. Or equal.

J. Warning Tape: Underground-line warning tape specified in Division 26 Section "Identification for Electrical Systems."

2.2 PRECAST CONCRETE HANDHOLES AND BOXES

A. Comply with ASTM C 858 for design and manufacturing processes.

B. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.

1. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.

2. Frame and Cover: Weatherproof steel frame, with steel cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.

3. Frame and Cover: Weatherproof steel frame, with hinged steel access door assembly with tamper-resistant, captive, cover-securing bolts.

a. Cover Hinges: Concealed, with hold-open ratchet assembly.

b. Cover Handle: Recessed.

4. Frame and Cover: Weatherproof aluminum frame with hinged aluminum access door assembly with tamper-resistant, captive, cover-securing bolts.

a. Cover Hinges: Concealed, with hold-open ratchet assembly.

b. Cover Handle: Recessed.

5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

6. Cover Legend: Molded lettering, "ELECTRIC." "TELEPHONE." “FIBER OPTIC”

7. Configuration: Units shall be designed for flush burial and have [open] [closed] [integral closed] bottom, unless otherwise indicated.

8. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.

    a. Extension shall provide increased depth of minimum of 12 inches.

    b. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.

9. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks plus an additional 12 inches vertically and horizontally to accommodate alignment variations.

    a. Windows shall be located no less than 6 inches from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.

    b. Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.

    c. Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.

10. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.

    a. Type and size shall match fittings to duct or conduit to be terminated.

    b. Fittings shall align with elevations of approaching ducts and be located near interior corners of handholes to facilitate racking of cable.

11. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.3 SOURCE QUALITY CONTROL

A. Test and inspect precast concrete utility structures according to ASTM C 1037.

    1. Strength tests of complete boxes and covers shall be by either an independent testing agency or the manufacturer.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine conditions under which the Work will be installed and notify Engineer in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION FOR MANHOLES AND HANDHOLES

A. Excavation and Backfill for Manholes and Handholes:

1. Provide manholes and handholes for electrical systems where shown or indicated and verify at the Site the required locations.

2. Perform excavation and filling required for installing manholes and handholes for electrical systems, in accordance with Section 31 00 05 Trenching and Earthwork.

3. Provide manholes and handholes on granular subbase course as shown or indicated. If not shown, provide layer of compacted select fill not less than six inches deep on which manhole or handhole for electrical systems will be installed.

4. Carefully set, level, and align at proper grade manhole bases and handholes.

B. Precast Manholes:

1. Set manhole sections vertical with steps and sections in true alignment. Butter the base of each bell or groove end at joints between components with one-to-two proportion cement-sand mortar to provide uniform bearing between components. Seal joints with cement mortar inside and out and trowel smooth to contour of wall surface. Raised or rough joint finishes are unacceptable.

2. Install sections, joints, and gaskets in accordance with manufacturer’s recommendations.

3. Tightly seal each lifting hole with solid rubber plug driven into hole from outside of barrel; fill remaining void with one-to-two proportion cement-sand mortar.

C. Manhole and handhole structures shall be watertight. Provide grout collar to seal all penetrations into manholes and handholes for electrical systems.

D. Cable Supports in Manholes:

1. Manhole shall be fabricated with cast-in-place galvanized steel cable support racks. Provide cable hooks to support each cable on each rack along the cable run within manholes.

2. Individually support each cable at each hook on porcelain insulators. Provide sufficient slack for each cable.

3. Securely tie each cable in place at each insulator block to prevent excessive movement of insulators, cables, or fireproof tape. Tie cables with non-metallic 3/4-inch strapping tape manufactured by 3M or approved equal, or tie down with nylon straps.

E. Grounding:

1. Provide 3/4-inch by 10-foot copper-clad ground rod for each manhole.

2. Bond all exposed metal manhole accessories and concrete reinforcing rods with No. 4 AWG minimum bare copper wire and connect to ground rod and to the ductbank ground cable.

F. Metal Pull Box:

1. Provide NEMA 4X, stainless steel, wall-mounted pull box inside each manhole and handhole for electrical systems where analog signal cables are mixed with power cables.

2. Route conduits for analog cables directly into and out of metal pull box so that analog cables are not exposed.

G. Riser Rings:

1. Provide riser rings for manholes when required to adjust cover to proper grade. Construct riser ring on manhole roof slab or cone section on which manhole frame and cover will be placed.

2. Height of riser rings shall be as required to bring frame to proper grade and shall not exceed 6 inches in height.

3. Riser rings shall be precast concrete and shall have a minimum thickness of 2 inches and a maximum thickness of 6 inches.

H. Grading at Manholes and Handholes:

1. Unpaved Areas:

a. Install manholes and handholes in unpaved areas as shown or directed by Engineer to rim elevation higher than finished grade.

b. Grade the ground surface to drain away from manholes and handholes.

c. Provide fill around manholes and handholes to level of upper rim of manhole or handhole frame, and evenly grade the surface to a one (vertical)-to-five (horizontal) slope to surrounding grade, unless otherwise shown or directed by Engineer.

2. Paved or Travelled Areas:

a. Install manholes and handholes in paved or travelled areas to meet final grade of paved or concrete surface.

b. Manholes and handholes shall not project above finished roadway pavement.

3. Contractor shall be solely responsible for proper height of manholes and handholes necessary to reach final grade. Engineer's review of Shop Drawings and other submittals for manholes and handholes is general in nature. Provide random-length precast manhole riser sections to adjust manholes to accommodate field conditions for final grading and final elevations.

3.3 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas and trafficways, set so cover surface will be flush with finished grade. Set covers of other handholes 1 inch above finished grade.

D. Install handholes and boxes with bottom below the frost line, 36 inches below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

F. Field-cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

G. For enclosures installed in asphalt paving and concrete paving and subject to occasional, non-deliberate, heavy-vehicle loading, provide concrete ring encircling, and in contact with, enclosure and with top surface of box cover frame. Bottom of ring shall rest on manhole.

3.4 INSTALLATION OF UNDERGROUND DUCTBANKS

A. Underground Duct Application

1. Ducts for Electrical Cables Over 600 V: RNC, NEMA Type EPC-40 - PVC, in concrete-encased duct bank, unless otherwise indicated.

2. Ducts for Electrical Feeders and branch circuits 600 V and Less: RNC, NEMA Type EPC-40 - PVC, in concrete-encased duct bank, unless otherwise indicated.

3. Underground Ducts for Telephone, Communications, or Data Utility Service Cables: RNC, NEMA Type EPC-40 - PVC, in concrete-encased duct bank, unless otherwise indicated.

4. Underground Conduits for Instrumentation and Control Wiring shall be PVC Coated galvanized rigid conduit installed in direct-buried underground conduits, unless otherwise indicated.

5. Conduits shall use plastic ty-wrap to tie to spacers. Tie wires shall not be used.

B. Excavation and Backfilling:

1. Provide excavation and backfilling for duct bank installation in accordance with 31 20 00 Excavation. Do not backfill with material containing large rock, paving materials, cinders, large or sharply angular substances, corrosive material, or other materials that can damage or contribute to corrosion of ducts or cables, or prevent adequate compaction of backfill.

C. Ductbank Layout:

1. Depth: Install top of duct bank at least 36 inches below finished grade in areas not subject to deliberate traffic, and at least 42 inches below finished grade in deliberate traffic paths for vehicles, unless otherwise indicated on drawings.

D. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions. Ductbank Assembly:

1. Assemble ductbanks using non-magnetic saddles, spacers, and separators. Position separators to provide minimum three-inch concrete separation between outer surfaces of each conduit. Provide side forms for each ductbank.

2. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.

E. Stub-Ups:

1. Use manufactured PVC Coated Rigid duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Extend concrete encasement throughout the length of the elbow.

2. Stub-Ups: Use manufactured PVC Coated Rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.

b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.

F. Curves and Bends:

1. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at transformer enclosures.

2. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, for all fiber optic cable runs.

3. Use manufactured long sweep bends with a minimum radius of 36 inches, both horizontally and vertically, at other locations, unless otherwise indicated.

4. Use PVC coated Rigid Conduit elbows for 90 degree turns in Rigid Non-metallic Conduit within concrete encasement.

G. Concrete Placing:

1. Provide minimum four-inch concrete covering on each side, top, and bottom of concrete envelopes around conduits. Concrete covering shall be as shown or indicated on the Drawings.

2. Firmly fix conduits in place during concrete placing. Carefully place and vibrate concrete to fill spaces between conduits.

H. Conduit Transitions:

1. Conduit installations shall be watertight throughout entire length of ductbank.

2. Terminate conduits with insulated grounding bushings.

3. Continue conduits inside buildings in accordance with Section 26 05 33.3.2, Rigid Conduits, and as shown or indicated in the Contract Documents.

4. If ducts are not concrete-encased, provide expansion and deflection fittings in accordance with Section 26 05 33, Expansion/Deflection Fittings.

5. Plug and seal empty spare conduits entering structures. Conduits in use entering structures shall be sealed watertight with duct sealing compound.

6. Pulling Cord: Install 100-lbf- (445-N-) test nylon cord in ducts, including spares.

I. Ductbank Reinforcing:

1. Provide reinforcing for all ductbanks:

2. Install ductbank reinforcement as shown or indicated on the Drawings.

3. Provide maximum clearance of 1.5 inches from bars to edge of concrete encasement.

J. Connections to Structures:

1. Firmly anchor ductbanks to structure walls, building walls, or slabs. Epoxy-grout ductbank rebar into structure concrete to eliminate sheer forces between ductbank and structure wall concrete.

2. Duct banks shall be doweled to concrete manholes, concrete hand holes, and concrete foundations with a minimum of four corners of the duct bank.

3. Ductbank penetrations through structure walls shall be watertight.

K. Grounding:

1. Provide bare stranded copper ductbank ground cable in each ductbank envelope. Make ground electrically continuous throughout entire ductbank system.

2. Connect ground cable to building and station ground grid or to equipment ground buses. Also, connect ground cable to steel conduit extensions of underground ductbank system.

3. Provide ground clamp and bonding of each steel conduit extension to maintain continuity of ground system.

4. Terminate ground cable at last manhole or handhole for outlying structures.

L. Detectable Underground Warning Tape:

1. Provide detectable underground warning tapes complying with Section 26 05 53, Identification for Electrical Systems, over the full length of each underground ductbank.

2. Install warning tapes approximately 12 inches below grade.

3. Provide multiple tapes across the width of each ductbank. Locate center of a warning tape above each edge of ductbank, and at intervals across top width of ductbank so that clear space between tapes does not exceed six inches.

4. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

M. Reused Existing Conduits or Ducts:

1. Pull rag swab through duct to remove water and to clean conduits prior to installing new cable.

2. Repeat swabbing until all foreign material is removed.

3. Pull mandrel through duct, if necessary, to remove obstructions.

N. Direct-Buried Conduits:

1. Only single run conduit shall be direct buried unless otherwise indicated.

2. Conduit shall be PVC coated rigid.

3. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottoms as specified in Section 31 00 05 Trenching and Earthwork

4. After installing conduit, backfill and compact. Start at tie-in point and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly tamp backfill around conduit to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill, make final connections at end of run and complete backfilling with normal compaction as specified in Section 31 00 05 Trenching and Earthwork.

5. Depth: Install top of conduit at least 36 inches below finished grade, unless otherwise indicated.

6. Install manufactured PVC Coated Rigid elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated.

3.5 FIELD QUALITY CONTROL

A. Watertightness:

1. Manholes and handholes for electrical systems shall be free of visible leakage. Inspect each manhole and handhole accompanied by Engineer, and repair leaks.

B. Perform the following tests and inspections and prepare test reports:

1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.

2. Pull test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.

3. Test manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Correct deficiencies and retest as specified above to demonstrate compliance.

3.6 CLEANING

A. Pull rag swab through duct to remove water and to clean conduits prior to installing new cable.

B. Repeat swabbing until all foreign material is removed.

C. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall provide all labor, materials, equipment, and incidentals shown, specified, and required to furnish and install identification for electrical apparatus and electrical Work.

2. Section Includes:

a. Identification for raceways.

b. Identification of power and control cables.

c. Identification for conductors.

d. Underground-line warning tape.

e. Warning labels and signs.

f. Instruction signs.

g. Equipment identification labels.

h. Miscellaneous identification products.

B. Related Sections:

1. Section 26 05 13 Medium Voltage Cables

2. Section 26 05 19, Low Voltage Electrical Power Conductors and Cables.

3. Section 26 13 13 - Metal Enclosed MV Switchgear

1.2 MEASUREMENT AND PAYMENT

A. This item is to be included in lump sum cost for Division 26 Electrical Equipment & Installation.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the following:

1. 2019 California Electrical Code, California Code of Regulations Title 24, Part 3, including but not limited to the sections below:

   a. CEC Article 110, Requirements for Electrical Installation.

   b. CEC Article 210, Branch Circuits.

   c. CEC Article 215, Feeders.

   d. CEC Article 250, Grounding & Bonding

   e. CEC Article 328, Medium Voltage Cable

   f. CEC Article 336, Power & Control Tray Cable

   g. CEC Article 392, Cable Trays

   h. CEC Article 408, Switchboards, Switchgear & Panelboards

   i. CEC Article 450, Transformers & Transformer Vaults

   j. CEC Article 504, Intrinsically Safe Systems.

   k. CEC Article 700, Emergency Systems.

   l. CEC Article 701, Legally Required Standby Systems.

   m. CEC Article 702, Optional Standby Systems.

2. 40 CFR 1910.145 (OSHA) – Specification for Accident Prevention Signs and Tags.

3. ANSI A13.1and IEEE C2.

4. NFPA 79.

5. 29 CFR 1910.144 and 29 CFR 1910.145.

6. ANSI Z535.4 for safety signs and labels.

7. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.4 FIELD CONDITIONS

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop

Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

1.5 SUBMITTALS

A. Action Submittals. Submit the following:

1. Product Data

a. Identification For Electrical Systems –Product Data

1) Manufacturer’s literature, cut sheets, specifications, dimensions and technical data for all products proposed under this Section.

2. Shop Drawings

a. Identification For Electrical Systems – Shop Drawings

1) Complete description and listing of proposed electrical identification and electrical identification devices for associated equipment or systems.

2) Conduit and wire identification numbering system and equipment signage.

b. Identification For Electrical Systems – Schedule

1) An index of nomenclature of electrical equipment and system components used in identification signs and labels.

3. Studies and Calculations

a. Electrical System Study – Report

1)

4. Samples

a. Identification For Electrical Systems – Samples

1) For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

A. Engraved Identification Devices (Nameplates and Legend Plates):

1. Lettering size and line weight shall be the same for all legend plates on the same panel or enclosure.

2. Nameplates:

a. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

b. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

c. Nameplates one-inch or less in height shall have one mounting hole at each end. Nameplates greater than one-inch in height shall have mounting holes in the four corners.

d. Nameplates one-inch or less in height shall have one mounting hole at each end. Nameplates greater than one-inch in height shall have mounting holes in the four corners.

3. Legend Plates:

a. Legend plates for pushbuttons, pilot lights, selector switches, and other panel-mounted devices shall be large size with dimensions of approximately 2-7/16 inches wide by 2-13/32 inches tall (Allen Bradley large automotive size), plastic, custom engraved with black letters on white background.

1) Provide standard-size legend plates where devices are mounted on motor control centers and spacing of devices precludes using automotive-size legend plates.

B. Safety Signs and Voltage Markers:

1. Provide all signage as required by California Electrical Code, including but not limited to the signs & markers listed in this specification.

2. Provide high voltage signs for equipment operating over 600 volts.

3. High-Voltage Safety Signs for Outdoor Applications:

    a. Unless otherwise shown or indicated, high voltage safety signs shall be not less than 10 inches high by 14 inches wide, of fiberglass reinforced plastic, and shall comply with 40 CFR 1910.145. Signs shall resist fading from exposure to temperature extremes, ultraviolet light, abrasive, and corrosive environments, and shall read, “DANGER – HIGH VOLTAGE – KEEP OUT”

    b. Mounting hardware shall be Type 316 stainless steel. Nylon cable ties shall be permitted for applications that do not allow stainless steel hardware.

4. High-Voltage Safety Signs for Indoor Applications:

    a. High voltage safety signs for installation on indoor equipment shall be either pressure-sensitive acrylic or vinyl, and shall be not less than 10 inches high by 14 inches wide, shall comply with 40 CFR 1910.145, and shall read, “DANGER – HIGH VOLTAGE – KEEP OUT”.

5. Cable Tray Safety Signs:

    a. Cable tray safety signs shall be pressure-sensitive vinyl conforming to 40 CFR 1910.145, 5 inches by 3.5 inches in size, and shall read, “DANGER – HIGH VOLTAGE”

6. Low-Voltage Safety Signs:

    a. Low voltage safety signs shall be pressure-sensitive vinyl complying with 40 CFR 1910.145, five inches by 3.5 inches in size, and shall read, “DANGER – 480 VOLTS”.

7. Low-Voltage Markers:

    a. Low voltage markers shall be either pressure-sensitive vinyl or vinyl cloth with black lettering on orange background and shall read, “120 VOLTS”, “208 VOLTS”, “120/208 VOLTS”, or “240 VOLTS” as required.

C. Arc-flash Safety Signs:

1. Warning signs shall be adhesive-backed polyester.

2. Warning signs shall read, “Warning – Arc Flash and Shock Hazard. Appropriate PPE Required.” Arc flash warning signs shall indicate the flash protection boundary, incident energy in calories per square centimeter, hazard level, description of required protective clothing, shock hazard, limited approach boundary, restricted approach boundary, prohibited approach boundary, and equipment name. Values included on labels shall be from section 26 05 73.

D. Detectable Underground Warning Tape:

1. Construction: Aluminum core encased with polyethylene

2. Width: Six inches.

3. Color Finish: Red

4. Detectable Underground Warning Tape: “CAUTION: BURIED ELECTRICAL LINE BELOW”

5. Detectable Underground Warning Tape: “CAUTION: BURIED FIBER OPTIC LINE BELOW”

6. Detectable Underground Warning Tape: “CAUTION: BURIED CATV LINE BELOW”

7. Detectable Underground Warning Tape: “CAUTION: BURIED TELEPHONE LINE BELOW”

E. Thermal Printing System:

1. Utilize thermal transfer printing system to provide non-smearing labels and markers.

2.2 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letter on an Orange field

2. Legend: Indicate voltage

C. Colors for Raceways Carrying Circuits at More Than 600 V:

1. Black letters on a red field.

2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- (75-mm-) high letters on 20-inch (500-mm) centers.

D. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

E. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.3 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Colors for Raceways Carrying Circuits at 600 V and Less:

1. Black letters on an orange field

2. Legend: Indicate voltage

C. Colors for Raceways Carrying Circuits at More Than 600 V:

1. Black letters on a red field.

2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- (75-mm-) high letters on 20-inch (500-mm) centers.

D. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

E. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.

2.4 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

D. Colors: Text shall be black letters on a white field

2.5 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.6 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with black letters on white face.

2. Punched or drilled for mechanical fasteners.

3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

2.7 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).

2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).

3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).

4. Color: Black.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).

2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).

3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).

4. Color: Black.

C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.

1. Minimum Width: 3/16 inch (5 mm).

2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 7000 psi (48.2 MPa).

3. UL 94 Flame Rating: 94V-0.

4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).

5. Color: Black.

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

2.9 FABRICATION

A. Engraved Identification Devices (Nameplates and Legend Plates):

1. Nameplate and legend plate text is preliminary and subject to change pending final review and approval of nomenclature by Engineer after start-up and testing.

PART 3 EXECUTION

3.1 GENERAL

A. Contractor shall be responsible for conducting relevant electrical calculations and studies to establish values for warnings, labels and signage based on build conditions and product specifications. See SECTION 26 05 73

3.2 INSTALLATION

A. Provide electrical identification in accordance with manufacturer recommendations and as required for proper identification of equipment and materials.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

E. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

F. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

G. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

I. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.

2. In Spaces Handling Environmental Air: Plenum rated.

3. Twist off excess length. Ensure ends are smooth and round.

J. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape per drawing detail. If no detail exists install directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench [or concrete envelope] exceeds 16 inches (400 mm) overall.

K. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application

L. Engraved Identification Devices (Nameplates and Legend Plates):

1. Equipment to Be Labeled:

a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved or engraved, laminated acrylic or melamine label.

b. Enclosures and electrical cabinets.

c. Access doors and panels for concealed electrical items.

d. Switchgear.

e. Switchboards.

f. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.

g. Substations.

h. Emergency system boxes and enclosures.

i. Motor-control centers.

j. Enclosed switches.

k. Enclosed circuit breakers.

l. Enclosed controllers.

m. Variable-speed controllers.

n. Push-button stations.

o. Power transfer equipment.

p. Contactors.

q. Remote-controlled switches, dimmer modules, and control devices.

r. Battery-inverter units.

s. Battery racks.

t. Power-generating units.

u. Monitoring and control equipment.

v. UPS equipment.

2. Unless otherwise indicated in the Contract Documents, attach permanent nameplates with permanent adhesive and with 3/16-inch diameter, round head, stainless steel machine screws into drilled and tapped holes.

3. Provide nameplate with 1.5-inch high letters to identify each console, cabinet, control station, panel, or enclosure as shown or indicated.

4. Provide nameplates for field-mounted motor starters, disconnect switches, manual starter switches, pushbutton stations, and similar equipment operating components, which shall describe motor or equipment function and circuit number.

5. Provide nameplates with 1/2-inch high letters to identify each junction and terminal box shown or indicated.

6. On control panel enclosures, provide nameplates for each main and feeder circuit including control fuses, and for each indicating light and instrument.

   a. Provide nameplate with 1.5-inch high letters giving switchgear designation, voltage rating, ampere rating, short circuit rating, manufacturer’s name, general order number, and item number.

b. Identify individual door for each compartment with nameplate giving item designation and circuit number.

7. Electrical Distribution Panel Identification

a. Panel designator shall consist of the following designator and format, unless alternate designations are provided on the drawings: Four digit Building number followed by a colon followed by a one digit floor number, followed by Voltage Designation (H/L) and one digit panel number.

b. Voltage Designation shall be “H” for 277/480 V and “L” for 120/208 V.

c. Format: BBBB:FVP

1) Example: 1000:1H1

a) Building Number:1000

b) Floor Number:1

c) Voltage: 480 V

d) Panel Number:1

8. Switchgear:

a. Provide nameplate with 1.5-inch letters with switchgear designation.

b. Provide nameplates for each main and feeder circuit.

c. Identify individual door for each unit compartment with nameplate identifying controlled equipment.

9. Motor Control Centers:

a. Provide nameplate with 1.5-inch letters with motor control center designation.

b. Identify individual door for each unit compartment with nameplate identifying controlled equipment.

10. Except conduit, all electrical appurtenances including lighting panels, convenience outlets, fixtures, and lighting switches, shall be provided with nameplates indicating appropriate circuit breaker number(s).

11. Push Buttons:

a. Provide legend plates for identification of functions.

b. Provide nameplates for identification of controlled equipment.

c. Name plates shall use the control panel reference designator and shall comply with NFPA 79.

12. Pilot Lights:

a. Provide legend plates for identification of functions.

b. Provide nameplates for identification of controlled equipment.

c. Name plates shall use the control panel reference designator and shall comply with NFPA 79.

13. Selector Switches:

a. Provide legend plates for identification of functions.

b. Provide nameplates for identification of controlled equipment.

c. Name plates shall use the control panel reference designator and shall comply with NFPA 79.

14. Panel Mounted Instruments:

a. Provide nameplates for identification of function.

b. Name plates shall use the control panel reference designator and shall comply with NFPA 79.

15. Interiors of Cabinets, Consoles, Panels, Terminal Boxes, and Other Enclosures:

a. Provide nameplates for identification.

b. Name plates shall use the control panel reference designator and shall comply with NFPA 79.

c. Provide each item inside cabinet, console, panel, terminal box, or enclosure with laminated plastic nameplate as shown on approved Shop Drawings and Contractor's other submittals. Install nameplates with adhesive.

d. Interior items require nameplates and shall use the reference designators as indicated on the bill of materials and electrical schematics. Items include, but not limited to:

1) Terminal blocks and strips.

2) Bus bars.

3) Relays.

4) Rear of face-mounted items.

5) Rear of door-mounted items.

6) Interior mounted items that require identification when mounted externally.

7) PLC

8) UPS

9) Radio

10) Surge Protective Devices

e. Circuit Breaker Directory:

1) Provide engraved laminated plastic directory listing function and load controlled for each circuit breaker within panel used for power distribution.

16. Re-label existing equipment whose designation have changed.

M. Safety Signs and Voltage Markers:

1. Provide safety signs and voltage markers on and around electrical equipment as shown or indicated.

a. Install rigid safety signs using stainless steel fasteners.

b. Clean surfaces before applying pressure-sensitive signs and markers.

2. Install high voltage safety signs on all equipment doors providing access to uninsulated conductors, including terminal devices, greater than 600 volts.

3. Provide cable tray safety signs on both sides of cable trays at maximum intervals of 20 feet. Install signs on side rails of tray as acceptable to Engineer.

a. Label cable trays that contain conductors greater than 600 volts with cable tray safety signs.

b. Cable trays that contain conductors greater than 208 volts and less than 600 volts shall be labeled with low voltage safety signs.

c. Cable trays that contain conductors of 120/208 volts shall be labeled with low voltage markers.

d. Label cable trays that contain intrinsically safe wiring or cables in accordance with CEC Article 504.

4. Install low voltage safety signs on equipment doors that provide access to uninsulated 480-volt conductors, including terminal devices.

5. Install low voltage markers on each terminal box, safety disconnect switch, and panelboard installed, modified, or relocated as part of the Work and containing 120/208 volt conductors.

N. Voltage System Identification Directories

1. Provide voltage system identification directories as required by CEC Article 210 and CEC Article 215.

2. Provide in each electrical room voltage system identification directory mounted on wall or door at each entrance to room.

3. For panelboards, switchboards, motor control centers, and other branch circuit or feeder distribution equipment that are not located in electrical rooms, provide voltage system identification directory mounted on equipment.

a. Directories shall be affixed using epoxy glue. Screws or bolts shall not penetrate equipment enclosures.

b. Directories shall be readily visible and not obscure labels and other markings on equipment.

O. Arc-flash Safety Signs:

1. Provide arc-flash safety signs as required by NFPA 70..

2. Provide signs for switchboards, panelboards, motor control centers, and industrial control panels. Provide signs for control panels that contain 480 volt equipment. Provide arc flash warning signs on other equipment where the incident energy is greater than 1.2 calories per square centimeter.

P. Conduit Labels:

1. Provide conduits with conduit labels unless otherwise shown or indicated.

2. Do not label flexible conduit.

3. Do not label exposed single conduit runs of less than 25 feet between local disconnect switches and their associated equipment.

4. Conduit labels shall indicate the following information:

a. Voltage

5. Conduits that contain intrinsically safe wiring shall have an additional conduit marker provided that has blue letters on white background and reads, “INTRINSICALLY SAFE WIRING”.

    a. Install intrinsically safe pipe markers in accordance with CEC Article 504 along entire installation. Spacing between labels shall not exceed 25 feet.

6. Provide conduit labels at the following locations:

    a. Where each conduit enters and exits walls, ceilings, floors, or slabs.

    b. Where conduit enters or exits boxes, cabinets, consoles, panels, or enclosures, except pull boxes and conduit bodies used for pull boxes.

    c. At maximum intervals of 50 feet along length of conduit.

7. Orient conduit labels to be readable. Text shall be left to right on horizontal conduits and down to up on vertical conduits.

Q. Wire and Cable Identification:

1. Color-coding of insulated conductors shall comply with Section 26 05 19 Low Voltage Electrical Power Conductors and Cables, and also comply with Section 26 05 13 Medium Voltage Cable

2. Text shall be left to right on horizontal conduits and down to up on vertical conduits.

3. Use wrap-around labels where wire or cable is to be labeled but is not terminated. Wire and cable shall be uniquely individually labeled. (i.e. Spare 1, Spare 2,….)

4. Do not provide labels for the following:

    a. Bare (uninsulated) conductors, unless otherwise shown or indicated as labeled.

5. Provide wire and cable labels for the following:

    a. New, rerouted, or revised wire or cable.

    b. Insulated conductors.

    c. Wire and cable terminations:

        1) Wire labels shall be applied outside of the wireway between the wireway and the terminal.

2) Apply cable labels between 1/2-inch and one inch of cable breakout into individual conductors.

a) Label individual conductors in a cable after breakout as specified for wires.

d. Wire or cable exiting cabinets, consoles, panels, terminal boxes, and enclosures.

1) Label wires or cables within two inches of entrance to conduit.

e. Wire or cable in junction boxes and pull boxes

1) Label wires or cables within two inches of entrance to conduit.

f. Wire and cable installed in cable tray.

1) Wire and cable shall have labels at maximum intervals of 20 feet.

g. Wire and cable installed without termination in electrical manholes.

1) Wire and cable shall have wrap-around labels applied within one foot of exiting manhole.

6. Modified Cabinets, Consoles, Panels, and Enclosures:

a. New or rerouted wire or cable in existing cabinets, consoles, panels, and enclosures shall be labeled using the same format and designation as shown above where possible. Where existing equipment naming differs from format listed above coordinate with Owner.

R. Terminal Strip Labeling:

1. Label panel side of terminal to match panel wire number.

2. Label field side of terminal to match field wire number.

S. Generator System Warning Signs:

1. Provide warning signs for generator systems as required by NEC.

2. Install generator location warning sign on or immediately adjacent to service equipment, or to “normal” source disconnecting means when generator is located out of sight of service equipment or disconnecting means.

3. Install generator grounding warning sign on enclosure or immediately adjacent to point where generator neutral is connected to grounding electrode system if connection is made remote from generator.

END OF SECTION

SECTION 26 05 73

ELECTRICAL SYSTEM STUDY

PART 1 GENERAL

1.1 DESCRIPTION

A. Provide computer-based, fault-current and overcurrent protective device coordination studies and arc flash protection study of all electrical equipment indicated on the Contract Documents.

1.2 WORK INCLUDED

A. Overcurrent Protective Device Coordination: All overcurrent protective devices (OCPD) proposed for this project shall be selected to be selectively coordinated with the overcurrent protective devices installed on their supply side such that an overcurrent event (overload, short-circuit, or ground-fault) occurring at the lowest level in the system (branch circuit) cannot cause the feeder protective device supplying the branch circuit panelboard to open. This coordination shall be carried through each level of distribution for all branches of both normal and emergency power. Best available settings shall be provided for the normal power system. Emergency power coordination shall coordinate to a level of 0.1 seconds.

B. Delegated Design for Short Circuit Analysis: Prepare a computer-based, short circuit study to determine three phase and ground fault at each bus to verify interrupting rating capacity for each equipment.

C. Delegated Design for Arc Flash Hazard Analysis: Prepare a computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

D. Protective devices shall be provided and based on results of this coordination study.

1.3 DEFINITIONS

A. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

B. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

C. SCCR: Short-circuit current rating.

D. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

E. PPE: Personal protective equipment.

1.4 SUBMITTALS

A. The following submittals shall be made for system protective devices specified in all electrical specification sections. The release of electrical equipment submittals (panelboards, engine generators, switchboards, bus ducts, fused switches, circuit breakers, switchgear, etc.) is dependent on the receipt of a complete and accurate overcurrent protective device coordination study. The Engineer requires a full submittal review period as delineated within these specifications to adequately review the OCPD study against the submitted electrical components prior to release of submittals for equipment procurement. The submittal schedule required by the project requirements shall provide for this review time in the action submittal process. Delay claims arising due to Contractor's failure to coordinate simultaneous action submittals will not be considered by the Owner. The following submittals shall be in digital and hard copy form:

1. Coordination-study input data, including completed computer program input data sheets. Provide editable electronic media, including all SKM files and breaker TCC's.

2. Study and Equipment Evaluation Reports.

3. Coordination-Study Report, signed, dated, and sealed by a qualified professional engineer in the state of the project.

4. Short circuit study input data, including completed computer program input data sheets. Utility available fault contribution.

5. Short circuit report, signed, dated, and sealed by a qualified professional engineer in the state of the project.

6. Arc-flash study input data, including completed computer program input data sheets.

7. Arc-Flash Hazard Analysis Report; signed, dated, and sealed by a qualified professional engineer in the state of the project.

B. Product Data: For computer software program to be used for the studies.

C. Qualification Data: For Coordination Study Specialist, Short Circuit and Arc-Flash Hazard Analysis Specialist.

D. Product Certificates: For coordination-study, Short Circuit and fault-current-study computer software programs, certifying compliance with IEEE 399. For arc-flash analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

E. Maintenance procedures according to requirements in NFPA 70E shall be provided in the equipment manuals.

F. Operation and Maintenance Procedures: Provide maintenance procedures for use by the Owner's personnel that comply with requirements in NFPA 70E.

G. Sample of all warning labels.

1.5 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this section. Manual calculations are not acceptable.

B. Delegated Design System Study Specialist Qualifications: Comprehensive engineering analysis by a qualified Professional Engineer or personnel trained and employed by the equipment manufacturer in required calculation methodology.

1. Analysis shall be performed by a Professional Engineer or personnel trained, employed, and supervised by a registered Professional Engineer.

2. Registered professional engineer shall be a full-time employee of the electrical equipment manufacturer or a professional engineering firm.

3. Report shall be signed and sealed by a Professional Engineer with current registration in the state of the project.

4. All reports shall be prepared by the same entity and delivered as a single report with tabbed sections for each study.

C. Comply with IEEE 242 for short-circuit currents and coordination time intervals.

D. Comply with IEEE 399 for general study procedures.

E. Comply with IEEE 1584 for Guide for Performing Arc Flash Hazard Calculations.

PART 2 PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Computer Software Developers: Subject to compliance with requirements, provide products by the following:

1. SKM Systems Analysis, Inc.

2. Power Analytics Corporation.

3. Easy Power LLC.

2.2 COMPUTER SOFTWARE PROGRAM REQUIREMENTS

A. Comply with IEEE 399 for fault-current and overcurrent protective device coordination studies.

B. Comply with IEEE 1584 and NFPA 70E for arc-flash hazard analysis.

C. Analytical features of fault-current-study computer software program shall include “mandatory,” “very desirable,” and “desirable” features as listed in IEEE 399.

D. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate coordination by computer-generated, time-current coordination plots.

2.3 SHORT-CIRCUIT STUDY REPORT CONTENT

A. Executive Summary

B. Study descriptions, purpose, basis and scope of the study.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.

2. Cable ratings and lengths.

3. Transformer kilovolt ampere (kVA) and voltage ratings.

4. Motor and generator designations and kVA ratings.

5. Switchgear, switchboard, motor-control center and panelboard designations.

6. For both normal and emergency power systems.

7. Generators and Automatic Transfer Switches.

8. Fused switches and circuit breakers.

9. Photovoltaic system equipment.

D. Study Input Data: As described in “Power System Data” Article

E. Short-Circuit Study Output:

1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a. Voltage

b. Calculated symmetrical fault-current magnitude and angle.

c. Fault-point X/R ratio.

d. No AC Decrement (NACD) ratio.

e. Equivalent impedence.

f. Incident Energy and Flash Protection Boundary Calculations

g. Arcing fault magnitude.

h. Protective device clearing time.

i. Duration of arc.

j. Arc-flash boundary.

k. Working distance.

l. Incident energy.

m. Hazard risk category.

n. Recommendations for arc-flash energy reduction.

F. Fault study input data, case descriptions, and fault-current calculations, including a definition of terms and guide for interpretation of the computer printout.

G. Equipment specific Arc Flash Warning Labels.

H. Recommendations for system improvements, where needed.

2.4 ARC-FLASH WARNING LABELS

A. Provide a 3.5-by-5-inch thermal transfer label of high-adhesion polyester for each work location included in the analysis.

B. The label shall have an orange header with the wording, “WARNING, ARC-FLASH HAZARD,” and shall include the following information taken directly from the final arc-flash hazard analysis.

1. Flash Hazard Boundary

2. Short Circuit Current Available

3. Shock Hazard when Cover is Removed

4. Limited Approach Boundary

5. Restricted Approach Boundary

6. Prohibited Approach Boundary

7. PPE Requirements, including the following:

   a. Hazard Risk Category

   b. Required Minimum Arc Rating of PPE in cal/cm^2

   c. Clothing Description

8. Engineering report number, revision number, and issue date.

C. Labels shall be machine printed, with no field-applied markings.

D. Labels shall provide all flash boundaries, flash hazard levels, voltage levels, shock hazards and recommended PPE.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance.

1. Proceed with coordination study and arc-flash study only after relevant equipment final submittals have been assembled, but prior to their submission to the Engineer.

   a. Coordination study shall accompany submission of relevant equipment submittals.

3.2 POWER SYSTEM DATA

A. Delegated Design System Analyst performing the short circuit, protective device coordination study, and arc-flash hazard analysis shall furnish the Contractor with a list of required data immediately after award of the contract. Contractor shall expedite collection of the data to ensure completion of the study and analysis, as required.

B. For new equipment, use characteristics of the final submitted shop drawing for all equipment. For existing equipment, this Contractor shall field verify all required equipment ratings and characteristics needed for completing the studies.

C. Source combination shall include present and future motors and generators indicated in the Contract Documents.

D. Gather and tabulate the following input data to support coordination study:

1. Product Data for overcurrent protective devices specified in these specifications and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.

2. Impedance of the incoming utility service entrance.

3. Electrical Distribution System Diagram: In electronic-copy formats, showing the following:

   a. Circuit breakers and fuses ratings and types.

   b. Relays and associated power and current transformer ratings and ratios.

   c. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, X/R ratios, taps measured in percent, and phase shift.

   d. Generator short-circuit current contribution data, including short-circuit reactance, rated kilovolt amperes, size, rated voltage, and X/R ratio.

   e. Cables: Indicate conduit material, sizes of conductors, conductor material insulation, and length.

   f. Busway ampacity, impedance, lengths, and conductor material.

   g. Motor horsepower and code letter designation according to NEMA MG 1.

   h. Low-voltage cable sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).

   i. Medium-voltage cable sizes, lengths, conductor material, and conductor construction and metallic shield performance parameters.

4. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:

   a. Special load considerations, including starting inrush currents and frequent starting and stopping.

   b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capacity.

   c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.

   d. Generator thermal-damage curve.

e. Ratings, types, and settings of the utility company's overcurrent protective devices.

f. Special overcurrent protective device settings or types stipulated by the utility company.

g. Time-current-characteristic curves of devices.

h. Manufacturer, frame size, interrupting rating in amperes RMS symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.

i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.

j. Panelboards, switchboards, switchgear, motor-control center ampacity, and interrupting rating in amperes RMS symmetrical.

3.3 FAULT-CURRENT STUDY

A. A short-circuit current ratings indicated in the Contract Documents are based on Fault-Current study prepared by the Engineer during design and are based on available information and anticipated feeder lengths. Calculate the maximum available short-circuit current in amperes RMS symmetrical at circuit-breaker positions of the electrical power distribution system based on proposed feeder routing and actual equipment being proposed for the project. The calculation shall be for a current immediately after initiation and for a three-phase bolted short-circuit at each of the following:

1. Electric Utility's supply termination point.

2. Switchgear and switchboard buses.

3. Transformers.

4. Distribution panelboards.

5. Branch circuit panelboards.

6. Standby Generators and Automatic Transfer Switches.

7. Enclosed Fused Switches.

8. Enclosed Circuit Breakers.

B. Study the electrical distribution system from normal and emergency power sources throughout electrical distribution system for the Project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.

C. Calculate momentary and interrupting duties on the basis of maximum available fault current.

D. Calculate short-circuit currents according to IEEE 551.

E. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with IEEE 241 and IEEE 242.

1. Transformers, as appropriate for transformers included in the project:

a. ANSI C57.12.10.

b. ANSI C57.12.22.

c. ANSI C57.12.40.

d. IEEE C57.12.00.

e. IEEE C57.96.

2. Medium-Voltage Circuit Breakers: IEEE C37.010.

3. Low-Voltage Circuit Breakers: IEEE 1015 and IEEE C37.20.1.

4. Low-Voltage Fuses: IEEE C37.46.

F. Study Report:

1. Show calculated X/R ratios and equipment interrupting rating (1/2-cycle) fault currents on the electrical distribution system diagram.

G. Equipment Evaluation Report:

1. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated ½-cycle symmetrical fault current.

2. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to ½-cycle symmetrical fault current.

3. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated ½-cycle symmetrical fault current.

4. Notify the Engineer, in writing, of any existing circuit protective devices improperly rated for the calculated available fault current.

3.4 COORDINATION STUDY

A. Provide a coordination study using an approved computer software program. Prepare a written report using results of fault-current study. Comply with IEEE 399.

1. Calculate the maximum and minimum ½-cycle short circuit currents.

2. Calculate the maximum and minimum ground-fault currents.

B. Comply with IEEE 241 and IEEE 242 recommendations for fault currents and time intervals.

C. Transformer Primary Overcurrent Protective Devices:

1. Device shall not operate in response to the following:

a. Inrush current when first energized.

b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.

c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.

2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

D. Utility Over Current Protection: Obtain available short circuit current, inrush current, and upstream protective device time current curves from the local electric utility as needed. Device setting for service entrance over current protection device shall be coordinated with utility device.

E. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Demonstrate that equipment withstands the maximum short circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short circuit current.

F. Coordination-Study Report: Prepare a written report indicating the following results of the coordination study:

1. Tabular Format of Settings Selected for Overcurrent Protective Devices:

a. Device tag.

b. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup values.

c. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.

d. Fuse-current rating and type.

e. Ground-fault relay-pickup and time-delay settings.

2. Coordination Curves: Prepared to determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including the power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

a. Device tag.

b. Voltage and current ratio for curves.

c. Three-phase and single-phase damage points for each transformer.

d. No damage, melting, and clearing curves for fuses.

e. Cable damage curves.

f. Transformer inrush points.

g. Maximum fault-current cutoff point.

h. Motor starting characteristics, damage points and overload relay.

i. Thermal damage curve for motors larger than 100 HP.

j. Generator short circuit decrement curve and damage point, and thermal damage curve.

G. Completed data sheets for setting of all adjustable overcurrent protective devices.

H. Complete Schedule of breaker settings to summarize information contained on data sheets.

3.5 ARC FLASH HAZARD ANALYSIS

A. Comply with NFPA 70E and its Annex D for hazard analysis study.

B. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system where work could be performed on energized parts, including, but not limited to, the following:

1. Disconnect switches.

2. Electrical substations.

3. Electrical switchgear and switchboards.

4. Enclosed circuit breakers.

5. Meter Sockets and assemblies.

6. Panelboards.

7. Automatic or Manual Transfer Switches.

8. Transformers.

9. Emergency Generator.

C. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short circuit and coordination study model. Ground overcurrent protection relays should not be taken into consideration when determining the clearing time when performing incident energy calculations.

D. Calculate the arc-flash protection boundary and the corresponding incident energy calculations for multiple system scenarios to be compared and the greatest incident energy to be uniquely reported for each equipment location. Calculations shall be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions.

1. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors OFF).

2. The maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable.

E. Incident energy calculations shall consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators to be decremented as follows:

1. Fault contribution from induction motors should not be considered beyond 3-5 cycles.

2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible.

F. For each equipment location with a separately enclosed main device, calculations for incident energy and flash protection boundary shall include both the line and load side of the main breaker.

1. When performing incident energy calculations on the line side of a main breaker, the line side and load side contributions must be included in the fault calculation.

G. Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device to compute the incident energy for the corresponding location.

H. Arc Flash calculation shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584 section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash even, a maximum clearing time based on the specific location shall be utilized.

I. Complete Arc Flash report shall be used for the preparation of Arc Flash Warning labels for electrical equipment. Labels shall not be made until the Engineer has no further comments to the final report.

J. Provide an 8-hour instructor led Electrical Safety Training Course which includes NFPA 70E materials, including the selection of personal protective equipment. The training shall be certified and provided by an OSHA authorized Instructor. Training shall occur at the Owner's facility. Training materials shall be provided by this Contractor.

3.6 CORRECT DEFICIENCIES, RE-CALCULATE AND REPORT

A. After the Engineer's initial review, correct unsatisfactory conditions and recalculate to demonstrate compliance, resubmit overcurrent protective devices, as required, to bring the system into compliance.

B. Revise and resubmit report multiple times, as necessary, to demonstrate compliance with all project requirements.

3.7 APPLICATION OF WARNING LABELS

A. Install arc-flash warning labels under the direct supervision and control of the Arc-Flash Hazard Study Specialist. Reference section 26 05 53 for label specifications and locations.

B. Coordinate locations with the Owner prior to any work.

3.8 FIELD ADJUSTMENTS

A. The contractor and equipment vendors shall adjust relay and protective device settings according to the recommended settings provided by the coordination study. This shall be performed prior to equipment being energized.

END OF SECTION

SECTION 26 11 16

SECONDARY UNIT SUBSTATIONS – SECONDARY LESS THAN 1000 V

PART 1 GENERAL

1.1 SCOPE

A. The Contractor shall furnish and install the secondary unit substation(s) complete from the incoming line terminals to the outgoing line terminals as specified herein and as shown on the contract drawings.

B. The secondary unit substation shall consist of primary equipment, transformer and secondary equipment as specified below. The manufacturer of the unit substation shall furnish and coordinate all major components of the substations, including incoming primary equipment section, transformer and low-voltage section, as well as circuit breakers, fusible switches, and metering components. Provide a single warranty covering all substation assemblies, transformers and components.

C. Connections between the primary device and transformer shall be bus and between the transformer and secondary shall be flexible bus braid.

D. Outdoor primary and secondary equipment where specified shall be of weatherproof construction, rodent proof and shall contain 120-volt space heaters, receptacles and lighting as required.

1.2 MEASUREMENT AND PAYMENT

A. This item is to be included in lump sum cost for Unit Substations.

1.3 RELATED SECTIONS

A. Section 26 12 16 – Substation Transformers – Dry-Type

B. Section 26 37 13 - Microgrid Energy Management System

C. Section 26 13 13 – Metal-Enclosed Breaker Switchgear – Medium Voltage

D. Section 26 24 13. – LV Distribution Switchboards – Low Voltage

E. Section 26 24 16. – Panelboards

1.4 REFERENCES

A. The secondary unit substation shall be designed, assembled, tested and installed in accordance with latest applicable standards of NEMA, IEEE and ANSI, applicable to its three major sections:

1. MV Metal-Clad Switchgear – NEMA SG4, SG5; ANSI C37
2. MV Metal-Enclosed Switchgear – NEMA SG4, SG5; ANSI C37
3. MV Load Interrupter Switchgear – NEMA SG4, SG5; ANSI C37
4. MV Motor Controllers – ANSI/NEMA ICS-3-Part 2, UL347
5. Secondary Substation Transformers – NEMA 210, IEEE 100, ANSI C57
6. LV Metal-Enclosed Switchgear – ANSI C37, UL 1558
7. LV Distribution Switchboards – NEMA PB-2, UL 891

1.5 SUBMITTALS – FOR REVIEW/APPROVAL

A. The following information shall be submitted to the Engineer:

1. Master drawing index
2. Front view elevation
3. Floor plan
4. Single line
5. Schematic diagram
6. Nameplate schedule
7. Component list
8. Conduit entry/exit locations
9. Assembly ratings including:
    a. Short-circuit rating
    b. Voltage
    c. Continuous current
    d. Basic Impulse level for equipment over 600 volts
    e. kVA
10. Major component ratings including:

a. Voltage

b. Continuous current

c. Interrupting ratings

11. Cable terminal sizes

12. Connection details between close-coupled assemblies

13. Composite front view and floor plan of close-coupled assemblies

14. Impedance for transformers

15. Product data sheets

B. Where applicable, the following additional information shall be submitted to the Engineer:

1. Busway connection

2. Key interlock scheme drawing and sequence of operation

1.6 SUBMITTALS – FOR CONSTRUCTION

A. The following information shall be submitted for record purposes:

1. Final as-built drawings and information for items listed Paragraph 1.04, and shall incorporate all changes made during the manufacturing process

2. Wiring diagrams

3. Certified production test reports

4. Installation information

5. Seismic certification as specified

1.7 QUALIFICATIONS

A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the

Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

D. Provide Seismic tested equipment as follows:

1. The equipment and major components shall be suitable for and certified by actual seismic testing to meet all applicable seismic requirements of the latest California Building Code (CBC) with OSHPD Amendments.

2. The Project Structural Engineer will provide site specific ground motion criteria for use by the manufacturer to establish SDS values required. See structural drawing S.1.

3. The Importance Factor rating of the equipment shall be 1.5.

4. Contractor shall provide seismic ratings and certifications of equipment as part of the submittal process for review by the Project Structural Engineer to verify equipment ratings are "equal to" or "greater than" those specified for the project site.

5. The following minimum mounting and installation guidelines shall be met, unless specifically modified by the above referenced standards.

a. The Contractor shall provide equipment anchorage details, coordinated with the equipment mounting provision, prepared and stamped by a licensed civil engineer in the state. Mounting recommendations shall be provided by the manufacturer based upon the above criteria to verify the seismic design of the equipment.

b. The equipment manufacturer shall certify that the equipment can withstand, that is, function following the seismic event, including both vertical and lateral required response spectra as specified in above codes.

c. The equipment manufacturer shall document the requirements necessary for proper seismic mounting of the equipment. Seismic qualification shall be considered achieved when the capability of the equipment, meets or exceeds the specified response spectra.

1.8 REGULATORY REQUIREMENTS

A. Certified copies of production test reports shall be supplied demonstrating compliance with these standards when requested by the engineer.

1.9 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.10 OPERATION AND MAINTENANCE MANUALS

A. Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins, and renewal parts lists where applicable for the complete assembly and each major component.

PART 2 A PRODUCTS – PRIMARY EQUIPMENT

Metal-Enclosed Switchgear – Section 26 13 13

B PRODUCTS – TRANSFORMERS

Dry-Type Transformers Section 26 12 16

C PRODUCTS – SECONDARY EQUIPMENT

Switchboards Low Voltage Section 26 24 13

Surge Protection Devices Section 26 43 13

Panelboards Section 26 24 16

Include surge protection device (SPD) on the secondary side of all unit substations.

PART 3 EXECUTION

3.1 FACTORY TESTING

A. Standard factory tests shall be performed on the primary equipment provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.

B. The following factory tests shall be made on all transformers. All tests shall be in accordance with the latest revision of ANSI and NEMA standards.

1. Resistance measurements of all windings on the rated voltage connection of each unit and at the tap extremes of one unit only of a given rating on this project

2. Ratio tests on the rated voltage connection and on all tap connections

3. Polarity and phase-relation tests on the rated voltage connections

4. No-load loss at rated voltage on the rated voltage connection

5. Exciting current at rated voltage on the rated voltage connection

6. Impedance and load loss at rated current on the rated voltage connection of each unit and on the tap extremes of one unit only of a given rating on this project

7. Applied potential test

8. Induced potential tests

9. Temperature test(s) shall be made on all units. Tests shall not be required when there is available a record of a temperature test on an essentially duplicate unit. When a transformer is supplied with auxiliary cooling equipment to provide more than one kVA rating, temperature tests as listed above shall be made on the lowest kVA OA or AA rating and the highest kVA FA rating

10. ANSI impulse test on all primary windings

C. The following standard factory tests shall be performed on the secondary equipment provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.

1. The switchgear shall be completely assembled, wired, adjusted and tested at the factory. After assembly, the complete switchgear shall be tested to ensure the accuracy of the wiring and the functioning of all equipment. The main bus system shall be given a dielectric test of 2200 volts for one minute between live parts and ground and between opposite polarities

2. The wiring and control circuits shall be given a dielectric test of 1500 volts for one minute or 1800 volts for one second between live parts and ground, in accordance with ANSI C37.20.1

D. The manufacturer shall provide three (3) certified copies of factory test reports.

E. Factory tests as outlined above shall be witnessed by the owner's representative unless declined by the owner or owner's representative in writing.

1. The manufacturer shall notify the owner two (2) weeks prior to the date the tests are to be performed

2. The manufacturer shall include the cost of transportation and lodging for up to three (3) owner's representatives. The cost of meals and incidental expenses shall be the owner's responsibility

3.2 FIELD QUALITY CONTROL

A. Provide the services of a qualified factory-trained manufacturer's representative to assist the Contractor in installation and startup of the equipment specified under this section. The manufacturer's representative shall provide technical direction and assistance to the contractor in general assembly of the equipment, connections and adjustments, and testing of the assembly and components contained herein.

B. The Contractor shall provide three (3) copies of the manufacturer's field startup report.

3.3 MANUFACTURER'S CERTIFICATION

A. A qualified factory-trained manufacturer's representative shall certify in writing that the equipment has been installed, adjusted and tested in accordance with the manufacturer's recommendations.

B. The Contractor shall provide three (3) copies of the manufacturer's representative's certification.

3.4 TRAINING

A. The Contractor shall provide a training session for up to five (5) owner's representatives for a minimum of 1 normal workday at a job site location determined by the owner.

B. The training session shall be conducted by a manufacturer's qualified representative. The training program shall include instructions on the assembly including primary equipment, transformer, and secondary equipment. All circuit breakers, protective devices and other major components shall be included.

3.5 INSTALLATION

A. The contractor shall install all equipment per the manufacturer's recommendation and the contract drawings.

B. All necessary hardware to secure the assembly in place shall be provided by the contractor.

END OF SECTION

SECTION 26 12 16

SUBSTATION TRANSFORMERS – DRY-TYPE

PART 1 GENERAL

1.1 SCOPE

A. The Contractor shall furnish and install the primary and/or secondary substation transformers as specified herein and as shown on the contract drawings.

1.2 MEASUREMENT AND PAYMENT

A. This item is to be included in lump sum cost for Unit Substations.

1.3 RELATED SECTIONS

A. 26 11 16 Secondary Unit Substation

1.4 REFERENCES

A. The substation transformers shall be designed, manufactured and tested in accordance with the latest applicable standards of NEMA and ANSI. ANSI C57

1.5 SUBMITTALS – FOR REVIEW/APPROVAL

A. The following information shall be submitted to the Engineer:

1. Master drawing index
2. Front view elevation and weight
3. Plan view
4. Schematic diagrams
5. Nameplate diagram
6. Component list
7. Conduit entry/exit locations
8. Ratings including:
    a. kVA
    b. Primary and secondary voltage
    c. Taps

d. Primary and secondary continuous current

e. Basic Impulse Level

f. Impedance

g. Insulation class and temperature rise

9. Cable terminal sizes

10. Product data sheets

B. Where applicable, the following additional information shall be submitted to the Engineer:

1. Busway connection

2. Connection details between close-coupled assemblies

3. Composite floor plan of close-coupled assemblies

4. Key interlock scheme drawing and sequence of operations

1.6 SUBMITTALS – FOR CONSTRUCTION

A. The following information shall be submitted for record purposes:

1. Final as-built drawings and information for items listed in Section 1.04, and shall incorporate all changes made during the manufacturing process.

2. Wiring diagrams

3. Certified production test reports

4. Installation information

5. Seismic certification as specified

1.7 QUALIFICATIONS

A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an

acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

D. Provide Seismic tested equipment as follows:

1. The equipment and major components shall be suitable for and certified by actual seismic testing to meet all applicable seismic requirements of the latest California Building Code (CBC) with OSHPD Amendments.

2. The Project Structural Engineer will provide site specific ground motion criteria for use by the manufacturer to establish SDS values required. See structural drawing S.1.

3. The Importance Factor rating of the equipment shall be 1.5.

4. Contractor shall provide seismic ratings and certifications of equipment as part of the submittal process for review by the Project Structural Engineer to verify equipment ratings are "equal to" or "greater than" those specified for the project site.

5. The following minimum mounting and installation guidelines shall be met, unless specifically modified by the above referenced standards.

   a. The Contractor shall provide equipment anchorage details, coordinated with the equipment mounting provision, prepared and stamped by a licensed civil engineer in the state. Mounting recommendations shall be provided by the manufacturer based upon the above criteria to verify the seismic design of the equipment.

   b. The equipment manufacturer shall certify that the equipment can withstand, that is, function following the seismic event, including both vertical and lateral required response spectra as specified in above codes.

   c. The equipment manufacturer shall document the requirements necessary for proper seismic mounting of the equipment. Seismic qualification shall be considered achieved when the capability of the equipment, meets or exceeds the specified response spectra.

1.8 REGULATORY REQUIREMENTS

A. UL label required.

1.9 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.10 OPERATION AND MAINTENANCE MANUALS

A. Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.

1.11 FIELD MEASUREMENTS

A. Measure primary and secondary voltages and make appropriate Tap adjustments.

PART 2 PRODUCTS – DRY-TYPE TRANSFORMERS

2.1 MANUFACTURERS

Example Product Manufacturers: Products and manufacturers specified are to establish a standard of quality for design, function, materials, and appearance. Products shall be modified as necessary by the manufacturer for compliance with requirements. The listed manufacturers are provided for example only and are not intended to represent all qualified manufactures. Contractor may select an alternate manufacturer provided the product(s) comply with all design requirements.

A. Eaton (Basis for Design)

B. ABB

C. Schneider Electric

D. GE

The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will also be considered.

2.2 RATINGS

A. The ratings of the transformer shall be as shown on the drawings and described below.

kVA Rating	As shown on drawings	
Impedance	5.75%	ANSI Standard Tolerance
HV	12kV	kV [Delta/Wye as shown on drawings]
HV BIL	95kV	kV
LV	480V	Volts Wye
LV BIL	45	kV

B. Minimum of two 2-1/2 percent FCAN and two 2-1/2 percent FCBN primary taps.

2.3 CONSTRUCTION

A. Forced air (FA) units for 300 kVA and above shall contain all necessary components and wiring, including fans, for automatically increasing the kVA rating by 33%. The (FA) package shall include an electronic temperature monitor and fan control unit. The package shall include a TC-50 Transformer Temperature Controller that monitors up to three (3) ventilated Dry Type transformer windings and (1) ambient temperature. The controller's electronic components shall be conformally coated to prevent premature failure due to extreme environmental conditions. The controller shall operate relays by comparing the highest winding temperature to stored set point temperatures and display four (4) thermocouple inputs as well as the stored maximum temperature and its associated winding. The unit shall provide Fans, Alarm, and Trip output relays. Form C contacts shall be provided to trip the transformer off-line if any of the winding temperatures exceeds the trip setting. A test function shall be provided to: test the digital display and all of the LEDs; simulate over-temperature conditions; and check the internal temperature of the monitor. A 4-20 mA analog signal shall be provided for remote indication or for use with SCADA systems or Microgrid Energy Management System (refer to section 26 37 13 for requirements). Control power shall be provided from a control power transformer in the secondary equipment, a separate, external control power source or internal control power transformer.

B. The electrical insulation system shall utilize Class H material in a fully rated 220 degrees C system. Transformer design temperature rise shall be based on a 30 degrees C average ambient over a 24-hour period with a maximum of 40 degrees C. Solid insulation in the transformer shall consist of inorganic materials such as porcelain, glass fiber, electrical grade glass polyester, electrical grade epoxy, or Nomex. All insulating materials must be rated for continuous 220 degree C duty. The insulation between the high- and low-voltage coils shall be more than sufficient for the voltage stress without the need of a varnish.

C. The transformer shall be designed for a temperature rise of 80 degrees C and shall be capable of operating at 35% above base nameplate kVA capacity continuously without any loss of life.

D. The transformer shall be designed to meet the sound level standards for dry-type transformers as defined in NEMA TR1. The measurement procedure shall be as specified in ANSI C57.12.90.

E. The transformer shall be UL labeled.

F. The transformer shall be of explosion-resistant, fire-resistant, air-insulated, ventilated dry-type construction, and cooled by the natural circulation of air through the windings.

G. High-voltage and low-voltage windings shall be copper. Insulation between layers of the windings shall be by Insuldur paper or equal.

H. For enhanced environmental protection, the entire core and coil assembly shall be Vacuum Pressure Encapsulated (VPE) with a silicone resin per MIL-1-24092. The total VPE process shall apply a four (4) cycle shield of silicone resin to the coils and a two (2) cycle protective shield to the bus, core and support structure. The VPE process shall effectively encapsulate the entire core and coil assembly which results in a transformer which is virtually impermeable to moisture, dust, dirt, salt, air, and other industrial contaminants.

I. The high- and low-voltage coil assembly shall be preheated to evaporate any moisture, then placed into a vacuum pressure tank. The air in the tank shall be evacuated; and at extremely low absolute pressure, all air bubbles are to be drawn out of the insulating materials. The resin shall be introduced to a level that submerges all parts while the vacuum is maintained. Then the vacuum shall be released and pressure applied, after which the coil shall be removed and placed in an oven for several hours in order for the resin to catalyze into a composite mass, completely sealing and binding the winding.

J. The transformer shall be supplied in a knockdown case design, for ease in fitting through limited openings, and shall be of heavy gauge sheet steel construction, equipped with removable panels for access to the core and coils. Front and rear panels shall incorporate lowered ventilating grills.

K. Where outdoor dry-type transformers are shown on the drawings, they shall include thermostatically controlled space heaters fed from an external source which remains energized when the transformer is de-energized or a fused control power transformer connected to the primary side of the substation transformer. Provide NEMA 3R enclosure with special ventilating grills that restrict the passage of rain or spray.

2.4 ACCESSORIES

A. Transformer shall include:

1. Diagram instruction plate

2. Provisions for lifting and jacking

3. Removable center panel for access to high-voltage strap-type connector taps for de-energized tap changing

4. Two ground pads with continuous ground bus

2.5 FINISH

A. The paint shall be applied using an electrostatically deposited dry powder system to a minimum of three (3) mils average thickness. Outdoor dry-type transformer units shall include suitable outdoor paint finish. Units shall be painted ANSI 61 for indoor service or outdoor service and shall match the primary and secondary equipment.

PART 3 EXECUTION

3.1 FACTORY TESTING

A. The following standard factory tests shall be performed on all equipment provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.

1. Resistance measurements of all windings on the rated voltage connection of each unit and at the tap extremes of one unit only of a given rating on this project

2. Ratio tests on the rated voltage connection and on all tap connections

3. Polarity and phase-relation tests on the rated voltage connections

4. No-load loss at rated voltage on the rated voltage connection

5. Exciting current at rated voltage on the rated voltage connection

6. Impedance and load loss at rated current on the rated voltage connection of each unit and on the tap extremes of one unit only of a given rating on this project

7. Applied potential test

8. Induced potential tests

9. For dry-type and cast-coil units, the manufacturer shall perform additional 100% quality control impulse test on the primary windings of each unit

B. The manufacturer shall provide three (3) certified copies of factory test reports.

C. The following special factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest revision of ANSI and NEMA standards.

1. Temperature test(s) shall be made on [all units]. Tests shall not be required when there is an available record of a temperature test on an essentially duplicate unit. When a transformer is supplied with auxiliary cooling equipment to provide more than one rating, temperature tests as listed above shall be made on the lowest kVA OA or AA rating and the highest kVA FA rating

2. ANSI impulse test on all primary windings

D. Factory tests as outlined above shall be witnessed by the owner's representative.

1. The manufacturer shall notify the owner two (2) weeks prior to the date the tests are to be performed

2. The manufacturer shall include the cost of transportation and lodging for up to three (3) owner's representatives. The cost of meals and incidental expenses shall be the owner's responsibility

3.2 FIELD QUALITY CONTROL

A. The Contractor shall provide three (3) copies of the manufacturer's field startup report.

3.3 MANUFACTURER'S CERTIFICATION

A. A qualified factory-trained manufacturer's representative shall certify in writing that the equipment has been installed, adjusted and tested in accordance with the manufacturer's recommendations.

B. The Contractor shall provide three (3) copies of the manufacturer's representative's certification.

3.4 INSTALLATION

A. The Contractors shall install all equipment per the manufacturer's recommendations and the contract drawings.

B. All necessary hardware to secure the assembly in place shall be provided by the Contractor.

3.5 FIELD ADJUSTMENTS

A. Adjust taps to deliver appropriate secondary voltage.

3.6 FIELD TESTING

A. Measure primary and secondary voltages for proper tap settings.

B. Megger primary and secondary windings.

END OF SECTION

SECTION 26 13 13

SWITCHGEAR – METAL ENCLOSED MV BREAKER

PART 1 GENERAL

1.1 SCOPE

A. The Contractor shall furnish and install the medium voltage metal enclosed switchgear equipment as specified herein and as shown on the contract drawings.

1.2 MEASUREMENT & PAYMENT

A. This item is to be included in lump sum cost for unit substations.

1.3 REFERENCES

A. The medium voltage metal-enclosed switchgear and all components shall be designed, manufactured and tested in accordance with the latest applicable standards as follows:

1. ANSI/IEEE C37.20.3
2. ANSI/IEEE C37.20.4
3. ANSI C37.22
4. ANSI C37.57, C37.58
5. EEMAC G8-3.3
6. NEMA SG5
7. NEMA SG6

1.4 SUBMITTALS – FOR REVIEW/APPROVAL

A. The following information shall be submitted to the Engineer by Contractor no later than 15 days after Contractor receives notice to proceed.

1. Master drawing index
2. Front view elevation
3. Floor plan

4. Top view
5. Single line
6. Nameplate schedule
7. Component list
8. Conduit entry/exit locations
9. Assembly ratings including:
    a. Short-circuit rating
    b. Voltage
    c. Continuous current
    d. Basic Impulse Level
10. Major component ratings including:
    a. Voltage
    b. Continuous current
    c. Interrupting ratings
11. Cable terminal sizes
12. Product data sheets

B. Where applicable, the following additional information shall be submitted to the Engineer:

1. Bus duct connection
2. Connection details between close-coupled assemblies
3. Composite floor plan of close-coupled assemblies
4. Key interlock scheme drawing and sequence of operations
5. Descriptive bulletins
6. Product data sheets

1.5 SUBMITTALS – FOR CONSTRUCTION

A. The following information shall be submitted for record purposes:

1. Final as-built drawings and information for items listed in Paragraph 1.04, and shall incorporate all changes made during the manufacturing process

2. Wiring diagrams

3. Certified production test reports

4. Installation information including equipment anchorage provisions

5. Seismic certification as specified

1.6 QUALIFICATIONS

A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

D. Provide Seismic tested equipment as follows:

1. The equipment and major components shall be suitable for and certified by actual seismic testing to meet all applicable seismic requirements of the latest California Building Code (CBC) with OSHPD Amendments.

A. The Project Structural Engineer will provide site specific ground motion criteria for use by the manufacturer to establish SDS values required. See structural drawing S.1.

B. The Importance Factor rating of the equipment shall be 1.5.

C. Contractor shall provide seismic ratings and certifications of equipment as part of the submittal process for review by the Project Structural Engineer to verify equipment ratings are "equal to" or "greater than" those specified for the project site.

2. The following minimum mounting and installation guidelines shall be met, unless specifically modified by the above referenced standards.

a. The Contractor shall provide equipment anchorage details, coordinated with the equipment mounting provision, prepared, and stamped by a licensed civil engineer in the state. Mounting recommendations shall be provided by the

manufacturer based upon the above criteria to verify the seismic design of the equipment.

b. The equipment manufacturer shall certify that the equipment can withstand, that is, function following the seismic event, including both vertical and lateral required response spectra as specified in above codes.

c. The equipment manufacturer shall document the requirements necessary for proper seismic mounting of the equipment. Seismic qualification shall be considered achieved when the capability of the equipment, meets or exceeds the specified response spectra.

1.7 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

B. Each switchgear assembly shall be split into shipping groups for handling as indicated on the drawings or per the manufacturer's recommendations. Shipping groups shall be designed to be shipped by truck, rail or ship. Shipping groups shall be bolted to skids. Accessories shall be packaged and shipped separately. Each switchgear shipping group shall be equipped with lifting eyes for handling solely by crane.

1.8 OPERATION AND MAINTENANCE MANUALS

A. Equipment operation and maintenance manuals shall be provided with each assembly shipped, and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component.

PART 2 PRODUCTS

A. Example Product Manufacturers: Products and manufacturers specified are to establish a standard of quality for design, function, materials, and appearance. Products shall be modified as necessary by the manufacturer for compliance with requirements. The listed manufacturers are provided for example only and are not intended to represent all qualified manufactures. Contractor may select an alternate manufacturer provided the product(s) comply with all design requirements.

2.1 ACCEPTABLE MANUFACTURERS

A. ABB

B. Eaton (Basis for Design)

C. Schneider Electric

The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will also be considered.

2.2 RATINGS – SWITCHGEAR, SWITCH AND CIRCUIT BREAKER

A. The 15 kV switchgear assembly ratings shall be as follows:

Maximum Design Voltage	15 kV
Lighting Impulse Voltage Withstand	95 kV
Nominal System Voltage	12 kV three-phase four wire
System Grounding	solid
Short-Time (2-Second) Current	_____Ka (See Note)

NOTE: SHORT-CIRCUIT CURRENT RATINGS SHALL BE COORDINATED WITH SAN DIEGO GAS & ELECTRIC AND APPROVED BY THE ENGINEER. REFER TO SECTION 2.10.

Main Cross Bus Continuous Current Rating	600 A (minimum)

B. Each circuit breaker shall have the following ratings:

Maximum Voltage	15 kV
BIL Rated	95 kV Peak
Continuous Current (15 kV)	600 A (minimum)
Short-Circuit Current at rated Maximum kV	_____kA RMS sym (See Note)
Rated Voltage Range Factor K	_____
Closing and Latching Capability	_____kA Crest (See Note)
Maximum Symmetrical Interrupting and 3-Second Rating	_____kA RMS SYM (See Note)
Rated Interrupting Time	5 Cycles

NOTE: SHORT-CIRCUIT CURRENT RATINGS SHALL BE COORDINATED WITH SAN DIEGO GAS & ELECTRIC AND APPROVED BY THE ENGINEER. REFER TO SECTION 2.10.

C. Load Interrupter Switches

A.	Non-Fused Switch (Continuous and Load Break)	600 Amperes
B.	Non-Fused Momentary Withstand	61 kA Asym RMS
C.	Non-Fused Switch Fault close RMS	61 kA Asymmetrical
D.	Non-Fused 2-Second short circuit current withstand	38 kA Sym RMS
E.	Fuse Rating	200 Amperes
F.	Type of Fuse	Boric Acid Expulsion
G.	Fuse Interrupting Rating	14.4 kA Sym RMS
H.	Fused Switch Fault Close	23 kA Asym RMS

NOTE: SHORT-CIRCUIT CURRENT RATINGS SHALL BE COORDINATED WITH SAN DIEGO GAS & ELECTRIC AND APPROVED BY THE ENGINEER.

2.3 CONSTRUCTION

A. The switchgear assembly shall consist of deadfront, completely metal-enclosed vertical sections each containing drawout vacuum circuit breakers and where shown, furnish additional vertical sections containing load interrupter switches and fuses or miscellaneous auxiliary apparatus of the number, rating and type noted on the drawings or specified herein.

B. The total depth of the switchgear shall be no more than 6’8” at any point.

C. The following feature shall be supplied on every vertical section containing a drawout vacuum circuit breaker:

D. High voltage parts within circuit breaker compartments shall be isolated with grounded metal barriers.

E. Vertical section construction shall be of the universal frame type using die-formed and bolted parts. All enclosing covers and doors shall be fabricated from steel whose thickness shall be equal to or greater than those specified in ANSI/IEEE C37.20.3. No owner removable hardware for covers or doors shall be thread forming type. To facilitate installation and maintenance of cables and bus in each vertical section, a

split removable top cover and hinged, bolted rear door with padlock provisions shall be provided. A high quality G90 grade galvanized base will isolate equipment from contact with the concrete pad providing protection from rust. Heavy-duty hot dipped galvanized anchor clips shall be provided to anchor the switchgear to the concrete pad.

F. Each vertical section shall be ventilated at the top and bottom, both front and rear, to allow airflow to help prevent buildup of moisture within the structure. For dust-resistant or outdoor applications, the ventilated covers shall be externally removable to allow safe maintenance of the filter media without providing access to live parts.

G. Each vertical section containing a switch shall have a single, full-length, flanged front door and shall be equipped with two rotary latch-type padlockable handles. A nameplate shall be mounted on the front door of each vertical section.

2.4 BUS

A. All buses shall be tin-plated copper or silver-plated copper.

B. Ground bus shall be silver-plated copper and be directly fastened to a galvanized metal surface of each vertical section and be of a size sufficient to carry the rated (2-second) current of the switchgear assembly.

C. A neutral bus shall be provided when indicated on the drawings. It shall be insulated for 1000 Vac to ground. The current rating of the neutral bus shall be 600 amperes.

2.5 BUS SUPPORTING SYSTEMS

A. All bus shall be supported utilizing a high strength and high creep, support providing a minimum of 10.5-inch of creep between phases and ground. The molded fins shall be constructed of high track-resistant aramid nylon, silicone rubber, or cycloaliphatic epoxy.

B. All standoff insulators on the primary switches and fuse mountings shall be glass polyester or cycloaliphatic epoxy

2.6 WIRING/TERMINATIONS

A. One terminal pad per phase shall be provided for attaching Contractor supplied cable terminal lugs for a maximum of two conductors per phase of the sizes indicated on the drawings. Sufficient space shall be allowed for Contractor supplied electrical stress relief termination devices.

B. Small wiring, fuse blocks and terminal blocks within the vertical section shall be furnished as indicated on the drawings. Each control wire shall be labeled with wire markers. Terminal blocks shall be provided for owner connections to other apparatus.

2.7 CIRCUIT BREAKER

A. Each circuit breaker shall be operated by a motor-charged spring stored energy mechanism. The spring may be charged manually in an emergency or during maintenance procedures.

B. Each circuit breaker shall have three (3) vacuum interrupter assemblies that are separately mounted on glass polyester insulators. Each vacuum interrupter shall have a contact wear indicator which does not require any tools to indicate the contact wear. The current transfer from the vacuum interrupter moving stem to the breaker main conductor shall be a non-sliding design. The breaker front panel shall be removable when the compartment door is open for ease of inspection and maintenance of the mechanism.

C. The breakers shall be electrically operated using the same control voltage as other equipment in the Unit Substation as described in related sections of this specification:

   1. Contractor to coordinate all equipment procured to determine voltages for control signals. Acceptable voltages are 120 or 240 Vac and 48 or 125 Vdc.

   2. Each breaker shall be complete with control switch and red and green indicating lights to indicate breaker contact position.

D. The control voltage shall be derived from a control power transformer mounted in the switchgear and shall meet the requirements described in section 26 37 13 Microgrid Energy Management System and section 26 11 16 Secondary Unit Substation.

2.8 PROTECTIVE RELAYS

A. The switchgear manufacturer shall furnish and install, in the metal-enclosed switchgear, the quantity, type and rating of protection relays as indicated on the drawings and described hereinafter in this specification and in related specification sections.

B. Microprocessor Three-Phase Protective Relay, providing the following functions at a minimum, as well as any functions needed to support the requirements indicated on the drawings and in related sections of this specification.

   1. Microprocessor-based multi-function overcurrent relay, ANSI device function 51/50, 51/50N, or 51/50G, and 86.

2.9 LOAD INTERRUPTER SWITCHES

A. Each load interrupter switch shall have a manual over-toggle type mechanism that does not require the use of a chain or a cable for operation and utilizes a heavy-duty coil spring to provide opening and closing action. The speed of opening and closing the switch shall be independent of the operator, and it shall be impossible to tease the switch into any intermediate position.

B. The interrupter switch shall have separate main and break contacts to provide maximum endurance for fault close and load interrupting duty.

C. The interrupter switch shall have insulating barriers between each phase and between the outer phases and the enclosure.

D. A maintenance provision shall be provided for slow closing the switch to check switch-blade engagement and slow opening the switch to check operation of the arc interrupting contacts.

E. For fused switch cubicles, fault protection shall be furnished by fuses with continuous ratings as shown in the contract documents. The fuses shall be RBA expulsion type or approved equivalent with three (3) spare fuse refills for each fused switch.

F. The following features shall be supplied on every vertical section containing a three-pole, two-position open-closed switch or switch and fuse:

1. The door shall be interlocked with the switch so that:

   a. The switch must be opened before the door can be opened

   b. The door must be closed before the switch can be closed

2. A minimum 8-inch x 16-inch high-impact viewing window that permits full view of the position of all three switch blades through the closed door. The window shall not be more than 58-inches above the switch pad level to allow ease of inspection

3. A hinged grounded metal barrier bolted closed in front of every switch to prevent inadvertent contact with any live part, yet allow for a full-view inspection on the switch blade position

4. Provision for padlocking the switch in the open or closed position

5. Green OPEN, Red CLOSED switch position indicators with the words “Open” and “Closed” in French, Spanish and English

6. A hinged cover with rustproof quarter turn nylon latches over the switch operating mechanism to discourage casual tampering

7. The switch shall be removable as a complete operational component

8. Provision shall be made for operating the switch and storing the removable handle without opening the full-length door.

2.10 UTILITY METERING & COORDINATION STUDY

A. Contractor shall coordinate with local electric utility and provide metering section and underground pull section on Substation A that meets the requirements of the local

utility. Each utility metering vertical section shall contain provisions for current transformers and voltage transformers as required by the utility. The construction shall conform to the utility company's metering standards. It shall also conform to the general electrical and construction design of the switchgear specified above.

B. Include a complete coordination, short circuit and arc flash hazard analysis study from incoming power lines through the medium voltage and low voltage switchgear prior to installation. Obtain available short circuit current, inrush current, and upstream protective device time current curves from the local electric utility as needed. Include arc flash hazard labels on equipment where appropriate according to local and national codes. See Section 26 05 73 Electrical System Study.

2.11 TRANSFORMER CONNECTIONS

1. A transformer primary load interrupter switch shall include the following when connecting to an indoor ventilated dry type secondary unit substation transformer, such as VPI, VPE or Cast Coil design

    a. Cable or bus bar connection from the load side of the fuse (or load side of an unfused switch) to the HV terminal pad locations of the transformer

    b. Include a connection for the ground bar termination to connect the switch enclosure to the transformer enclosure

    c. A bus transition section is not required for indoor applications. When the transformer and switch are outdoor, provide a 15" throat with a 5" flange (20" altogether) with flange dimensions to match the dimensions of the transformer flange.

2. A transformer primary load interrupter switch shall include the following when connecting to an indoor or outdoor liquid filled transformer, such as mineral oil, FR3, or silicone filled transformer

    a. Cable or bus bar connection from the load side of the fuse (or load side of an unfused switch) to the HV bushing terminal pad on the primary of the transformer.

    b. Include a connection for the ground bar to connect the switch enclosure to the transformer enclosure

    c. A 20"W bus transition section shall be provided. If outdoor, provide a 15" throat with a 5" flange (20" altogether) with flange dimensions to match the dimensions of the transformer flange.

2.12 ACCESSORIES

A. Furnish, distribution class surge arresters with ratings in accordance with manufacture's recommendations.

2.13 ENCLOSURES

A. Each vertical section shall have a sloped weatherproof roof with labyrinth shaped joints. Use of gasket or caulking to make roof joints weatherproof shall not be permitted. All exterior openings shall be screened to prevent the entrance of small animals and barriered to inhibit the entrance of snow, sand, etc. A minimum of one (1) 250-watt, 120-volt space heater shall be provided in each vertical section. Power for the space heater(s) shall be furnished by a fused control power transformer. The design shall be non-walk-in type.

B. Enclosure shall be Dust Resistant. All ventilated openings shall be filtered to inhibit the ingress of dust. The ventilated covers shall be externally removable to allow safe maintenance of the filter media without providing access to live parts. All external doors and covers shall be gasketed.

C. Enclosures shall be constructed per IEEE/ANSI C37.20.3 Outdoor specifications. (Meets or Exceeds NEMA 3R.)

2.14 NAMEPLATES

A. A nameplate shall be mounted on the front door of each switch vertical section in accordance with the drawings.

2.15 FINISH

A. Prior to assembly, all enclosing steel shall be thoroughly cleaned and phosphatized. A powder coating shall be applied electrostatically, then fused on by baking in an oven. The coating is to have a thickness of not less than 1.5 mils. The finish shall have the following properties:

Impact resistance (ASTM D-2794)	60 direct/60 indirect
Pencil hardness (ASTM D-3363)	H
Flexibility (ASTM D-522)	Pass 1/8-inch mandrel
Salt spray (ASTM B117-85 [20])	600 hours
Color	ANSI 61 gray

2.16 MISCELLANEOUS DEVICES

A. Communication equipment where indicated on the drawings, shall have the following features and shall be compatible with, and meet the requirements of section 26 37 13 Microgrid Energy Management System.

1. Each breaker or load interrupter switch position (open and closed), where shown, shall be communicated via an addressable relay. This relay shall communicate over a local area network (LAN). The relay shall monitor an auxiliary switch contact that monitors the breaker or switch position and shall be rated for the application. Each relay shall have a unique address so that it is possible to “call up” and “read” each load interrupter switch’s position from a host computer.

2. A blown high voltage fuse condition on each set of three fuses shall be monitored by an addressable relay. Any blown fuse operation shall be communicated immediately over a local area network (LAN) via the monitoring addressable relay. Each relay shall have a unique address so that it is possible to “call up” and “read” a fuse blown operation for a set of fuses with the communication system

3. The manufacturer shall wire a LAN within the switchgear to all communication capable devices with the same protocol and wire the LAN to a set of easily accessible terminal blocks

4. Control power for addressable relays shall be as described in section 26 37 13 Microgrid Energy Management System.

PART 3 EXECUTION

3.1 FACTORY TESTING

A. The following standard factory tests shall be performed on the circuit breaker element provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.

1. Circuit breaker operated over the range of minimum to maximum control voltage

2. Factory setting of contact gap

3. One (1) minute dielectric test per ANSI standards

4. Final inspections and quality checks.

B. The following production test shall be performed on the circuit breaker housing:

1. One (1) minute dielectric test per ANSI standards on primary and secondary circuits

2. Operation of wiring, relays and other devices verified by an operational sequence test

3. Final inspection and quality check.

C. The manufacturer shall provide three (3) certified copies of factory test reports.

3.2 FIELD QUALITY CONTROL

A. The Contractor shall provide three (3) copies of the manufacturer’s field startup report.

3.3 INSTALLATION

A. The Contractor shall install all equipment per the manufacturer's recommendations and the contract drawings.

B. All necessary hardware to secure the assembly in place shall be provided by the Contractor.

3.4 FIELD ADJUSTMENTS

A. The relays shall be set in the field by:

1. The Contractor in accordance with settings designated by the Engineer

END OF SECTION

SECTION 26 24 13

SWITCHBOARDS

PART 1 GENERAL

1.1 SUMMARY

A. Scope: Provide labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, configuration and installation for low voltage switchboards (also identified as SWBDs) as required for the complete performance of the Work, as shown on the Drawings, as specified herein.

B. Related Sections: Related sections include, but shall not be limited to, the following:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

2. Applicable general requirements for electrical Work specified within Division 26 Specification Sections apply to this Section.

3. The following SWBD information is typically depicted on the Drawings: bus configuration, bus ratings, interrupting ratings, component size and type, power line and feeder connections, application specific control wiring, elevation and footprint, etc. Where not shown on or able to be derived from the Drawings, the minimum requirements specified herein shall be provided.

4. Section 26 37 13 Microgrid Energy Management System

5. Section 26 11 16 Secondary Unit Substation

6. Section 26 43 13 Surge Protection Devices

1.2 MEASUREMENT AND PAYMENT

A. This item is to be included in lump sum cost for Unit Substations.

1.3 REFERENCES

A. General, Publications: The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.

1. ASTM (ASTM):

a. ASTM E 329, "Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction."

2. Federal Specifications (FS):

a. FS W-C-375, "Circuit Breakers, Molded Case, Branch Circuit and Service."

3. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

a. ANSI/IEEE C57.13, "Standard Requirements for Instrument Transformers".

4. International Electrical Testing Association (NETA):

a. NETA ATS, "Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems."

5. International Organization for Standardization (ISO):

a. ISO 9001, "Quality Management Systems - Requirements."

b. ISO 14001, “Environmental Management Systems – Requirements”

6. National Electrical Contractors Association (NECA):

a. NECA 400, “Standard for Installing and Maintaining Switchboards"

7. National Electrical Manufacturers Association (NEMA):

a. NEMA EI 21.1, "Instrument Transformers for Revenue Metering (110 kV BIL and Less).”

b. NEMA KS 1, "Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)"

c. NEMA PB 2, "Deadfront Distribution Switchboards."

d. NEMA PB 2.1, "General Instructions for Proper Handling, Installation, Operation and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less."

8. National Fire Protection Association (NFPA):

a. NFPA 70, "National Electrical Code" (NEC)

b. NFPA 70B, “Electrical Equipment Maintenance”

c. NFPA 70E, “Standard for Electrical Safety in the Workplace”

9. Underwriters Laboratories, Inc. (UL):

a. UL 98, "Standard for Enclosed and Dead-Front Switches"

b. UL 489, "Standard for Molded-Case Circuit Breakers and Circuit Breaker Enclosures."

c. UL 891, "Standard for Dead-Front Switchboards"

d. UL 943, "Standard for Ground-Fault Circuit Interrupters"

e. UL 1283, “Standard for Safety for Electro-Magnetic Interference Filters"

f. UL 1449, "Standard for Surge Protective Devices"

1.4 DEFINITIONS

A. Unless specifically defined within the Contract Documents, the words or acronyms contained within this specification shall be as defined within, or by the references listed within this specification, the Contract Documents, or, if not listed by either, by common industry practice.

1.5 SUBMITTALS

A. General: Submittals shall be in accordance with the requirements of Section [01 33 00], in addition to those specified herein.

1. Submit sufficient information to determine compliance with the Contract Documents. Identify submittal data with the specific equipment tags and/or service descriptions to which they pertain. Submittal data shall be clearly marked to identify the specific model numbers, options, and features of equipment and work proposed.

2. Submit required product data and shop drawings specific to each product and accessory proposed. In addition, include the following information, including dimensions and manufacturer’s technical data on features, performance, ratings and finishes:

a. Each type of SWBD overcurrent protective device

b. Surge Protective Devices (SPD)

c. Ground Fault Protectors

d. Additional accessories and components indicated herein.

e. Indicate front and side enclosure elevations with overall dimensions, conduit entrance locations and requirements, nameplate legends, one-line diagrams, equipment schedule and switchboard instrument details.

f. Submit mimic-bus diagram.

3. Wiring Diagrams: Submit wiring diagrams detailing power, signal, and control systems, clearly differentiating between manufacturer-installed wiring and field-installed wiring, and between components provided by the manufacturer and those provided by others.

4. Quality Control Submittals:

a. Test Reports: Submit field quality control test reports.

B. Operation & Maintenance (O&M) manuals shall be provided in accordance with the minimum requirements specified in Section [01 78 23] Operation and Maintenance Data, and additional requirements specified herein.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall be a firm engaged in the manufacture of specified products of types and sizes required, and whose products have been in satisfactory use in similar service for a minimum of 20 years.

1. The manufacturer shall have a valid ISO 9001 certification and an applicable quality assurance system that is regularly reviewed and audited by a third-party registrar. Manufacturing, inspection, and testing procedures shall be developed and controlled under the guidelines of the quality assurance system.

2. The manufacturer shall have the ISO 14001 Environment Certification and shall supply the Product Environmental Profile (P.E.P.) upon request of the Engineer.

B. Provide Seismic tested equipment as follows:

1. The equipment and major components shall be suitable for and certified by actual seismic testing to meet all applicable seismic requirements of the latest California Building Code (CBC) with OSHPD Amendments.

2. The Project Structural Engineer will provide site specific ground motion criteria for use by the manufacturer to establish SDS values required. See structural drawing S.1.

3. The Importance Factor rating of the equipment shall be 1.5.

4. Contractor shall provide seismic ratings and certifications of equipment as part of the submittal process for review by the Project Structural Engineer to verify equipment ratings are "equal to" or "greater than" those specified for the project site.

5. The following minimum mounting and installation guidelines shall be met, unless specifically modified by the above referenced standards.

    a. The Contractor shall provide equipment anchorage details, coordinated with the equipment mounting provision, prepared, and stamped by a licensed civil engineer in the state. Mounting recommendations shall be provided by the manufacturer based upon the above criteria to verify the seismic design of the equipment.

    b. The equipment manufacturer shall certify that the equipment can withstand, that is, function following the seismic event, including both vertical and lateral required response spectra as specified in above codes.

    c. The equipment manufacturer shall document the requirements necessary for proper seismic mounting of the equipment. Seismic qualification shall be considered achieved when the capability of the equipment, meets or exceeds the specified response spectra.

C. Installer Qualifications: Installer shall be a firm that shall have a minimum of five years of successful installation experience with projects utilizing switchboards similar in type and scope to that required for this Project.

D. Inspecting and Testing Agency Qualifications: To qualify for acceptance, an independent inspecting and testing agency hired by the Contractor or manufacturer to test products shall demonstrate to the Architect/Engineer's satisfaction that they are qualified according to ASTM E 329 to conduct testing indicated.

E. All work performed and all materials used shall be in accordance with the National Electrical Code, and with applicable local regulations and ordinances. Equipment, assemblies and materials shall be listed and labeled by Underwriter's Laboratories or by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Prior to delivery to the Project site, ensure that suitable storage space is available to store materials in a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity, and corrosive atmospheres. Materials shall be protected during delivery and storage and shall not exceed the manufacturer stated storage requirements. As a minimum, store indoors in clean, dry space with uniform temperature to prevent condensation. In addition, protect electronics from all forms of electrical and magnetic energy that could reasonably cause damage.

B. Deliver materials to the Project site in supplier's or manufacturer's original wrappings and containers, labeled with supplier's or manufacturer's name, material or product brand name, and equipment tag number or service name as identified within the Contract Documents.

C. Inspect and report any concealed damage or violation of delivery storage, and handling requirements to the Engineer.

1.8 WARRANTY

A. General: Refer to Section 01 77 00 - Closeout Procedures

B. Surge Protective Devices: Warranty shall be provided by the equipment manufacturer and supported by their respective field services organization, for a period of five years, incorporating unlimited replacement of suppressor parts.

C. Additional Owner Rights: The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

1.9 SPECIAL TOOLS AND SPARE PARTS

A. The Contractor shall provide a recommended spare parts list with the following information provided as a minimum:

1. Contact information for the closest parts stocking location to the Owner.

2. Critical spare parts shall be identified as those parts being associated with long lead times and/or those being critical to the unit's operation.

3. Maintenance spares shall be identified as being those parts required to regularly perform scheduled maintenance on the furnished equipment. These spares shall include, but shall not be limited to, consumable spares that are required to be exchanged during scheduled maintenance periods.

B. Spare parts shall be provided for each type and size of unit installed. At a minimum, the following shall be provided:

1. Provide the minimum spare parts recommended by the manufacturer.

C. Any manufacturer specific special tool, not normally found in an electrician’s toolbox, required to remove and install recommended or furnished spare parts shall be furnished. At a minimum the following shall be provided:

1. If available from manufacturer, provide PC-based configuration software tool and a minimum of [one] communication interface cable for each type of cable required to connect a PC-based computer to the devices specified herein for configuration and programming.

2. Electronic configuration files, in a media format acceptable by the Owner (e.g. CD, USB stick, etc.), updated to an as-installed and commissioned state.

3. Provide a minimum of one compatible communication interface and programming device and required connection cable for each device specified herein for configuration and programming.

D. Spare parts shall be properly marked and packaged for long term storage. Printed circuit boards shall be provided in separate anti-static containers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Example Product Manufacturers: Products and manufacturers specified are to establish a standard of quality for design, function, materials, and appearance. Products shall be modified as necessary by the manufacturer for compliance with requirements. The listed manufacturers are provided for example only and are not intended to represent all qualified manufactures. Contractor may select an alternate manufacturer provided the product(s) comply with all design requirements.

- Eaton (basis for design)
- ABB
- Schneider Electric

2.2 General Requirements

A. The following SWBD information is typically depicted on the Drawings: bus configuration, bus ratings, interrupting ratings, component size and type, power line and feeder connections, application specific control wiring, elevation and footprint, etc. Where not shown on or able to be derived from the Drawings, the minimum requirements specified herein shall be provided.

B. Front Accessible Switchboard: Provide main & branch breakers with sections front and rear aligned.

C. Nominal System Voltage: Nominal AC system voltage shall be 480Y/277 volts. If applicable, auxiliary DC systems shall be rated up to 250V.

D. Main bus continuous rating: as shown on drawings

E. Short circuit current ratings: 100 kA

F. Enclosure: Provide steel enclosure, in compliance with UL 891, NEMA Type 3R.

G. Enclosure Finish: Provide factory-applied finish in manufacturer's paint over a rust-inhibiting primer on treated metal surface.

H. Barriers: Provide barriers between adjacent switchboard sections.

I. Insulation and isolation: Provide taped bus for through bus.

J. Strip Heaters: Provide factory-installed electric strip heaters of sufficient wattage in each vertical section to maintain enclosure temperature above expected dew point.

1. Strip Heater Control: Provide thermostats to maintain temperature of each section above expected dew point and humidistat to control humidity of each section.

2. Strip Heater Power Source: Provide transformer, factory-installed in switchboard.

K. Bussed Auxiliary Section: If required to satisfy design requirements per the drawings, Auxiliary section shall be matched and aligned with basic switchboard.

L. Bus Transition and Incoming Pull Sections: Match and align with basic switchboard.

M. Front Covers and Doors:

1. Front covers shall be screw removable with a single tool.

2. All doors shall be hinged with removable hinge pins.

N. Buses and Connections: Three phase, four wire, unless otherwise indicated. Provide hard-drawn plated copper of 98 percent conductivity.

1. Group-Mounted Feeder Vertical Bus Stack:

a. Bus stack shall be capable of mounting feeder breakers with different frame sizes and number of poles across from one another on the bus stack.

b. Non-conducting surface films shall be removed during circuit breaker installation by a wiping action of the circuit breaker jaws.

c. The design of the circuit breaker jaws and bus stack shall create blowon forces under fault conditions.

d. Bolted lap joint connections for feeder breakers shall not be allowed for group-mounted feeders.

2. Ground Bus: Size per current NEC and UL 891 Tables 28.1 and 28.2, hard-drawn copper of 98 percent conductivity, equipped with pressure connectors for feeder and branch circuit ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.

3. Bus Composition: Tin plated copper. Plating shall be applied continuously to bus work. The switchboard bussing shall be of sufficient cross-sectional area to meet UL 891 temperature rise requirements. The phase and neutral through-bus shall have an ampacity as shown on the Drawings. For four-wire systems, the neutral shall be of equivalent ampacity as the phase bus bar. Tapered bus is not permitted. Full provisions for the addition of future sections shall be provided. Bussing shall include, but shall not be limited to, necessary hardware to accommodate splicing for future additions.

4. Isolation Barrier Access Provisions: Allows for inspection access to check bus bolt torque values.

O. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit breaker compartment.

P. Switchgear shall be seismic zone 4 and have seismic certification as required by the Authority Having Jurisdiction.

Q. All main circuit breakers utilized within the Microgrid Energy Management System (MEMS) for control shall be electrically operated and capable of being opened and closed by commands over the MEMS Ethernet network. Branch circuit breakers used to supply battery electric bus charging circuits shall at a minimum be capable of being shunt-tripped by the MEMS with manual reset. The circuit breakers should also allow for manual operation. See Section 26 37 13 - MICROGRID ENERGY MANAGEMENT SYSTEM for additional details.

2.3 SURGE PROTECTIVE DEVICES (SPD)

A. Install surge protective devices that meet or exceed the following criteria:

1. Minimum surge current capability (single pulse rated) per phase shall be 240 kA,

2. UL 1449 suppression voltage rating, voltage L-N, L-G, N-G, shall be 480Y/277 volts.

B. EMI/RFI filtering shall be minimum -50 dB at 100 kHz with insertion ratio of 50:1 using MIL-STD-220 methodology.

C. Provide with one set of NO/NC dry contacts.

D. Accessories shall include but shall not be limited to, six-digit transient counter set to total transient surges that deviate from the sine wave envelope by more than 125 volts.

2.4 OVERCURRENT PROTECTIVE DEVICES

A. Breaker Type:

1. Molded case circuit breakers

2. Insulated case circuit breaker

3. Electronic trip, standard and advanced.

B. Molded Case Circuit Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.

1. Lugs: Compression style, suitable for number, size, trip ratings, and conductor material.

2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

3. Trip units shall be interchangeable within frame size.

4. Current Limiting Characteristics: Circuit breaker upstream of charging cabinet shall be provided with current limiting characteristics that is capable of reducing fault current under 35kA. Refer to single line diagram for breakers that require this feature. Acceptable circuit breakers model includes ABB T5 series but not limited other manufacture and/or model that achieves the equivalent function.

5. Ground Fault Protection: Integral to circuit breaker with adjustable pickup and time delay settings, push-to-test feature, and ground fault indicator.

6. Remote: Where indicated on drawings, circuit breaker must be capable of remote operation (open and close) as well as reporting status (open, close, and tripped). Coordinate remote features with Section 26 37 13 - MICROGRID ENERGY MANAGEMENT SYSTEM.

7. Communication Capability: See Section 26 24 13, 2.8

8. Shunt Trip: 120 volt trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.

9. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1 second to 0.6 second time delay.

10. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts shall mimic circuit breaker contacts, "b" contacts shall operate in reverse of circuit breaker contacts.

11. All molded case circuit breakers shall be capable of being permanently locked open (lock-out tag-out) without the use of an additional device.

C. Enclosed, Insulated Case Circuit Breaker: Fully rated, encased power circuit breaker with interrupting capacity rating to meet available fault current.

1. Mounting: Drawout circuit breaker mounting or fixed mount as indicated on drawings.

2. Closing: Two-step, stored energy closing.

3. Trip Units: Microprocessor-based trip units with interchangeable rating plug, LED trip indicators, and the following field-adjustable settings:

   a. Instantaneous trip.

   b. Long-time and short-time pickup levels.

   c. Long-time and short-time time adjustments with I2t response.

   d. Ground fault pickup level, time delay, and I2t response.

4. Remote: Where indicated on drawings, circuit breaker must be capable of remote operation (open and close) as well as reporting status (open, close, and tripped). Coordinate remote features with Section 26 37 13 - MICROGRID ENERGY MANAGEMENT SYSTEM.

5. Shunt Trip: 120 volt trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.

6. Sequence of Operations: See Section 26 24 13, 2.8

7. Control Voltage: See Section 26 37 13 - MICROGRID ENERGY MANAGEMENT SYSTEM

8. All circuit breakers shall be capable of being permanently locked open (lock-out tag-out) without the use of an additional device.

2.5 CONTROL POWER

A. Control Circuits: 120 volts, supplied through secondary disconnecting devices from control power transformer.

2.6 ACCESSORIES

A. Provide accessory set, including, but not limited to, tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Provide one remote racking device for drawout circuit breakers.

C. Provide portable test set to test functions of solid state trip devices without removal from switchboard. Include relay and meter test plugs suitable for testing switchboard meters and switchboard class relays.

D. Provide one portable, floor-supported, roller-based, elevating carriage arranged for movement of circuit breakers in and out of compartments for present and future circuit breakers.

E. Provide overhead circuit breaker lifting device, mounted at top front of switchboard, with hoist and lifting yokes matching each drawout circuit breaker.

2.7 POWER Metering

A. Provide a power meter for each application as described in section 26 37 13 Microgrid Energy Management System.

B. Instrument Transformers: NEMA EI 21.1, ANSI/IEEE C57.13, and the following:

1. Potential Transformers: Secondary voltage rating of 120 volts and NEMA accuracy class of 0.3 with burdens of W, X, and Y.

2. Current Transformers: Ratios shall be as indicated with accuracy class and burden suitable for connected relays, meters, and instruments.

3. Control Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kV.

4. Current Transformers for Neutral and Ground Fault Current Sensing: Connect secondaries to ground overcurrent relays to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit breaker ground fault protection.

2.8 COMMUNICATIONS

A. Switchgear/switchboard lineup shall include communications capabilities as specified in section 26 37 13 Microgrid Energy Management System.

2.9 ELECTRICAL POWER MANAGEMENT SYSTEM

A. Switchgear/switchboard lineup shall include power management capabilities as specified in Section 26 37 13 - MICROGRID ENERGY MANAGEMENT SYSTEM.

2.10 SWITCHBOARD LIGHTING

Provide convenience lights inside cabinet. Lights should be activated when weatherproof door is opened and shall provide illumination of equipment on switchboard.

2.11 MARKINGS AND LABELING

A. All identification and warning labels and nameplates exterior to the SWBD shall be resistant to weather, UV and their intended installation environment.

B. Each SWBD shall be provided with an engraved nameplate identifying the project specific equipment tag and service description.

C. Warning labels and nameplates shall be present at access locations to advise personnel of possible hazards. The SWBD shall be marked in accordance with UL, NFPA 70 NEC, NFPA 70E, and other applicable standards.

D. Mimic Bus: Provide an anodized aluminum or plastic engraved plaque. Arrange in single-line diagram format, using symbols and letter designations consistent with final mimic bus diagram. Produce a concise visual presentation of principal switchboard components and connections.

PART 3 - EXECUTION

3.1 GENERAL

A. In addition to the requirements specified herein, execution shall be in accordance with the requirements of Specification Section 26 05 05 and Drawings.

B. Examine equipment exterior and interior prior to installation. Report any damage and do not install any equipment that is structurally, moisture, or mildew damaged.

C. Verification of Conditions: Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Owner and the Engineer, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

D. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Installer.

E. Install equipment in accordance with reviewed product data, final shop drawings, manufacturer’s written instructions and recommendations, and as indicated on the Drawings.

F. Functional testing, commissioning, and first parameter adjusting shall be carried out by a factory trained manufacturer’s representative field service engineer. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment. Report to the Engineer any discrepancies or issues with the installation.

G. Provide final protection and maintain conditions in a manner acceptable to the manufacturer that shall help ensure that the equipment is without damage at time of Substantial Completion.

3.2 INSTALLATION

A. Pre-Installation Conference: Conduct pre-installation conference. Prior to commencing the installation, meet at the Project site to review the material selections, installation procedures, and coordination with other trades. Pre-installation conference shall include, but shall not be limited to, the Contractor, the Installer, and any trade that requires coordination with the work. Date and time of the pre-installation conference shall be acceptable to the Owner and the Engineer.

B. Install switchboards and accessories according to NEMA PB 2.1 and NECA 400.

C. Install and anchor switchboards level on concrete bases. Concrete base is specified in drawings, and concrete materials and installation requirements are specified in Division 03 - Concrete.

D. Frame and mount the printed basic operating instructions for switchboards, including, but not limited to, control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.

E. Adjust circuit breaker trip and time delay settings to values indicated within coordination study or as instructed by the Engineer.

F. Measure, using a Megger, the insulation resistance of each bus structure phase-to-phase and phase-to-ground for one minute each, at minimum test voltage of 1000 Vdc; minimum acceptable value for insulation resistance is 1 megohms. Refer to manufacturer's literature for specific testing procedures.

3.3 TESTING AND COMMISSIONING

A. Switchboard and related equipment shall be commissioned and tested as a system for conformance to specification requirements prior to scheduling the acceptance tests. Contractor shall conduct performance verification tests in the presence of Owner’s representative, observing and documenting complete compliance of the system to the specifications. Contractor shall submit a signed copy of the test results, certifying proper system operation before scheduling tests.

1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

3. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Sections 7.1, 7.5, 7.6, 7.9, 7.10, 7.11, and 7.14 as appropriate. Certify compliance with test parameters.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install panelboards.

B. Related Sections:

1. Section 26 05 05, General Provisions for Electrical Systems.

2. Section 26 05 53, Identification for Electrical Systems.

3. Section 26 12 16, Substation Transformers – Dry-Type

4. Section 26 43 13, Surge Protective Devices.

1.2 MEASUREMENT AND PAYMENT

1. Panelboards indicated on drawings as part of a unit substation shall be included in lump sum cost for Unit Substations.

2. Any panelboards not indicated on drawings as part of a unit substation shall be included in lump sum cost for Division 26 Electrical Equipment & Installation.

1.3 REFERENCES

A. Standards referenced in this Section are:

1. NEMA PB 1, Panelboards.

2. NETA, InterNational Electrical Testing Association

3. UL 67, Panelboards.

1.4 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.5 SUBMITTALS

A. Action Submittals. Submit the following:

1. Product Data

a. Panelboards - Product Data

1) Submit technical information for panelboards proposed for use, including product literature and specifications. Indicate options and features to be provided.

2. Shop Drawings

a. Listing of Panelboards and Proposed Locations

1) Listing of panelboards to be furnished with identification of their proposed location, and all electrical characteristics, including number and rating of branch circuit breakers and enclosure type.

2) Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graph paper; include selectable ranges for each type of overcurrent protective device.

3) Include evidence of NRTL listing for series rating of installed devices.

4) Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

5) Include wiring diagrams for power, signal, and control wiring.

6) Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.

7) Detail enclosure types and details for types other than NEMA 250, Type 1.

8) Detail bus configuration, current, and voltage ratings.

9) Short-circuit current rating of panelboards and overcurrent protective devices.

b. Panelboard Schedule

1) For installation in panelboards. Submit final versions after load balancing.

B. Informational Submittals. Submit the following:

1. Field Quality Control Submittals

a. Panelboards Testing Plan, Procedures and Results

1) Submit test procedures used.

2) Submit test results that comply with requirements.

3) Include results of failed tests and corrective action taken to achieve test results that comply with requirements.

C. Closeout Submittals. Submit the following:

1. Operation and Maintenance Data

a. Panelboard - Operation and Maintenance Data

1) Operation, and maintenance manuals for panelboards and components to include in emergency.

2) Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

3) Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

2. Record Documentation

a. Panelboard Record Documentation

1) Provide an electronic modifiable copy of each updated and/or new panel board schedule with date of change(s).

2) Submit final versions after load balancing.

D. Maintenance Material Submittals. Submit the following:

1. Spare Parts

a. Fuses for Fused Power-Circuit Devices:

1) 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

B. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

C. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Regulatory Requirements; Comply with the following:

1. NEC Article 408, Switchboards and Panelboards.

2. Comply with NEMA PB 1.

3. Comply with NFPA 70.

1.7 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling, and Unloading:

1. Packing:

a. Inspect prior to packing to assure that assemblies and components are complete and undamaged.

b. Protect mating connections.

c. Cover all openings into enclosures with-vapor inhibiting, water-repellent material.

2. Deliver materials and equipment to Site to ensure uninterrupted progress of the Work. Deliver anchorage materials to be embedded in concrete in ample time to prevent delaying the Work. Upon deliver, check materials and equipment for evidence of water that may have entered equipment during transit.

3. Comply with Section 01 65 00, Product Delivery Requirements.

B. Storage and Protection:

1. Store panelboards in a clean, dry location with controls for uniform temperature and humidity. Protect equipment with coverings and maintain environmental controls.

2. Comply with Section 01 66 00, Product Storage and Handling Requirements.

1.8 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding [minus 22 deg F (minus 30 deg C)] to plus 104 deg F (plus 40 deg C).

3. Altitude: Not exceeding 6600 feet (2000 m).

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.

2. Altitude not exceeding 6600 feet (2000 m).

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Engineer no fewer than 14 days in advance of proposed interruption of electric service.

2. Do not proceed with interruption of electric service without Engineer's written permission.

3. Comply with NFPA 70E.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

PART 2 PRODUCTS

2.1 MANUFACTURERS

1. Provide products of one of the following:

   a. Cutler-Hammer (Eaton).

   b. Siemens.

   c. Square D (Schneider Electric).

2.2 MATERIALS

A. Panelboards:

1. Rating: Voltage rating, current rating, number of phases, number of wires and number of poles as shown or indicated on the Drawings.

2. Circuit Breakers: Molded case, bolt-in thermal magnetic type with number of poles and trip ratings as shown or indicated. Where indicated on the Drawings, circuit breakers shall be ground fault circuit interrupting type equipped with solid state sensing and five-milliamp sensitivity.

3. Circuit breakers for 480-volt panelboards shall have minimum interrupting rating of 14,000 ampere RMS symmetrical, unless otherwise indicated on the Drawings. Circuit breakers for other panelboards shall have minimum interrupting rating of 10,000 ampere RMS symmetrical, unless otherwise indicated on the Drawings.

4. Bus Bars: Bus bars shall be 98 percent conductivity copper. Four-wire panelboards shall have solid neutral bar. Each panel shall have ground bus bar.

5. Main: Panelboards shall have main circuit breaker, unless the Drawings specifically indicate main lugs only.

6. Connect branch circuit breakers for sequence phasing.

7. Enclosures: Panel enclosures shall be as required for the area classifications indicated in Section 26 05 05, General Provisions for Electrical Systems, unless otherwise indicated on the Drawings.

8. Construction: Code-grade steel, ample gutter space, flush door, flush snap latch and lock. Panelboards shall comply with NEMA PB 1 and UL 67.

9. Trim: Surface or flush as required. Provide Door-In-Door Construction.

10. Directory: Typed or computer-printed card, with transparent protective cover in frame on back of door giving circuit numbers and area or equipment served.

11. Identification: Identify panelboards in accordance with Section 26 05 53, Identification for Electrical Systems. Identification shall indicate panel number and voltage.

12. Directory of Existing Panelboards: When adding or removing breakers or loads from existing panelboards, provide a new typed or computer-generated directory card, indicating the circuit numbers and equipment served.

13. Provide surge protective device in accordance with Section 26 43 13, Surge Protective Devices, for each panelboard shown or indicated on the Drawings. Surge protective device shall be included and factory-mounted within panelboard by panelboard manufacturer. Surge protective device monitoring and display shall be visible from front of panelboard.

14. Front: Secured to box with concealed trim clamps, unless otherwise indicated. Front for surface-mounted panelboards shall be same dimensions as box. Fronts for flush panelboards shall overlap box, unless otherwise indicated.

15. Main and Neutral Lugs: Compression type.

16. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors. Bonded to box.

17. Service Equipment Approval: Listed for use as service equipment for panelboards with main service disconnect.

18. Future Devices: Equip with mounting brackets, bus connections, and necessary appurtenances, for overcurrent protective device ampere ratings indicated for future installation of devices.

19. Special Features: Include following features for panelboards as indicated:

    a. Isolated Equipment Ground Bus: Adequate for branch-circuit equipment ground conductors; insulated from box.

20. Extra Gutter Space: Dimensions and arrangement as indicated.

    a. Subfeed: Overcurrent protective device or lug provision as indicated.

21. Feed-through Lugs: Sized to accommodate feeders indicated.

B. Integrated Panelboard and Transformer:

1. Products and Manufacturers: Provide products of one of the following:

    a. Mini-Power Center by Cutler-Hammer (Eaton).

    b. Integrageted Power Systems by Siemens.

c. Mini-Power Zone by Square D (Schneider Electric).

2. General: Unit shall consist of encapsulated dry-type transformer, primary and secondary main circuit breakers, and secondary panelboard all in one enclosure.

3. Transformer Rating: Transformer portion shall comply with Section 26 12 16, Substation Transformers – Dry-Type. KVA, primary voltage, secondary voltage, frequency and number of phases shall be as shown or indicated on the Drawings.

4. Branch Circuits: Molded case circuit breakers, plug-in thermal magnetic type with number of poles and trip ratings as shown or indicated on the Drawings.

5. Enclosure: Enclosures shall be as required for the area classifications indicated in Section 26 05 05, General Provisions for Electrical Systems, unless otherwise indicated on the Drawings.

2.3 BRANCH CIRCUIT OR DISTRIBUTION PANELBOARDS

A. Doors: Door-In Door type panelboard front, with concealed hinges. Secure with flush catch and tumbler lock, keyed alike.

B. Branch-Circuit Breakers: Where overcurrent protective devices are indicated to be circuit breakers, use bolt-on circuit breakers, except circuit breakers 225-A frame size and greater may be plug-in type where individual positive-locking device requires mechanical release for removal.

2.4 OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker: NEMA AB 1, handle lockable.

1. Characteristics: Frame size, trip rating, number of poles, and auxiliary devices as indicated and interrupting capacity rating to meet available fault current.

2. Circuit Breakers, 200 A and Larger: Trip units interchangeable within frame size.

3. Circuit Breakers, 400 A and Larger: Field-adjustable short-time and continuous current settings.

4. Current-Limiting Trips: Where indicated, let-through ratings less than NEMA FU 1, Class RK-5.

5. Current Limiters: Where indicated, integral fuse listed for circuit breaker.

6. Lugs: Mechanical lugs and power-distribution connectors for number, size, and material of conductors indicated.

7. Shunt Trip: Where indicated.

2.5 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items as required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: Arranged to permit testing of functions of solid-state trip devices without removal from panelboard.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine conditions under which the Work is to be installed and notify Engineer in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

B. Receive, inspect, handle, and store panelboards according to NECA 407 and NEMA PB 1.1.

C. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

3.2 INSTALLATION

A. Identify panelboards in accordance with Section 26 05 53, Identification for Electrical Systems.

B. Install panelboards and accessory items according to NEMA PB 1.1.

C. Mounting Heights: Top of trim 74 in. (1880 mm) above finished floor, unless otherwise indicated.

D. Mounting: Plumb and rigid without distortion of box. Mount flush panelboards uniformly flush with wall finish.

E. Circuit Directory: Type directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing.

F. Install filler plates in unused spaces.

G. Provision for Future Circuits at Flush Panelboards: Stub four 1 in. (27 mm) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in future. Stub four 1 in. (27 mm) empty conduits into raised floor space or below slab not on grade.

H. Wiring in Panelboard Gutters: Arrange conductors into groups, and bundle and wrap with wire ties after completing load balancing.

3.3 GROUNDING

A. Make equipment grounding connections for panelboards.

B. Provide ground continuity to main electrical ground bus.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

F. Panelboards will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Set field-adjustable pick-up and time-sensitivity ranges in accordance with Section 26 05 73.

3.7 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install wiring devices.

2. Section includes:

a. Straight-blade Devices, 125 V, 20 A.

b. GFCI Receptacles, 125 V, 20A.

c. Pendant Cord-Connector Devices.

d. Cord and plug sets.

e. Toggle switches, 120/277 V, 20 A.

f. Wall plates.

B. Coordination:

1. Review installation procedures under other Sections and coordinate installation of items to be installed with or before Wiring Devices.

C. Related Sections:

1. Section 26 05 05, General Provisions for Electrical Systems.

2. Section 26 05 19, Low-Voltage Electrical Power Conductors and Cables.

3. Section 26 05 26, Grounding and Bonding for Electrical Systems.

4. Section 26 05 33, Raceways and Boxes for Electrical Systems.

5. Section 26 05 53, Identification for Electrical Systems.

1.2 MEASUREMENT AND PAYMENT

1. This item is to be included in lump sum cost for Division 26 Electrical Equipment & Installation.

1.3 REFERENCES

A. Definitions referenced in this Section are:

1. Abbreviations of Manufacturers' Names:

a. Eaton: Eaton; Arrow-Hart Wiring Devices.

b. Hubbell: Hubbell Incorporated; Hubbell Wiring Devices-Kellems.

c. Leviton: Leviton Mfg. Company, Inc.

d. P & S: Pass & Seymour/Legrand.

B. Standards referenced in this Section are:

1. FS – Federal Specifications:

a. FS WC-596, Electrical Power Connector, Plug, Receptacle, and Cable Outlet.

b. FS W-S-896-E, Switch, Toggle

2. UL 498, Standard for Attachment Plugs and Receptacles

3. ULK 1682, Plugs, Receptacles, and Cable Connectors of the Pin and Sleeve Type

4. NEMA WD 1, General Color Requirements for Wiring Devices.

5. NEMA OS 3, Selection and Installation Guidelines for Electrical Outlet Boxes.

6. NEMA WD 6, Wiring Devices – Dimensional Requirements.

7. NEMA FB 11, Plugs, Receptacles and Connectors of the Pin and Sleeve Type for Hazardous Locations.

8. NFPA 70, National Electrical Code.

1.4 DEFINITIONS

A. Definitions referenced in this Section are:

1. BAS: Building automation system.

2. EMI: Electromagnetic interference.

3. GFCI: Ground-fault circuit interrupter.

4. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

5. RFI: Radio-frequency interference.

6. SPD: Surge protective device.

1.5 SUBMITTALS

A. Action Submittals: Submit the following:

1. Product Data

a. Wiring Devices - Product Data

1) For each type of product.

B. Informational Submittals. Submit the following:

1. Test and Evaluation Reports

a. Wiring Devices – Test and Evaluation Reports

1) Results of required Test and Evaluation Reports.

C. Closeout Submittals. Submit the following:

1. Operation and Maintenance Data:

a. Wiring Devices - Operation and Maintenance Data

1) Submit complete installation, operation and maintenance manuals including all manufacturer's packing-label warnings and instruction manuals that include labeling conditions.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements:

1. National Electrical Code (NEC): Components and installation shall comply with National Fire Protection Association (NFPA) 70.

B. Manufacturer:

1. Manufacturer shall have not less than five years of experience producing substantially similar equipment to that required and, upon request, shall submit documentation of not less than five installations in satisfactory operation for not less than five years in the United States.

2. Wiring Devices and Wall Plates shall be product of a single manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in unopened cartons or bundles as appropriate, clearly identified with manufacturer's name, Underwriter's or other approved label, grade or identifying number.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

PART 2 –PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by the following:

1. Eaton

2. Hubbell

3. Leviton

4. P & S

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Comply with NEMA WD 1.

D. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranded building wire.

2. Devices shall comply with the requirements of this Section.

E. Devices for Owner-Furnished Equipment:

1. Receptacles: Match plug configurations.

2. Cord and Plug Sets: Match equipment requirements.

2.3 STRAIGHT-BLADE DEVICES, 125 V, 20A

A. Duplex Receptacles: 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Eaton: AH5351 (single), AH5352 (duplex).

b. Hubbell: HBL5351 (single), HBL5352 (duplex).

c. Leviton: 5361 (single), 5352 (duplex).

d. P & S: 5361 (single), 5362 (duplex).

2.4 GFCI RECEPTACLES, 125 V, 20 A

A. General Description for dry location:

1. 125 V, 20 A, straight blade, feed-through type.

2. Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 943 Class A, and FS W-C-596.

3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

a. Eaton: SGF20.

b. Hubbell: GF20.

c. Leviton: G5362.

d. P & S: 2097TR

B. General Description for wet location:

1. 125 V, 20 A, straight blade, feed-through type, weather-proof.

2. Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 943 Class A, and FS W-C-596.

3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

a. Eaton: WRSGF20.

b. Hubbell: GFTR20.

c. Leviton: G5362-WT

d. P & S: 2097TRWR

2.5 PENDANT CORD-CONNECTOR DEVICES

A. Description:

1. Matching, locking type plug and receptacle body connector, heavy-duty grade.

2. Configuration: NEMA WD6, type L5-20P and L5-20R.

3. Body: Nylon with screw-open, cable-gripping jaws and provision for attaching external cable grip.

4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

5. Standards: Comply with FS W-C-596.

B. Use GFCI type circuit breaker for GFCI applications.

2.6 CORD AND PLUG SETS

A. Description:

1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.

2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.

3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

B. Use GFCI type circuit breaker for GFCI applications.

2.7 TOGGLE SWITCHES, 120/277 V, 20A

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Single Pole:

    a. Products: Subject to compliance with requirements, provide one of the following:

        1) Eaton: AH1221.

        2) Hubbell: HBL1221.

        3) Leviton: 1221-S.

        4) P & S: PS20AC1.

2. Three Way:

    a. Products: Subject to compliance with requirements, provide one of the following:

        1) Eaton: AH1223.

        2) Hubbell: HBL1223.

        3) Levition: 1223-S.

        4) P & S: PS20AC3.

3. Four Way:

    a. Products: Subject to compliance with requirements, provide one of the following:

        1) Eaton: AH1224.

        2) Hubbell: HBL1224.

        3) Leviton: 1224-S.

        4) P & S: PS20AC4.

4. Lighted Toggle:

    a. Products: Subject to compliance with requirements, provide one of the following:

        1) Eaton: AH1221LTW (SP), AH1223LTW (3-Way)

        2) Hubbell: HBL1221IL (SP), HBL1223IL (3-Way)

        3) Leviton: 1221-LH (SP), 1223-LH (3-Way)

4) P & S: PS20AC1SL (SP), SP20AC3SL (3-Way)

b. Pilot Light (Red):

1) Eaton: AH1221PL (SP), AH1223PL (3-Way), AH1224PL (4-Way)

2) Hubbell: HBL1221PL (SP), HBL1223PL (3-Way)

3) Leviton: 1221-PL (SP), 1223-PL (3-Way)

4) P & S: PS20AC1PL (SP), PS20AC3PL (3-Way)

2.8 WALL-BOX DIMMERS

A. Audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

C. LED Lamp Dimmer Switches: Modular; compatible with LED lamps and drivers; trim potentiometer to adjust low-end dimming; capable of consistent dimming with low end not greater than 10 percent of full brightness.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Eaton:SF10P.

b. Leviton: IP710-LFZ.

c. Lutron: DVSTV (Diva Series)

d. P & S: CD4FBL3P (Titan Series).

2.9 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.

2. Material for Finished Spaces: 0.035-inch-thick, satin-finished, Type 302 stainless steel.

3. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

4. Material for areas classified as hazardous locations: Where required by NEC, shall be NEMA 7 explosion-proof and comply with UL 886.

5. In corrosive locations, where the conduit system is PVC-coated, wall plates shall be Type 316 stainless steel, or non-metallic thermoplastic or fiberglass reinforced plastic material.

2.10 EXTERIOR WALL COVER PLATES

A. Single and combination types shall be as follows:

1. All exterior device cover plates shall be while-in-use style.

2. All exterior device cover plates shall be cast aluminum.

3. Manufacturers and model shall be as follows:

a. Single Gang Horizontal Mount:

1) Hubbell: WP26EH.

2) Leviton: IUM1H-GY.

3) P & S: WIUCAST1.

b. Single Gang Horizontal Mount:

1) Hubbell: WP26E.

2) Leviton: IUM1V-GY.

3) P & S: WIUCAST1.

c. Double Gang Mount:

1) Hubbell: WP262E.

2) Leviton: IUM2V-GY.

3) P & S: WIUCAST2.

2.11 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: As selected by Engineer unless otherwise indicated or required by NFPA 70 or device listing.

2. Wiring Devices Connected to Emergency Power System: Red.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.

2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.

3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.

4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.

2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.

3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

4. Existing Conductors:

a. Cut back and pigtail, or replace all damaged conductors.

b. Straighten conductors that remain and remove corrosion and foreign matter.

c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.

2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.

3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.

4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.

5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.

6. Use a torque screwdriver when a torque is recommended or required by manufacturer.

7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.

8. Tighten unused terminal screws on the device.

9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.

2. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Section 26 0553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

A. Test Instruments: Use instruments that comply with UL 1436.

B. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

C. Perform the following tests and inspections:

1. Test Instruments: Use instruments that comply with UL 1436.

2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

D. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.

2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.

3. Ground Impedance: Values of up to 2 ohms are acceptable.

4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.

5. Using the test plug, verify that the device and its outlet box are securely mounted.

6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

E. Wiring device will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION

SECTION 26 31 00

PHOTOVOLTAIC SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Photovoltaic system requirements.

B. Photovoltaic modules.

C. Photovoltaic module mounting system.

D. Photovoltaic combiner boxes.

E. Photovoltaic inverters.

F. Monitoring system.

1.2 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 260529 - Hangers and Supports for Electrical Systems.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

B. IEC 61215-1 - Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval - Part 1: Test Requirements; 2021, with Corrigendum.

C. IEC 61215-1-1 - Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval - Part 1-1: Special Requirements for Testing of Crystalline Silicon Photovoltaic (PV) Modules; 2021.

D. IEC 61215-2 - Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval - Part 2: Test Procedures; 2021.

E. IEEE 1547 - IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces; 2018, with Amendment (2020).

F. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

G. NECA 412 - Standard for Installing and Maintaining Photovoltaic (PV) Power Systems; 2012.

H. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

K. UL 1699B - Outline of Investigation for Photovoltaic (PV) DC Arc-Fault Circuit Protection; Current Edition; Current Edition, Including All Revisions.

L. UL 1703 - Flat Plate Photovoltaic Modules and Panels; Current Edition, Including All Revisions.

M. UL 1741 - Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources; Current Edition, Including All Revisions.

N. UL 2579 - Low-Voltage Fuses - Fuses for Photovoltaic Systems; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment or other potential obstructions within the spaces dedicated for photovoltaic system components.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Roof-Mounted Arrays: Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
4. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Preinstallation Meeting: Convene one week prior to commencing work of this section; require attendance of all affected installers. Include adequate instruction on the electrical hazards associated with photovoltaic systems and appropriate safety procedures to be followed.

C. Utility Interconnection:
   1. Prepare and submit documentation as required for securing utility interconnection agreement between Owner and Utility Company.
      a. Include copies of documentation with submittals.
   2. Preinstallation Meeting: Convene one week prior to commencing work of this section to review interconnection requirements and details with Utility Company representative.
   3. Coordinate with Utility Company to provide utility metering suitable for system requirements.
   4. Arrange for inspections and secure permits necessary to obtain Utility Company approval of system.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product. Include ratings, configurations, standard wiring diagrams, outline and support point dimensions, finishes, weights, service condition requirements, and installed features.

C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, attachment locations and details, and proposed size, type, and routing of conduits and cables. Include system interconnection schematic diagrams showing all factory and field connections.

D. Design Data:
   1. Include structural calculations, signed and sealed by a professional structural engineer licensed in the state of California , for equipment and mounting system.

E. Certify that products of this section meet or exceed specified requirements.

F. Certify that work of this section does not void roof warranty.

G. Certify that materials provided under this section meet the project’s Buy America requirements.

H. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

I. Manufacturer’s detailed field testing procedures.

J. Manufacturer's detailed startup procedures.

K. Utility interconnection documentation.

L. Source quality control test reports.

M. Field quality control test reports.

N. Structural Designer's Qualification Statement.

O. Manufacturer's Qualification Statement.

P. Installer's Qualification Statement.

Q. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

R. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

S. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.

T. Software: One copy of software provided under this section.

U. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Photovoltaic Modules: Two.
   2. Extra Fuses: Ten of each type used on the system.

1.6 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with Utility Company requirements for interconnection.

C. Structural Designer Qualifications: Registered structural engineer licensed in the State in which the Project is located.

D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

E. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience with photovoltaic systems of similar size, type, and complexity.
   1. Licensed in the State in which the Project is located to install photovoltaic systems.
   2. Manufacturer's authorized installer.
   3. Supervisor: North American Board of Certified Energy Practitioners (NABCEP) certified PV Installer or three years experience supervising the installation of photovoltaic systems.
   4. Installer Personnel: At least 2 years of experience installing photovoltaic systems.

F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.8 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Photovoltaic Modules:
   1. Provide minimum five year manufacturer warranty covering repair or replacement due to defective materials or workmanship.
   2. Provide manufacturer warranty guaranteeing minimum 90 percent of rated power output for 10 years and minimum 80 percent of rated power output for 20 years.

C. Photovoltaic Module Mounting System: Provide minimum 10 year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

D. Photovoltaic Combiner Boxes: Provide minimum five year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

E. Photovoltaic Inverters: Provide minimum five year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Photovoltaic Modules, Crystalline Silicon:
   1. Hanwha Q CELLS America Inc; Q.PEAK Series: www.qcells.com/.

B. Photovoltaic Module Mounting System:
   1. Metal Roof Innovations, Ltd. S-5! Attachment Solutions; S-5! PV Kit: www.s-5.com/.
   2. Preformed Line Products: www.plp.com/.

C. Photovoltaic Combiner Boxes:
   1. Solectria Renewables, LLC; XGI Series: solectria.com/.

D. Photovoltaic Inverters:
   1. Solectria Renewables, LLC; XGI Series String Inverters: www.solectria.com/.
   2. Enphase Energy; IQ Series Microinverters: www.enphase.com/.

E. PV Wire
   1. Southwire Company LLC: www.southwire.com/.
   2. ServiceWire Corporation: www.servicewire.com/.
   3. Encore Wire Corporation: www.encorewire.com/.

F. Source Limitations: The PV System and its subcomponents shall meet the Federal Transit Adminstration's Buy America requirements (49 CFR Part 661).

2.2 PHOTOVOLTAIC SYSTEM REQUIREMENTS

A. Provide complete photovoltaic system consisting of photovoltaic modules and associated balance of system components necessary for connection to facility electrical system.

B. System Description - Tire Shop:
1. Photovoltaic array is roof-mounted in location indicated on the drawings.
2. Orientation of array is as indicated on the drawings.
3. System includes interconnection with utility grid (grid-tied system).
4. System includes DC system surge protection.
5. System includes monitoring system.
6. System includes module level rapid shutdown.
7. Inverter Type: Microinverters.

C. System Description - Bus Canopy
1. Photovoltaic array is canopy/ground mounted in location indicated on the drawings.
2. Orientation of array is as indicated on the drawings.
3. Photovoltaic DC system is ungrounded.
4. System includes DC system surge protection.
5. System includes monitoring system.
6. Inverter Type: String Inverter

D. Capacity:
1. Minimum Expected Annual Energy Production - Tire Shop: 46.88 MWh, as calculated by Aurora Solar Helioscope.
2. Minimum Expected Annual Energy Production - Bus Canopy: 328.1 MWh, as calculated by Aurora Solar Helioscope.
3. Total Nominal Rated Power Output of Array: Equal to or greater than the rated output of the basis of design array.
4. Nominal Rated Power Output of Individual Modules: Equal to or greater than the rated output of the basis of design module.

E. Size:
1. Array: Designed to fit within the area designated on the drawings.
2. Individual Modules: Size is not critical.

F. Appearance:
1. Only systems with similar appearance to basis of design system will be considered.
2. Arrange array such that modules are aligned with uniform spacing.

G. Provide photovoltaic system and associated components suitable for wind loads, snow loads, seismic loads, and other structural design considerations of the installed location.
1. Comply with ASCE 7.
2. Include structural calculations demonstrating compliance with submittals.

H. Provide photovoltaic system and associated components suitable for continuous operation under the service conditions at the installed location.

I. Provide products listed, classified, and labeled as suitable for the purpose intended.

J. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system.

K. DC Arc Fault Circuit Protection: Provide DC photovoltaic arc-fault protection devices listed as complying with UL 1699B as required for compliance with NFPA 70.

L. Rapid Shutdown of Photovoltaic Systems on Buildings: Provide listed equipment arranged to provide rapid shutdown in accordance with NFPA 70.

M. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

N. Arrange array to minimize shading during peak production periods.

O. Roof-Mounted Arrays:
1. Arrange array such that normal roof drainage is not affected.
2. Arrange array to maintain required safety clearances from edges of roof as required by authority having jurisdiction.
3. Arrange array to maintain access and clearance requirements for other roof-mounted equipment.
4. Arrange array to avoid spanning of expansion joints.

2.3 PHOTOVOLTAIC MODULES

A. Acceptable Module Types: Only crystalline silicon modules are acceptable. Thin film modules will not be considered for this project.

B. General Requirements:
1. Photovoltaic Modules: Factory assembled; consisting of photovoltaic cells, frame, junction box, cables for series connection, and bypass diodes for shade tolerance; rated for 1500 V DC; complying with IEC 61215-1 and IEC 61215-2 and listed as complying with UL 1703.
2. Crystalline Silicon Photovoltaic Modules: Comply with IEC 61215-1-1.
3. Frame: Anodized aluminum.
4. Factory-Installed Junction Box: Weatherproof, with factory-installed terminals and bypass diodes.
5. Factory-Installed Cables: Type USE-2 or listed photovoltaic (PV) wire with polarized locking connectors.
6. Unless otherwise indicated, specified module performance characteristics are rated under Standard Test Conditions (STC).

C. Basis of Design: Hanwha Q Cells Q.PEAK DUO XL-G11S.3 / BFG.

2.4 BALANCE OF SYSTEM COMPONENTS

A. Photovoltaic Module Mounting System:
1. Provide complete mounting system compatible with modules to be installed and suitable to properly install them in the location indicated, including all necessary hardware and accessories.
2. Support Structure and Associated Hardware Materials: Use Series 6000 Structural Aluminum.
3. Roof-Mounted Arrays:
   a. Acceptable System Types: Only non-penetrating systems are acceptable. Penetrating systems will not be considered for this project.
   b. Provide system compatible with the roof at the installed location.
   c. Module Tilt Angle: No tilt, parallel with roof plane.
   d. Provide minimum clearance of 3 inches (76 mm) between roof and module for air circulation and drainage.
   e. Products:
      1) Preformed Line Products Power Rail - P Series.
      2) S-5! Standing Seam Roof Clamps
4. Ground-Mounted (Canopy) Arrays:
   a. Module Tilt Angle: No tilt.
   b. Provide system compatible with the new bus charging canopy structure.
   c. Products:
      1) Preformed Line Products Power Rail - LD/MD Series.

B. Photovoltaic Combiner Boxes:
1. Provide combiner box(es) for termination of strings as indicated or as required for the array configuration installed.
2. Combiner Boxes: Rated for 1500 V DC; current ratings suitable for connected strings; equipped with fuseholders; listed as complying with UL 1741.
3. Fuseholders: Touch-safe; suitable to accept fuses indicated.
4. Number of Input Circuits: As indicated or as required for termination of strings.
5. Enclosure: NEMA 250, Type 4X, unless otherwise indicated.
6. Provide integral load-break rated disconnect.

C. Photovoltaic Inverters:
1. Provide inverter(s) as indicated or as required for connection of the photovoltaic array DC system to the AC system indicated.
2. String Inverters: Suitable for the requirements of the connected array; output configuration compatible with connected system; listed as complying with UL 1741; furnished with the following features:
   a. Maximum power point tracking (MPPT).
   b. LCD display.
   c. Integral AC disconnect.
   d. Integral DC disconnect.
   e. Integral DC ground fault detection and interruption (GFDI).
   f. Communications Interface: As required for connection to system indicated.
   g. Integral input and output surge protection.
   h. Remote power curtailment.

3. Grid-Tied Inverters: Comply with IEEE 1547, including over/under grid voltage and frequency protection, and anti-islanding protection to automatically disconnect upon loss of utility power and to remain disconnected until utility power restoration has been maintained for five minutes.
4. Total Harmonic Distortion: Less than five percent.
5. Enclosure Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   a. Outdoor Locations: NEMA 250, Type 4X.

D. Enclosed Switches, in Addition to Requirements of Section 262816.16:
1. Switches for DC System: Rated for 1500 V DC.

E. Surge Protective Devices, in Addition to Requirements of Section 264300:
1. Surge Protective Devices for DC System:
   a. Rated for 600 V DC.
   b. Listed and labeled as complying with UL 1449, Type 1.
   c. Surge Current Rating: Not less than 50 kA per mode.
   d. UL 1449 Nominal Discharge Current (I-n): 20 kA.

F. Fuses, in Addition to Requirements of Section 262813:
1. Fuses for DC System: Rated for 1500 V DC.
2. Fuses for Protection of Photovoltaic Strings and Arrays: Photovoltaic fuses listed as complying with UL 2579.

G. Monitoring System:
1. Provide a system to monitor photovoltaic system performance including all sensors, dataloggers, connections, software, equipment and accessories necessary for a complete operating system.
2. System communications interfaces to be wired, with compatible interconnected components.
   a. Provide suitable raceway, minimum 3/4 inch (21 mm) trade size, for all required wired connections.
3. System to monitor and report to the facility microgrid energy management system:
   a. Inverter status and alarms.
   b. Instantaneous power (kW).
   c. Cumulative energy production (kWh).
4. Energy Production Meter: Revenue grade, with accuracy of plus or minus two percent.
5. System to provide alarm notification via e-mail or instant message.
6. System to be compatible with the facility microgrid energy management system.

H. PV Wire:
1. Insulation: Type RHW-2, Cross Linked Polyethylene, 2kV rated.
2. Conductor: Stranded bare copper per ASTM B3 and ASTM B8.
3. Ratings: 90°C, Sunlight, Gasoline, and Oil Resistant
4. Listings: UL 4703 for Type PV Wire.

2.5 SOURCE QUALITY CONTROL

A. Factory test the following products to verify operation and performance characteristics. Include test reports with submittals.
   1. Photovoltaic modules.
   2. Photovoltaic inverters.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings and configurations of system components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive system components.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Use open circuiting, short circuiting, or opaque covering to disable modules, array or portions of array prior to installation and service.

B. Roof-Mounted Arrays: Protect roof and adjacent roof-mounted items from damage.

3.3 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install photovoltaic system in accordance with NECA 412.

D. Provide required support and attachment in accordance with Section 260529.

E. Mount equipment such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches (2000 mm) above the floor, ground, or working platform.

F. Circuiting Requirements. in Addition to Requirements of Section 260519:
   1. Wiring Methods:
      a. Unless otherwise indicated, use exposed module factory-installed cables (not routed inside building) for module interconnections.
      b. Unless otherwise indicated, use exposed type USE-2/RHH/RHW-2 single-conductor cable or listed photovoltaic wire (not routed inside building) for wiring between string(s) and combiner box(es).
      c. Secure exposed cables in accordance with NFPA 70. Where possible, conceal behind array.

d. Install cables in suitable raceway where readily accessible or where required by authority having jurisdiction.
e. Use suitable mechanical connectors for photovoltaic circuit splices and taps.

2. Photovoltaic DC System Conductor Color Code:
   a. Ungrounded System:
      1) Positive: Red.
      2) Negative: Black.
3. Maintain separation of photovoltaic and non-photovoltaic circuits in accordance with NFPA 70.

G. Grounding and Bonding Requirements, in Addition to Requirements of Section 260526:
1. Ensure that there is only one AC System bonding connection between grounding system and grounded/neutral conductor, including external connections and connections internal to equipment.

H. Identification Requirements, in Addition to Those Specified in Section 260553:
1. Color for Photovoltaic System Identification Nameplates and Labels: White text on red background, unless otherwise required by NFPA 70 or authorities having jurisdiction.
2. Use identification nameplate or means of identification acceptable to authority having jurisdiction to identify the presence of multiple power sources and the location of main service disconnecting means and each photovoltaic system disconnecting means. Locate at main service disconnecting means and at each photovoltaic system disconnecting means. Verify format and descriptions with authorities having jurisdiction.
3. Use identification nameplate to identify each photovoltaic system disconnecting means with text "PV SYSTEM DISCONNECT".
4. Use identification nameplate or identification label to identify systems equipped with rapid shutdown and associated rapid shutdown switch(es). Format, descriptions, and locations to comply with NFPA 70 and requirements of authorities having jurisdiction.
5. Use identification nameplate or identification label to identify the information required by NFPA 70 for marking of direct-current photovoltaic power sources. Locate at each DC disconnect means requiring marking.
6. Use identification nameplate or identification label to identify the interactive system point of interconnection at the disconnecting means as a power source and with the rated AC output current and the nominal operating AC voltage.
7. Use warning labels to identify electrical hazards for photovoltaic system disconnecting means. Include the word message "Warning - Electric Shock Hazard; Terminals on the line and load sides may be energized in the open position" or approved equivalent.
8. Use warning labels, identification nameplates, or identification labels to identify electrical hazards for photovoltaic systems equipped with DC ground-fault protection in accordance with NFPA 70. Include the word message "Warning - Electric Shock Hazard; If a ground fault is indicated, normally grounded conductors may be ungrounded and energized".
9. Use wire and cable markers to identify photovoltaic system source, output, and inverter circuit conductors at all points of termination, connection, and splices.

10. Use voltage markers, identification labels, stenciled text, or suitable permanent marking approved by authority having jurisdiction to identify exposed raceways, cable trays, pull boxes, junction boxes, and conduit bodies with the text "Warning: Photovoltaic Power Source" at maximum intervals of 10 feet (3 m) in accordance with NFPA 70.

3.4 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. See article "SYSTEM STARTUP" below for additional requirements related to testing and inspection.

C. Inspection and testing to include, at a minimum:
1. Inspect each system component for damage and defects.
2. Verify that equipment enclosures, boxes, and associated connections installed outdoors are weatherproof.
3. Verify proper wiring connections have been made and check for conductor continuity. Verify proper polarity.
4. Verify tightness of mechanical and electrical connections are according to manufacturer's recommended torque settings.
5. Measure and record ambient conditions, including date and time, ambient temperature, cell temperature, solar irradiance in the module plane, and wind speed.
6. Measure and record open circuit voltage of each string.
7. Measure and record voltages at the inverter AC and DC inputs.
8. Measure and record operating current for each string, sub-array, and array.
9. Measure and record AC output power.
10. Perform inverter functional test.
    a. Grid-Tied Inverters: Include simulation of loss of utility power and subsequent power restoration.
11. Verify proper operation of monitoring system.

D. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

E. Diagnostic Period: After successful completion of inspections and tests, operate system in normal mode for at least 14 days without any system or equipment malfunctions.
1. Record all system operations and malfunctions.
2. If a malfunction occurs, start diagnostic period over after correction of malfunction.

F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

G. Repair roof or adjacent roof-mounted items damaged as a result of work of this section.

3.5 SYSTEM STARTUP

A. Obtain Owner's approval prior to performing system startup.

B. Grid-Tied Systems: Obtain Utility Company's approval prior to performing system startup.

C. Prepare and start system in accordance with manufacturer's instructions.

3.6 CLEANING

A. Clean modules using only methods recommended by manufacturer to avoid scratches and other damage. Clean exposed surfaces on other components to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.7 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.

B. Training: Train Owner's personnel on operation, adjustment, and maintenance of photovoltaic system.
1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of four hours of training.
3. Instructor: Qualified contractor familiar with the project and with sufficient knowledge of the installed system.
4. Location: At project site.

3.8 PROTECTION

A. Protect installed products from subsequent construction operations.

END OF SECTION

SECTION 26 31 01

BATTERY ENERGY STORAGE SYSTEM

PART 1 - GENERAL

The General Provisions of the Contract, including General and Special Conditions and the requirements of Division 1, apply to the Work in this Section.

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and all Divisions under Notice to Bidders and Special Provisions, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Battery Inverter
2. Battery Storage
3. Battery Modules

1.3 STANDARDS AND CODES

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. Institute of Electrical and Electronics Engineers (IEEE):

1. 100 CD-13.....The Authoritative Dictionary of IEEE Standards Terms
2. 519-14.....Recommended Practices and Requirements for Harmonic Control in Electric Power Systems
3. 937-07.....Recommended Practice for Installation and Maintenance of Lead-Acid Batteries for Photovoltaic (PV) Systems
4. 1013-07.....Recommended Practice for Sizing Lead-Acid Batteries for Stand-Alone Photovoltaic (PV) Systems
5. 1361-14.....Guide for Selection, Charging, Test and Evaluation of Lead-Acid Batteries Used in Stand-Alone Photovoltaic (PV) Systems

6. 1547-03.....Standard for Interconnecting Distributed Resources with Electric Power Systems
7. 1561-07.....Guide for Optimizing the Performance and Life of Lead-Acid Batteries in Remote Hybrid Systems
8. 1661-07.....Guide for Test and Evaluation of Lead-Acid Batteries Used in Photovoltaic (PV) Hybrid Power Systems

C. International Code Council (ICC):
1. IBC-15 International Building Code
2. IFC-15.....International Fire Code

D. National Electrical Manufacturer's Association (NEMA)
1. 250-14.....Enclosures for Electrical Equipment (1,000 Volts Maximum)

E. National Fire Protection Association (NFPA)
1. 70-17 National Electrical Code (NEC)

F. Underwriters Laboratories (UL):
1. 6-07.....Electrical Rigid Metal Conduit – Steel
2. 969-17.....Standard for Marking and Labeling Systems
3. 1741-10.....Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources

1.4 SUBMITTALS

A. Submittals shall comply with the following requirements:

B. Shop Drawings:
1. Submit sufficient information to demonstrate compliance with drawings and specifications.
2. Include electrical ratings, dimensions, mounting details, materials, required clearances, terminations, weight distribution, wiring and connection diagrams, accessories, and nameplate data.
a. Include shop drawings for foundations and other support structures.

C. Product Data:

1. Manufacturer’s cut sheets for each product.

D. Manufacturer’s warranty data.

1.5 COMMISSIONING

A. Third-Party commissioning agent shall be contracted to provide independent commissioning of the PV system. Commissioning agent shall be NABCEP (or equivalent) accreditation for commissioning of PV systems.

1.6 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace Battery Electric Storage System components (batteries, inverters, and other appurtenances) that fail in materials or workmanship within specified warranty period.

1. Manufacturer's materials and workmanship warranties include, but are not limited to, the following:

a. Battery Modules

b. Power Conversion System

c. Battery Management System

d. System Enclosure and Ancillary Support Systems

2. Warranty Period: Twelve (12) years from date of Substantial Completion.

B. Manufacturer's Special Minimum Power Output Warranty: Manufacturer agrees to repair or replace Battery Electric Storage System components that fail to exhibit the minimum power output within specified warranty period. Special warranty, applying to modules only, applies to materials only, on a prorated basis, for period specified.

1. Specified minimum energy storage capacity to be 80 percent or more, for a period of 15 years.

PART 2 – PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. The system shall confirm to the following specification.

B. BESS shall consist of:

1. A power conversion system (PCS) suitable for outdoor installation on a user-furnished concrete pad or the user-furnished box pad;

2. An energy storage unit of at least 0.5MW/ at least 1.0 MWh at 20%-95% SOC.

3. Lithium-ion battery with life expectancy rating of 10 years under normal operating conditions, suitable for outdoor installation, and a battery management system (BMS).

C. Seismic Qualification Certificates: For battery enclosure and system.

1. Certification of Seismic for planned installation

2.2 POWER CONVERSION SYSTEM (PCS)

A. General: Grid-tied energy storage units are predominately DC in nature. To utilize the energy storage capability on the AC electric grid, the energy from batteries must be converted to a standard AC level and regulated through a converter, generally known as the Power Conversion System (PCS). The PCS serves as the interface between the DC battery system and the AC system, providing bi-directional conversion from DC to AC (for discharging batteries) and AC to DC (for charging batteries). The PCS may consist of one or more parallel units. The PCS shall be bi-directional converter that can be operated in inverting mode for battery discharging and rectifying mode for battery charging.

1. Converter area: The converter area shall contain an AC circuit breaker, converter and DC circuit breaker.

2. AC Termination Area: The user-accessible AC termination area shall include bus terminal pads for connection of utility source and the customer load cables

3. DC Termination Area: The user-accessible DC termination area shall include terminations for cables from the battery pack.

4. Controls Area: The user-accessible controls area shall contain the master controls and associated circuitry to support operation. Within the control area shall be the following:

a. Control panel – The control panel shall include a three-position rotary switch for selecting the control mode of the power unit (MGC-enabled, MGC- disabled, and Remove From Service).

b. Master control board – The master control board shall provide the main processing and control functions of the converter.

c. Power supply – The power supply shall provide the necessary DC control power for the system controls.

B. System Operation

1. Start/stop characteristics: The PCS starts or stops by pushing buttons “RUN” or “STOP”, respectively, or receiving control commands from a local HMI or MGC.

2. Operation during normal condition: The following functions shall be required with the PCS for the grid-connected and islanded (off grid) operation.

   a. The AC power transformed efficiently from the DC power of the battery arrays shall be bi- directionally transferred to or from the distribution line without causing harmonics higher than the PEA regulation.

   b. The following operation modes shall be provided:

      1) Virtual synchronous generator

      2) Active and reactive power control

      3) Voltage and frequency control

      4) Voltage and frequency droop for parallel operation (BESS may be paralleled with PV)

   c. Black start capability

   d. The PCS shall contain a remote synchronization feature, as well as the standard synchronization used when starting the PCS online. The remote synchronization feature allows the PCS to synchronize its voltage and frequency to any other remote AC bus or generator.

   e. PCS shall be stable against the usual change in voltage and frequency of the grid.

3. Operation during abnormal condition: The PCS shall operate as follows during abnormal operation:

   a. The PCS stops automatically when serious abnormal conditions are detected.

   b. When not-serious errors are detected, the PCS continues operation with error signals which shall be reported to MGC.

C. Detailed Technical Specifications: Table 1 Summarize PCS Technical Specifications:

TABLE 1 – PCS TECHNICAL SPECIFICATIONS

Details	Technical requirement
AC ratings	

Total rated output power to load @ nominal voltage	0.5 (charge) to 0.5 MW (discharge)
Rate output power of each unit	0.5MW
Real and reactive power control accuracy	±1%
Voltage range	480VAC
Type of output	AC three-phase system
Frequency	60 Hz ±1%
VAR production	Full VAR production at rated voltage
Harmonics	according to PEA standards
DC input ratings	
Voltage range	as defined by bidder
Ripple voltage	Less than 4V RMS
Ripple current	Less than 10% of full current peak to peak
Environmental ratings	
Operating temperature	0ºC - 45ºC without derating
Humidity	0 – 95% non-condensing
Maximum altitude	1,000* m without derating
Seismic Rating	Zone 4
Functions/Features	
Power flow operation	Yes, support four-quadrant control
Real power control	Yes, positive and negative
Reactive power control	Yes, capacitive and inductive
Combination of real and reactive power control	Yes, with real power taking priority
Load following (renewable smoothing)	Yes, allowing renewable smoothing
Low-voltage ride through	Yes, supporting transition from grid connected to islanded operation
Synchro-check function	Yes, supporting parallel operation with the grid, PV and diesel generator
Operation modes	
Black start	Yes, external command
Commanded power	Yes, external command
Commanded VAR	Yes, external command
Frequency regulation	Yes, external command
Frequency response	Yes, automatic
Islanding	Yes, automatic (when utility source is lost) or external command (from MGC or ADDC)
Renewable smoothing	Yes, automatic
Scheduled power	Yes, preconfigured time/date of work power profiles
Voltage regulation	Yes, external command
Response time of PCS to the command received	< 100 ms
Communications	
Communications with MGC	Yes, via DNP 3.0 over IP or IEC61850
Communications with ADDC	Yes, via DNP 3.0 over IP
Battery technologies	
Battery technologies supported	Li-ion
Physical systems	
Protection class	Containerized solution for indoor installation or IP54 for outdoor installation

Cooling system	Yes
Time source	
Time source	CSCS via MGC
Monitoring and control	
Interface, status and control panel	Yes
Battery voltage (AC/DC)	Yes
Battery current (AC/DC)	Yes
Active power (AC/DC)	Yes
Reactive power	Yes
Energy (AC/DC)	Yes
Capacity (Ah)	Yes
Power factor	Yes
Fault	Yes
Battery information	Yes
Audible alarm	Yes
Battery temperature (average/extreme)	Yes
State of Charge (SOC)	Yes
Warning messages	Yes
Efficiency	
Efficiency of power conversion	≥ 95%
Protection system	
Under/over voltage (DC and AC)	Yes
Under/over frequency	Yes
Over current protection	Yes
Ground fault protection	Yes
Over heat protection	Yes
Smoke detection (Trip/Alarm)	Yes
Surge protection (DC and AC)	Yes
Automatic AC & DC open circuit when fault detection	Yes
Insulating monitoring	Yes
Function Features	
Overload capability of 3 MW Switching frequency	120% 30 seconds >= 1 kHz
Insulation resistance	Over 3 M-Ohm at DC 1000 V (exclude the circuit less than DC 60V)
Withstand voltage	AC 2000V 1 minute (exclude the circuit less than DC 60V)
Withstand impulse voltage	± 5000V 1.2 x 50μS each 3 times
Noise level	
Noise level	Less than 50 dBA at 10 meters from the BESS

2.3 ENERGY STORAGE

A. Battery Type: Battery shall be off Lithium-Ion type suitable for utility scale BESS. Different chemistry of Lithium-Ion batteries, such as Lithium Manganese (LMO), Lithium Phosphate (LFP), Lithium Nickel Manganese Cobalt Oxide (NMC), Lithium Nickel Cobalt Aluminum Oxide (NCA), can be proposed.

B. Detailed Technical Specifications: Table 2 Summarizes technical specifications of the battery energy storage system (BESS).

TABLE 2 – ENERGY STORAGE UNIT TECHNICAL SPECIFICATIONS

Details	Technical requirement
Rated output power @ nominal voltage	0.5MW (charge) to 0.5MW (discharge) (Continuous discharge measured at PCS output)
Energy	At least 1 MWh at 20%-95% SOC, at least 4 hours at 0.25MW to load
Type	Li-ion
Allowable charging capacity	See Note #1 below table
Discharging capacity	See Note #1 below table
Round-trip AC energy efficiency (including auxiliaries) at 22 kV system	> 80%
Cycle life	> 4,000 at 20-80% SOC

Note #1 – Charging and discharging requirements shall meet the requirements of the worst case solar smoothing requirements, full charge and full discharge

C. Standard: Battery preferable produced by a manufacturer certified with ISO 9001 or equivalent

D. Battery Module/Tray

1. Battery module shall consist of many battery cells connected in series/parallel.

2. Module/tray battery management system (BMS) shall be provided.

3. Automatic module balancing shall be provided.

4. Module/tray cooling system shall be provided

E. Battery Rack

1. Battery modules shall be connected in series/parallel in the battery rack so that the nominal voltage of the DC is more than 480V, suitable for PCS DC voltage.

2. Rack BMS with battery fuse, DC current measurement devices and contractors shall be provided.

3. Electrical connection shall be at rack front side.

4. Many racks shall be connected in parallel to total capacity required for this project.

5. All racks shall seismic rated for the location.

F. Battery Protection: The following protections shall be provided:

1. Over-charge protection

2. Over-discharge protection

3. Over-temperature protection

4. Over-current protection

5. Ground-fault detection

6. Internal battery fault detection

7. Cell balancing

8. Protective devices should include for DC-side protection:

a. Battery fuse for each battery cell and module (preferred)

b. DC contactor for each battery rack

9. Grounding over current (76G)

G. Cycle Life

1. If the product is sensitive to depth of discharge, the manufacturer must state the limitations and the product should be sized such that the depth of discharge corresponds to the required cycle life.

2. For purposes of estimating and demonstrating cycle life, cycles are defined in the same manner as system efficiency.

3. For lifetime assessment the supplier should provide a graph that displays the relationship between depth of discharge and the corresponding number of cycles available within the system's life.

4. Results of charging and discharging are tested at 1C.

2.4 BATTERY MAINTENANCE SYSTEM (BMS)

A. General: BMS is used to monitor, protect, maintain safety and optimal operation of each battery cell, module and rack. BMS consist of: Module/tray BEMS, rack BMS and system BMS.

B. Minimum Functions of Module/Tray BMS:

1. Metering and monitoring
2. Battery cell voltage (all cells)
3. Battery module voltage
4. Battery cell temperature (at least one or several measured locations in battery module/tray)
5. Battery module current
6. Cell balancing
7. Module/tray BMS should balance voltage of cells
8. Safety protection
9. Module/tray BMS should protect the battery cells and module/tray from:
10. Over and under voltage
11. Over current
12. Short circuit current
13. Over and under temperature
14. Data communication: all metering items and contactor status shall be provided for rack BMS control and monitoring system.

C. Minimum Functions of Rack BMS

1. Metering and monitoring
2. Battery rack voltage
3. Battery rack current
4. Battery rack temperature (one or several locations in battery rack)
5. Battery SOC of battery modules
6. Module/tray balancing
7. Balancing battery modules/trays scheme

8. Safety protection

9. Rack BMS should protect the battery rack from:

10. Over and under voltage

11. Over current

12. Short circuit current

13. Over and under temperature

2.5 ALARMS AND RESETS

A. Alarms:

1. Informational Notification—indicates the status of the unit.

2. Warning Alarm—indicates a problem with the converter requiring attention (not affecting proper operation).

3. Converter Inhibit—indicates a problem with the converter affecting proper operation. The converter will stop operation.

4. Trip Offline Alarm—indicates a severe problem with the converter. The system will not operate.

5. Isolate Alarm—indicates a problem affecting proper operation of the system. The system will operate with limited functionality.

6. Fire detection remote alarm status for main fire alarm control panel, and control and monitoring system.

7. These alarms shall be reported to MGC and HMI of BESS system.

B. Resets: Energy storage unit alarms shall be reset by any of the following means.

1. Manual Reset—via the reset button located on the control panel, or via a personal computer connected to the control panel Ethernet port.

2. Auto Reset—automatically performed until reaching a predetermined reset count.

3. Self Reset—automatically performed whenever required.

2.6 ENCLOSURE CONSTRUCTION

A. The PCS shall be contained within a weatherproof, moisture-sealed, tamper-resistant, metal enclosure with a minimum IP54 or equivalent rating suitable for

outdoor installation on a concrete pad or cover of a fiberglass box pad, in accordance with the following requirements.

1. The enclosure shall not utilize replaceable filters, dehumidifiers, or similar features requiring periodic maintenance. Air intakes are designed so that any entrance of water or dust is directed away from internal components and does not affect operation of the unit.

2. The enclosures shall be equipped with complete and failsafe fire detection/extinguishing system.

3. The overall enclosure footprint shall not exceed 20’-0” x 8’-0”.

4. The enclosure shall comply with security requirements of IEEE C57.12.28 Section 4. The enclosure shall limit access to the controls and physical network connections.

5. The enclosure shall comply with coating system requirements of IEEE C57.12.28 Section 5.

6. Enclosure grounding shall be provided.

7. The enclosure shall have access control.

8. If applicable, wiring and weather-tight enclosure egress to an external antenna shall be provided.

9. A nameplate shall be provided specifying the following:

    a. Manufacturer name

    b. Connection diagram

    c. Unit ratings: Power, energy, voltage, BIL

    d. Specimen data: serial number, date of manufacture

10. Signage shall indicate Source and Load-Side AC Buses, Neutral Bus, DC Bus, Isolation Contactor, and Module names. Custom signage will be in accordance with specific utility requirements.

11. All necessary safety signs and warnings as described in ANSI Z535-2002 shall be included on the unit.

12. All necessary signs and warnings for identification of hazardous materials as described in NFPA 704 shall be included on the unit.

2.7 SAFETY

A. General:

1. The BESS must be compliant with IEEE 1547, IEC 62619, and UL 1973 as appropriate. Systems must be able to protect themselves from internal failures and utility grid disturbances.

2. For all BESS equipment, the Supplier shall provide information on specific safety issues related to the equipment, including appropriate responses on how to handle the energy storage system in case of an emergency, such as fires or module ruptures.

B. Fire Mitigation

1. Provisions shall be included to extinguish internal container fires without the need to open container doors.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrate areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Do not begin installation until mounting surfaces have been properly prepared.

C. If preparation of mounting surfaces is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

D. Examine modules, module connectors and array frame before installation. Reject modules and arrays that are wet, moisture damaged, or mold damaged. Modules shall not be stored in locations exposed to an exterior environment or open to elements of weather.

E. Examine roofs, supports, and supporting structures for suitable conditions where container battery system will be installed.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with latest edition of California Electrical Code.

END OF SECTION

SECTION 26 32 13

GAS ENGINE DRIVEN GENERATOR SETS

PART 1 - GENERAL

The General Provisions of the Contract, including General and Special Conditions and the requirements of Division 1, apply to the Work in this Section.

1.1 WORK INCLUDED

A. The installation of the power generation system shall include the following:

1. Engine-driven generator set
2. Control system
3. Cooling system
4. Fuel supply system
5. Generator set accessories
6. Mounting system
7. System control
8. Outdoor Enclosure

B. Roughing-in, installation of equipment, and final connection of utilities, with labor, services, and incidentals necessary for complete and operational equipment installation.

C. Piping, wiring, and switching between equipment and utilities.

1.2 CODES, STANDARDS AND REGULATORY REQUIREMENTS

A. Equipment indicated within this specification section shall comply with all applicable national, state and local codes and regulations, including seismic and fire codes and regulations. Additional, more specific compliance requirements may be listed under individual equipment headings. All materials, design, fabrication, assembly and test procedures shall be in accordance with the requirements of all applicable codes, standards or regulations having jurisdiction over the work.

B. The organizations having jurisdiction include, but are not limited to, the following:

1. ANSI/IEEE 112 Test Procedures for Polyphase Induction Motors and Generators.

2.	ANSI/IEEE 115	Test Procedures for Synchronous Machines.
3.	ANSI/IEEE C.2	National Electric Safety Code.
4.	ANSI/ISA S18.1	Annunciator Sequence and Specification.
5.	ASCE/SEI 7	American Society of Civil Engineers/Structural Engineering Institute
6.	ASME	American Society of Mechanical Engineers
7.	EEC 89/392	Safety and Health
8.	EGSA	Electrical Generating Systems Association
9.	EPA	Federal, State and Local Environmental Protection Agencies
10.	IBC	International Building Code, California Edition
11.	IEEE	Institute of Electrical and Electronics Engineers
12.	IEC	International Electrotechnical Commission
13.	ISO	International Standards Organization 9000
14.	NEC	National Electrical Code.
15.	NEMA ICS-2	Enclosures for Industrial Control and Systems.
16.	NEMA MGI	Motors and Generators.
17.	NEMA MG2	Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators.
18.	NESC	National Electrical Safety Code.
19.	NFAC	National Fire Alarm Code.
20.	NFPA 37	Installation and Use of Stationary Combustion Engines and Gas Turbines.
21.	OSHA	Regulations of the Occupations Safety and Health Administration.
22.	SAE	Society of Automotive Engineers
23.	UL	Underwriter's Laboratories Inc.

24. The state, county or municipal laws and regulations governing the location where the equipment is to be installed

C. Reference to any code, standard or regulation shall mean the latest published edition, including addenda, supplements and revisions thereto, which are in effect when the purchase order is awarded.

D. In the event of conflict between codes, standards or regulations, the conflict shall be referred to the Engineer for resolution.

E. 'Buy America' Requirements: All manufactured products listed within this specification section are part of a federally assisted procurement involving funds granted by the Federal Transit Administration (FTA), and shall comply with Buy America requirements as delineated by Title 49 Code of Federal Regulations (CFR) Subsection 661.

1.3 SUBMITTALS

A. Shop Drawings: Submit in accordance with Division 1 -General Requirements of these specifications.

1. Submitted shop drawings shall be project specific and shall include a minimum 1/8 inch to 1 foot scaled (or larger standard architectural imperial scale), dimensioned, graphical representation of the size, orientation, and location for the submitted equipment. The drawings shall further include dimensions from structural elements or architectural grid lines, operational clearances, locations of any utility service connection points, mounting requirements, and structural supports required for the submitted equipment.

B. Submittals shall include but not be limited to:

1. Component List - A breakdown of all components and options including switchgear.

2. Technical Data - Manufacturer produced generator set specification or data sheet identifying make and model of engine and generator, and including relevant component design and performance data.

a. Engine:

1) Type, aspiration, compression ratio, and combustion cycle

2) Bore, stroke, displacement, and number of cylinders

3) Engine lubricating oil capacity

4) Engine coolant capacity without radiator

5) Engine coolant capacity with radiator

6) Coolant pump external resistance (maximum)

7) Coolant pump flow at maximum resistance

b. Alternator:

1) Model

2) Frame

3) Insulation class

4) Number of leads

5) Weight, total

6) Weight, rotor

7) Air flow

c. At rated voltage:

1) Efficiency at 0.8 power factor for: 50% load

2) 75% load

3) 100% load

4) Time constants; short circuit transient (T'D)

5) Time constants, armature short circuit (TA)

6) Reactance, subtransient - direct axis (X"D),

7) Reactance, transient - saturated (X'D)

8) Reactance, synchronous - direct axis (XD)

9) Reactance, negative sequence (X2)

10) Reactance, zero sequence (X0)

11) Fault current, 3 phase symmetrical

12) Decrement curve

d. Radiator:

1) Model

2) Type

3) Fan drive ratio

4) Coolant capacity, radiator

5) Coolant capacity, radiator and engine

6) Weight, dry

7) Weight, wet

e. System:

1) Dimensions:

a) length

b) width

c) height

d) Weight, dry

e) Weight, wet

2) Power rating at 0.8 power factor

3) kVA rating

4) Fuel consumption at standard conditions for:

a) 50 % load

b) 75 % load

c) 100% load

5) Combustion air inlet flow rate

6) Exhaust gas, flow rate

7) stack temperature

8) Exhaust system backpressure (maximum)

9) Heat rejection to:

a) coolant

b) aftercooler

c) exhaust

d) atmosphere from engine

e) atmosphere from generator

C. Auxiliary Equipment - Specification or data sheets, including switchgear, load bank, vibration isolators, and day tank.

D. Drawings - General dimensions drawings showing overall generator set measurements, mounting location, and interconnect points for load leads, fuel, exhaust, cooling and drain lines.

E. Wiring Diagrams - Wiring diagrams, schematics and control panel outline drawings published by the manufacturer in Joint Industrial Council (JIC) format for controls and switchgear showing interconnected points and logic diagrams for use by contractor and owner.

F. Warranty Statements - Warranty verification published by the manufacturer.

G. Service - Location and description of supplier's parts and service facility including parts inventory and number of qualified generator set service personnel.

H. ’Buy America’ Certificates: ‘Buy America’ certificates required during bidding shall also be required as part of each product submittal. Certificates shall be complete and accurate. Certificates shall indicate either compliance or non-compliance with the ‘Buy America’ regulations. Certificates of non-compliance shall also include copies of any granted waivers. Waivers still being applied for or being processed at the time of submittal shall be indicated as such.

I. Product Data:

1. Submit Product Data in accordance with Division 1 - General Requirements of these specifications.

2. All Product Data submittals shall identify proposed project specific items marked by arrow, circle, underline, reproducible highlight, or other markings clearly discernable by the reviewer, to show which specific items, parts and accessories are being submitted for the project product data review. Non-marked or generic product data submittals with no marks indicating specific items, parts and accessories will be a cause for rejection.

3. Restrict submitted material to pertinent data. For instance, do not include manufacturer's complete catalog when pertinent information is contained on a single page.

B. Load Bank

1. The manufacturer shall submit for review technical data including features, performance, electrical characteristics, physical characteristics, ratings, accessories, and finishes.

2. Shop drawings shall include dimensional plans and mounting details sufficient to properly install the load bank. Load bus configuration and load connections termination area shall be clearly identified.

3. Electrical schematic drawings shall be provided to detail the operation of the load bank and the provided safety circuits. Over-current protection and control devices shall be identified and their ratings marked. An interconnection drawing shall be included for control wiring related to the load bank.

4. A complete parts list with part numbers, device identification, rating shall be included in the manuals. The original manufacturers name and part number shall be included in the parts listing.

5. Installation and operation manuals shall be provided with the equipment and shall include complete details for the installation, commissioning, operation, and maintenance of the load bank.

6. The manuals shall include the electrical schematic and interconnect drawings for the power and control wiring for the load bank and all control devices.

J. Operation and Maintenance Manual:

1. Provide a Complete parts list, operating instructions, and maintenance manual covering equipment at time of installation including, but not limited to:

   a. Description of system and components.

   b. Schematic diagrams of electrical, plumbing and compressed air systems.

   c. Manufacturer's printed operating instructions.

   d. Printed listing of periodic preventive maintenance items and recommended frequency required to validate warranties. Failure to provide maintenance information will indicate that preventive maintenance is not a condition for validation of warranties.

   e. List of original manufacturer's parts, including suppliers' part numbers and cuts, recommended spare parts stockage quantity and local parts and service source.

2. Assemble and provide copies of manual in 8-1/2 by 11 inch format. Foldout diagrams and illustrations are acceptable. Manual to be reproducible by dry copy method. Provide copies per provisions of Division 1 - General Requirements.

1.4 PRODUCT SUBSTITUTIONS

A. Follow requirements specified in Division 1 - General Requirements.

B. Additional costs resulting from substitution of products other than those specified, including drawing changes and construction, will be at the expense of the Contractor.

C. Substitution Approval: Manufacturers listed for each equipment item may bid without submittal for that item. Manufacturers not listed shall submit for approval in accordance with "Instructions to Bidders". Prior to installation, submittals for each equipment item by Mark Number shall be provided in accordance with Division 1 - General Requirements.

1.5 QUALITY ASSURANCE

A. The complete power generation system, including engine, generator, shall be the product of one manufacturer who has been regularly engaged in the production of complete generating systems for at least fifteen (15) years. All components shall have been designed to achieve optimum physical and performance compatibility and prototype tested to prove integrated design capability. The complete system shall have been factory fabricated, assembled, and production tested (transfer switches not included in the factory system test) as performed by the manufacturer. The engine must be designed and manufactured by the generator set manufacturer. Suppliers/Manufacturers using engines other than their own product and assembling it into a generator set will not be considered. The local supplying dealer must be a factory authorized facility allowing for troubleshooting access to all generator components and ECM’s. Suppliers that cannot troubleshoot and repair every component on the generator set will not be considered. The naming of a specific manufacture does not waive any requirements of this specification. Any exceptions or variations must be noted as described in paragraph 1.10, Equipment Alternatives

B. The Supplier of the Engine/Generator set shall be responsible for satisfactory total operation of the system and its certification. This Supplier shall have had experience with three or more installations of systems of comparable size and complexity in regards to coordinating, engineering, testing and supervising. Each of these installations shall have been in successful operation for three or more years. Prior to review of submittals, the Engineer reserves the right to:

1. Have the Supplier submit a list of locations of similar installations.

2. Inspect any of these installations and operations of Engine/Generator package, and question the user concerning the installations without the presence of the Supplier.

C. Factory authorized representative shall be capable of providing emergency maintenance and repairs at the project site within four (4) hours maximum of notification.

D. A single Supplier shall be responsible for the furnishing of the Engine/Generator, Load Bank, Switchgear and SCR with auxiliary components as specified and as required. Supplier shall design Generator enclosure with capability to support the SCR reactor housing and all associated piping/accessories.

E. Noise level developed by the generator set shall be as herein specified.

F. Load Bank

1. The load bank shall be fully tested using a test specification written by the supplier. Tests shall include electrical functional testing, verifying conformance to assembly drawings and specifications. Each load step shall be cold resistance checked to verify proper calibration of resistive load steps and proper ohmic value.

2. The manufacturer shall maintain this data on file for inspection purposes by the purchaser. Tests using high potential equipment shall be performed to ensure isolation of the load circuits from the control circuits and to determine isolation of the load circuits from the load bank frame. Tests of all safety circuits shall be performed to verify conformance to the specification

3. All electrical circuits shall have a high potential insulation resistance test performed at twice rated voltage plus 1000 VAC to assure insulation integrity.

4. All quality control test equipment shall be regularly maintained and calibrated to traceable national standards.

5. The Company's Quality System shall be ISO9001 Certified.

6. The load bank shall be manufactured by a firm regularly engaged in the manufacture of load banks and who can demonstrate at least five (5) years experience with at least twenty five (5) installations of load banks similar or equal to the ones specified herein.

7. The manufacturer shall have a written Quality Control procedure available for review by the purchaser, which will document all phases of operations, engineering, and manufacturing.

G. Supplier shall submit certification that Engine/Generator, accessories, and components will withstand seismic forces defined in the IBC "International Building Code" CA Edition.

H. Manufacturer's Representative:

1. Installation: Provide a qualified manufacturer's representative at site to supervise work related to equipment installation, check out and start up.

2. Training: Provide technical representative to train Owner's maintenance personnel in operation and maintenance of specified equipment.

I. Comply with ASME B15.1

J. Comply with NFPA 37

K. Comply with NFPA 70

L. Comply with UL2200 and provide UL2200 label. The generator system is intended to be factory UL listed. Custom generator enclosure to be IBC certified ASCE 7. Custom enclosure/generator assembly to be provided UL inspection at facility with load testing as required and provided UL inspection onsite after completion of installation/commissioning.

1.6 FIELD CONDITIONS

A. The operating environment of the power generating system shall be:

1. Altitude: 66 ft

2. Max Ambient Temperature: 105 F

3. Minimum Ambient Temperature: 25 F

4. Fuel Type: Pipeline Natural Gas

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery shall be FOB to the jobsite by the system manufacturer's authorized dealer. The genset, enclosure, genset and any components shall be shipped in pieces measuring no more than 13’H x 40’L, and have a weight of no more than 40 tons.

B. Deliver equipment in manufacturer's containers, appropriately packaged and/or crated for protection during domestic shipment and storage in humid, dusty conditions.

C. Indelibly label all containers, including those contained in others, on outside with item description(s) per title and Mark Number of this specification.

D. The Engine/Generator Supplier shall be responsible for the shipment of the unit to the job site. Supplier shall be responsible for packaging and all precautions necessary for shipments to arrive at destinations in the condition shipped when handled by commercial carriers.

E. Installing Contractor shall be responsible for the receiving and unloading of the equipment at the job site. This responsibility includes proper protection for storage at the job site.

F. Supplier shall confirm shipping clearances and shall provide the status of shipments in transit upon request.

G. Supplier shall, 4 weeks prior to shipping, provide a complete list of material to be shipped. Included in this submittal shall be a list of loose ship material including the weight and sizing of such packages

1.8 LABELING

A. Manufacturer shall securely attach in a prominent location on each major item of equipment a non-corrosive nameplate showing manufacturer's name, address, model number, serial number, and pertinent utility or operating data.

B. H.E. Testing Agency Qualifications: An independent agency (hired/approved by owner), with the experience and capability to conduct the testing indicated, that is a member company of the International Electrical Testing Association (NETA) or is a nationally recognized testing laboratory (NRTL), and that is acceptable to authorities having jurisdiction.

C. All electrical equipment and materials shall be new and shall be listed by Underwriter's Laboratories, Inc. (U.L.), or other National Recognized Testing Laboratory (NRTL), in categories for which standards have been set by that agency and labeled as such in the manufacturer's plant.

1.9 WARRANTY

A. Submit warranties in accordance with Division 1 - General Requirements of these specifications.

B. The Manufacturer shall warrant that all materials and equipment furnished under this contract will be new and of good quality, free from defects in design, workmanship, and materials. Defects shall include, but not be limited to noisy, rough, or substandard operation; loose, damaged, and missing parts; and abnormal deterioration of finish.

C. Each item of equipment, or part thereof, proving to be defective within the specified period of the warranty shall be replaced, free of defect, without cost to the Owner. Warranty shall include materials and labor necessary to correct defects.

D. The manufacturer's authorized dealer shall be capable of administering the manufacturer and dealer's warranty for all components supplied by the selling dealer (who may or may not be the same as the servicing dealer).

1. The manufacturer's and dealer's extended warranty shall in no event be for a period of less than five (5) years from date of initial start-up of the system and shall include repair parts, labor, reasonable travel expense necessary for repairs at the jobsite, and expendables (lubricating oil, filters, antifreeze, and other service items made unusable by the defect) used during the course of repair. Applicable deductible costs shall be specified in the manufacturer's warranty. Provide a temporary generator set in the event a covered repair exceeds 96 hours. Submittals received without written warranties as specified will be rejected in their entirety.

2. The enclosure and all ancillary options shall have a two-year parts and labor warranty.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers, subject to compliance with requirements of this specification, are as follows:

1. Engine

   a. Caterpillar

   b. Cummins

   c. Approved Equal

2. Governor:

   a. Caterpillar

   b. Woodward

3. Alternator:

   a. Caterpillar

   b. Kato

   c. Leroy Somers

   d. Marathon

4. Voltage regulator:

a. Caterpillar

b. Basler

c. Marathon

5. Radiator:

a. Caterpillar

b. Cummins

c. MTU

6. Silencer:

a. Caterpillar

b. Harco

c. GT Exhaust

7. Battery charger:

a. Caterpillar

b. Sens

c. Lamarche

8. Circuit breakers:

a. Merlin Gerin

b. Square D

c. Siemens

d. ABB

9. Vibration Isolators:

a. Caterpillar Ace

b. Korfund

c. Mason

10. Enclosures:

a. Precision Power Source

b. Fiberbond

c. Robinson

d. Modutek

11. SCR

a. Safety Power

b. Miratech

c. Approved Equal

2.2 PERFORMANCE

A. Engine exhaust emissions at full load shall meet the criteria listed in Part IV - Attachments prior to any emission control device.

B. The Engine/Generator set shall conform to the technical criteria listed in Part IV – Attachments.

C. Rating - Engine brake horsepower shall be sufficient to deliver full rated generator set kW/kVA when operated at rated rpm and equipped with all engine-mounted parasitic and external loads such as radiator fans and power generators.

D. Conditions - The rating shall be based on ISO 3046/1 standard conditions of 100 kPa and 27C (29.53 in Hg, 81F

E. Fuel – Natural Gas engines shall be able to deliver rated power when operating on pipeline natural gas having an LHV of 920 BTU/cu ft

F. Block Load Acceptance - Transient response shall conform to ISO 8528 requirements.

G. Exhaust Emissions - The proposed generator set shall be in compliance with San Diego County Air Pollution Control District (APCD) emission regulations for a spark ignited engine in a peak shaving/continuous application.

2.3 GAS ENGINE DRIVEN GENERATOR

A. The engine shall be equipped with air filters, restriction gauge, lubricating oil cooler, filters, and pressure gauge, water pump and temperature gauge, service hour meter, flywheel, and flywheel housing when applicable.

B. Structure/Metallurgy

1. The design of the basic engine shall provide for maximum structural integrity to extend service life. Materials used in the engine shall incorporate the highest level of proven metallurgical and manufacturing technology. Block shall be of one-piece design and cast of high tensile strength iron.

C. Lubrication System

1. The lubrication oil pump shall be a positive displacement type that is integral with the engine and gear driven from the engine gear train. The system shall incorporate full flow filtration with bypass valve to continue lubrication in the event of filter clogging.

2. The bypass valve must be integral with the engine filter base or receptacle. The filter shall incorporate a self-lubricating, free rotating seal and have a nonmetallic core sufficiently rigid to minimize movement or shifting of the filtration media.

D. Electronic Fuel Control Valve

1. The engine shall be equipped with an electronic engine fuel control valve. Fuel control valve shall mix the fuel with the intake combustion air. It shall meter incoming fuel and provide throttle control for engine operation. It shall require no more the .5 PSI at the inlet to the throttle control unit.

E. Fuel Strainer

1. A fuel strainer shall be provided as per the generator set MFG requirements to remove particles and debris from the incoming fuel supply line

F. Fuel Train

1. Provide the incoming fuel train as required per the MFG requirements for a natural gas fired engine generator set. Pressure losses through the fuel train shall be kept to a minimum. Provide fuel train per NFPA 37. Maximum pressure loss through the fuel train shall be 0.15 PSi

G. Fuel Lines

1. Flexible fuel lines between engine and fuel supply shall be installed to isolate vibration.

H. Engine Control

1. The engine control shall be an electronic type and shall control engine speed while optimizing both steady state and transient engine performance. The control will monitor all significant engine parameters, and adjust engine performance according to speed, altitude, temperature,

aftercooler temperature, and engine condition. It shall incorporate revisable control software capable of reconfiguring engine operation to desired performance levels.

2. The engine control shall be configured to avoid interruption of power whenever possible. In the event of system faults, which do not require immediate shutdown, the engine shall be programmed to continue operation at power levels sufficient to remain within performance limits. Engine governing shall maintain steady state speed regulation of +/- 1%, and be adjustable. In the event of a DC power loss, the fuel system will remain closed.

I. Cooling System

1. The engine jacket water cooling system shall be a closed circuit design with provision for filling, expansion, and deaeration. The cooling pump shall be gear driven by the engine. Auxiliary coolant pumps required for heat exchangers or separate circuit aftercooling shall also be gear driven by the engine. The cooling system shall tolerate at least 172-kPa (25-PSI) static head. Coolant temperature shall be internally regulated to disconnect external cooling systems until operating temperature is achieved. Radiator shall be rated at 105 degrees F.

J. Radiator

1. Heat rejected to the engine jacket water shall be discharged to the atmosphere through a close-coupled radiator. The radiator shall be sized to cool the engine continuously while operating at full rated load and at specified site conditions.

K. Fan and Belt Guarding

1. The fan, fan drive, and fan belts shall be covered with 14 gauge punched steel mesh guarding for personnel protection. The guarding shall conform to IEC 34-5, ISO and OSHA standards.

L. Blower Fan

1. The radiator-cooling fan shall be a blower type driven from the engine. Air shall be drawn from the engine side and exhausted through the radiator core. It shall have an external static pressure capability of 0.75” H_20, not including the radiator core.

M. Inlet Air System

1. The engine air cleaner shall be engine mounted with dry element requiring replacement no more frequently than 250 operating hours or once each year.

N. Turbocharging

1. Turbochargers shall be of the radial turbine type driven by engine exhaust gases and direct - connected to a compressor supplying engine combustion air.

O. Crankcase Fumes Reclamation

1. Provide a crankcase fumes reclamation system on the engine. System shall collect crankcase emissions, filter out airborne lube oil, and return the crankcase fumes back to the engine air intake. Crankcase fumes shall not be allowed to vent directly into the atmosphere. Fumes collection system shall be as MFG by Racor or approved equal

P. Wiring and Conduit

1. Engine and generator control wiring shall be multi-strand annealed copper conductors encased by cross-linked polyethylene insulation resistant to heat, abrasion, oil, water, antifreeze, and diesel fuel. Wiring shall be suitable for continuous use at 120C (250F) with insulation not brittle at -50C (-60F). Each cable will be heat stamped throughout the entire length to identify the cable's origin and termination. Cables shall be enclosed in nylon flexible conduit, which is slotted to allow easy access and moisture to escape. Reusable bulkhead fittings will attach the conduit to generator set mounted junction boxes.

Q. Electrical Starting System

1. The engine starting system shall include 24V dual DC starting motors, starter relay, and automatic reset circuit breaker to protect against butt engagement. Batteries shall be maintenance free, lead acid types mounted near the starting motor. A corrosion resistant or coated steel battery rack shall be located to avoid spillage from servicing of fuel and oil filters. Required cables will be furnished and sized to satisfy circuit requirements. The system shall be capable of starting a properly equipped engine within 60 seconds at ambient temperatures.

R. Jacket Water Heater

1. Jacket water heater shall be provided to maintain coolant temperature of 32C (90F) while the engine is idle. Heaters shall accept 120 or 240 VAC single phase power and include thermostatic controls. Hoses to and from the heater shall be industrial quality, which exhibit long life in operational environments. Manual shutoff valves shall be incorporated to isolate the heaters during servicing.

S. Batteries

1. Batteries for starting and control shall be selected and supplied by the generator set manufacturer. They shall be a heavy duty SLI lead acid type with thru-partition connectors, and housed in a hard rubber or polypropylene case with provision for venting.

2. Starting batteries shall be rated 24V DC Sizing shall consider specific application requirements of engine oil viscosity, ambient starting temperature, control voltage, overcharging and vibration.

3. Batteries shall be located as close to the starting motor as practical, away from spark sources, in a relatively cool ambient, and permit easy inspection and maintenance. Battery warranty shall be the responsibility of the generator set manufacturer.

T. Alternator

1. An engine-mounted belt driven battery-charging alternator shall be installed with an automatic voltage regulator. It shall be suitable for heavy-duty applications with a rating of 24V 35 amperes minimum.

2. The alternator(s) shall be rated for peak shaving/continuous service at 1000 ekW, 1250 kVA, 0.80 PF, 480 VAC, three phase, 3 wire, 60 Hz, 1800 rpm.

3. The alternator(s) shall be capable of withstanding a three-phase load of 300% rated current for 10 seconds, and sustaining 150% of continuous load current for 2 minutes with field set for normal rated load excitation.

4. It shall exhibit less than 5% waveform deviation at no load.

5. Structured – Close Coupled

   a. The alternator shall be close coupled, drip proof and guarded, constructed to NEMA 1 and IP 22 standards, single bearing, salient pole, revolving field, synchronous type with amortisseur windings in the pole faces of the rotating field. The alternator terminal box shall provide generous space for entrance and installation of power cables.

6. Mechanical Design

   a. The alternator housing shall be one piece and mount directly to the engine flywheel housing without bolted adapters. Engine torque shall be transmitted through flexible steel plates to the alternator rotor. The alternator-ventilating fan shall mount to the engine flywheel and act as a pressure plate to secure the flexible plates.

7. Windings

a. The windings shall consist of copper magnet wire coated with an underlay of polyester (amide)(imide) resins and a superimposed heavy coat of polyamideimide resins. All winding insulation materials shall be Class H in accordance with BS and IEEE standards. No materials shall be used which support fungus growth, and shall be impervious to oil, dirt, and fumes encountered in diesel and natural gas engine operating environments. Temperature rise shall be 80 degree C rise over 40 degree C ambient. Pitch shall be 2/3.

8. Operating Environment

a. The alternator shall be designed to operate in a sheltered drip-proof environment.

9. Excitation

a. The alternator exciter shall be brushless with the circuit consisting of a three-phase armature and a three-phase full wave bridge rectifier mounted on the rotor shaft. Surge suppressors shall be included to protect the rotating diodes from voltage spikes.

10. Exciter – PMG Type

a. The permanent magnet excitation system shall derive excitation current from an external stator shaft mounted exciter. It shall enable the alternator to sustain 300% of rated current for ten seconds during a fault condition.

11. Voltage Regulator

a. The voltage regulator shall be microprocessor based with adjustable operating and protection characteristics. The regulator shall be capable of sensing true RMS in three phases of alternator output voltage, or operating in single phase sensing mode. It shall exhibit the following operational characteristics:

1) Alternator output voltage maintained within +/- 0.5% at steady state conditions.

2) Alternator output voltage maintained within +/- 0.5% of rated value for any load variation between no load and full load.

3) Alternator output voltage drift no more than +/-0.5% of rated value at constant temperature.

4) Alternator output voltage drift no more than +/- 0.5% of rated value within a 40 change over ambient temperature range of -40øC to 70øC.

U. Mounting

1. The engine and generator shall be assembled to a common base by the engine-generator manufacturer. The generator set base shall be designed and built by the engine-generator manufacturer to resist deflection, maintain alignment, and minimize resonant linear vibration.

2. Isolator – Spring Type

a. Provide spring type vibration isolators to be mounted between the generator set base assembly and the site mounting surface. Isolators shall be spring type seismic zone 2 compliant. Isolators shall have a maximum deflection of 1” Isolators shall be Ace Mountings 822 series or approved equal

V. Controls, Protection, and Monitoring

1. The controls, protection, and monitoring systems of the generator set and its operation shall be the responsibility of the generator set manufacturer. All subsystem components, interfaces, and logic shall be compatible with engine mounted devices.

2. Cycle Cranking

a. A cycle crank timer shall provide five 10 second cranking periods separated by 10-second rest periods.

b. Engine Cooldown

1) A cool down timer shall provide an adjustable 0-30 minute engine-running period before shutdown after removal of load.

3. Controls – Generator Set Mounted

a. Provide a fully solid-state, microprocessor based, generator set control. The control panel shall be designed and built by the engine manufacturer. The control shall provide all operating, monitoring, and control functions for the generator set. The control panel shall be Caterpillar EMCP4 or approved equal.

b. Environmental

1) The generator set control shall be tested and certified to the following environmental conditions:\ –40°C to +70ºC Operating Range

100% humidity condensing, 30ºC to 60ºC
IP22 protection

2) 5% salt spray, 48 hours, +38ºC, 36.8V system voltage

3) Sinusoidal vibration 4.3G's RMS, 24-1000Hz

4) Electromagnetic Capability (89/336/EEC, 91/368/EEC, 93/44/EEC, 93/68/EEC, BS EN 50081-2, 50082-2)

5) Shock: withstand 15G

c. Functional Requirements

1) The following functionality shall be integral to the control panel.

a) The control shall include a minimum 64 x 240 pixel, 28mm x 100mm, white backlight graphical display with text based alarm/event descriptions

b) The control shall include a minimum of 3-line data display

c) Audible horn for alarm and shutdown with horn silence switch

d) Standard ISO labeling

e) Multiple language capability

f) Remote start/stop control

g) Local run/off/auto control integral to system microprocessor

h) Cooldown timer

i) Speed adjust

j) Lamp test

k) Push button emergency stop button

l) Password protected system programming

d. Digital Monitoring Capability

1) The controls shall provide the following digital readouts for the engine and generator. All readings shall be indicated in either metric or English units

2) Engine

a) Engine oil pressure

b) Engine oil temperature

c) Engine coolant temperature

d) Engine RPM

e) Battery volts

f) Engine hours

3) Generator

a) Generator AC volts (Line to Line, Line to Neutral and Average)

b) Generator AC current (Avg and Per Phase)

c) Generator AC Frequency

d) Generator kW (Total and Per Phase)

e) Generator kVA (Total and Per Phase)

f) Generator kVAR (Total and Per Phase)

g) Power Factor (Avg and Per Phase)

h) Total kW-hr

i) Total kVAR-hr

j) % kW

k) % kVA

l) % kVAR

e. Alarms and Shutdowns

1) The control shall monitor and provide alarm indication and subsequent shutdown for the following conditions. All alarms and shutdowns are accompanied by a time, date,

and engine hour stamp that are stored by the control panel for first and last occurrence:

2) Engine Alarm/Shutdown

a) Low oil pressure alarm/shutdown

b) High coolant temperature alarm/shutdown

c) Loss of coolant shutdown

d) Overspeed shutdown

e) Overcrank shutdown

f) Low coolant level alarm

g) Emergency stop depressed shutdown

h) Low coolant temperature alarm

i) Low battery voltage alarm

j) High battery voltage alarm

k) Control switch not in auto position alarm

l) Battery charger failure alarm

3) Generator Alarm/Shutdown

a) Generator over voltage

b) Generator under voltage

c) Generator over frequency

d) Generator under frequency

f. Maintenance

1) All engine, voltage regulator, control panel and accessory units shall be accessible through a single electronic service tool. The following maintenance functionality shall be integral to the generator set control

a) Engine running hours display

b) Service maintenance interval (running hours or calendar days)

c) Engine crank attempt counter

d) Engine successful starts counter

e) 20 events are stored in control panel memory

f) Programmable cycle timer that starts and runs the generator for a predetermined time. The timer shall use 14 user-programmable sequences that are repeated in a 7-day cycle. Each sequence shall have the following programmable set points:

(1) Day of week

(2) Time of day to start

(3) Duration of cycle

g. Remote Communications

1) The control shall include Modbus RTU communications as standard via RS-485 half duplex with configurable baud rates from 2.4k to 57.6k.

h. Local and Remote Annunciation

1) Local Annunciator (NFPA 99/110, CSA 282)

2) Provide a local, control panel mounted, annunciator to meet the requirements of NFPA 110, Level 1.

a) Annunciators shall be networked directly to the generator set control

b) Local Annunciator shall include a lamp test pushbutton, alarm horn and alarm acknowledge pushbutton

c) Provide the following individual light indications for protection and diagnostics

(1) Overcrank

(2) Low coolant temperature

(3) High coolant temperature warning

(4) High coolant temperature shutdown

(5) Low oil pressure warning

(6) Low oil pressure shutdown

(7) Overspeed

(8) Low coolant level

(9) EPS supplying load

(10) Control switch not in auto

(11) High battery voltage

(12) Low battery voltage

(13) Battery charger AC failure

(14) Emergency stop

(15) Spare

(16) Spare

d) Provide a remote annunciator that shall provide annunciation of all points stated below and shall incorporate ring-back capability so that after silencing the initial alarm, any subsequent alarms will sound the horn

e) Ability to be located up to 4000 ft from the generator set

f) Provide the following individual light indications for protection and diagnostics

(1) Overcrank

(2) Low coolant temperature

(3) High coolant temperature warning

(4) High coolant temperature shutdown

(5) Low oil pressure warning

(6) Low oil pressure shutdown

(7) Overspeed

(8) Low coolant level

(9) EPS supplying load

(10) Control switch not in auto

(11) High battery voltage

(12) Low battery voltage

(13) Battery charger AC failure

(14) Emergency stop

(15) Spare

(16) Spare

W. Battery Charger

1. A battery charger shall be provided which shall accept 120 VAC single phase input to provide 24 VDC output. It shall be fused on the AC input and DC output; and incorporate current limiting circuitry to avoid the need for a crank disconnect relay. An AC voltage power switch shall be mounted on the face of the charger and shielded from accidental switching. The charger shall include an AC ammeter and voltmeter, a failure malfunction alarm switch, and be housed in a NEMA 1 enclosure suitable for wall mounting. It shall include alarm relays for remote annunciation of battery charger failure, low DC volts, and high DC volts, per NFPA 110

2.4 MAINLINE GENERATOR PROTECTION – OUTDOOR ENCLOSURE

A. Construction: The enclosure shall be vandal-resistant, rust-resistant and weather-protective housing and shall be of a 0.125” thick 3003 Aluminum formed construction. The enclosure is rated to a wind load of 125 MPH and 50lbs./sq ft roof load. Rain test equal to 4 inches/hour. The basic structure meets all seismic requirements of Zone 4 or equivalent. The design and construction shall be modular in that the panels shall not exceed 24” in width. All exterior components of the enclosure shall be assembled utilizing stainless steel bolts, nuts and lock washers. All seams shall be sealed to prevent leaks. The enclosure must be built to IBC standards and must be provided with proper certifications proving so. Enclosure must be designed to be ship disassembled with any one piece weighing no more than 40 tons and having a maximum dimension of 13’W x 74”L including any shipping skids, trailers etc. Include break down of the enclosure after testing.

B. Doors: Doors shall not exceed 36” in width. All doors on the enclosure shall be strategically located in areas as to allow ease of maintenance on the generator set and allow good access to and visibility of instruments, controls, engine gauges, etc. The doors shall be fitted with stainless steel bolt on, lift off hinges

with pins of a diameter not less than .375". Each door shall be fitted with flush-mounted, key lockable latches keyed alike. The latch hardware shall allow escape from within when locked externally. Door holdback hardware shall be provided to secure the door to the enclosure wall during installation and maintenance. All doors shall be Gasketed to prevent leaks. Provide five (5) sets of keys for each door lock.

C. Roof: The roof of the enclosure shall meet or exceed the minimum thickness requirements specified, but in addition, shall be strengthened by utilizing 3/16" thick aluminum trusses. The roof must be covered with a rubber membrane to prevent any water intrusion.

D. SCR Platform: A platform shall be provided around the SCR reactor housing providing working clearance for the reactor. Platform shall provide access to exhaust stack test ports in compliance with San Diego Air Pollution Control District requirements.

E. Ships ladder to be provided, allowing for easy access to SCR platform above the enclosure. Ships ladder to be mounted securely to outside edge of tank or enclosure and able to support a minimum of 350lbs.

F. Cooling: Under no circumstances shall the floor area or any of its parts be considered for cooling air intake or discharge requirements of the generator set or its associated equipment.

G. Working Clearance: The base and enclosure assembly shall allow room within the package to mount and maintain the specified battery charger, engine starting batteries, racks and cables, engine-generator control panel, and other items as specified or as shown on the drawings. Code required working clearances about the genset shall be provided.

H. Sound Attenuation: The entire enclosure except for the louvered openings shall have acoustic material installed on the interior roof and wall panels of a weight and thickness consistent with the specified level of noise reduction. The acoustic material shall be held in place by aluminum perorated metal sheeting to form a removable section easily inspected by maintenance personnel. The enclosure package shall be designed to achieve a 74 dB(A) sound level when measured at a distance of 3.3 feet (1 meter) from any point around the perimeter of the enclosure at 5 feet above grade based on free-field environment Paint: The enclosure shall be spray finish utilizing (2) coats of rust-inhibiting primer and finished with a minimum of two (2) coats of polyurethane. Final color of finish coat will be selected at shop drawing review.

I. Enclosure Power: The enclosure shall be equipped with a minimum 100-amp 480:120/208, 3 phase mini-power zone including a 45 kVA transformer to power the generator jacket water heaters, battery charger, lighting, receptacles, etc., as specified and as shown on the drawings. The placement of this equipment shall be shown on the submittal drawings. All internal conduit and wiring to the ancillary equipment shall be supplied within the package and shall be pre-wired

by the enclosure manufacturer in accordance with all governing codes pursuant to this application. The Load Center is to be supplied complete with bolt-in circuit breakers, as required, to complete system. Enclosure electrical package shall include but not limited to the following:

1. (6) Vapor-proof LED lights
2. (2) Vapor-proof interior emergency LED 2-head lights with battery backup.
3. (2) 3-Way light switches
4. (3) GFCI receptacles
5. Ventilation fan(s) with thermostat
6. (4) Exterior LED lights with photocell and override local (2) switches
7. (6) Ceiling mounted heat detectors, (2) manual wall mounted pull stations, (2) wall mounted horn/strobe units
8. (3) Roof mounted vapor proof flashing beacons
9. (2) Emergency stop buttons, externally mounted with nameplates
10. (4) 5 lb CO2 fire extinguishers

J. Internal Wiring: All wiring (type THHN-2, 90°C.) within the enclosure shall be in conduits made from galvanized rigid metal material specifically manufactured for electrical use. All connections at the generator set shall be liquid tight flexible conduits, and all shall be provided and installed by the enclosure manufacturer.

K. Airflow

1. Intake/exhaust fans
    a. Quantity as required for combustion, ventilating, and radiator cooling air
    b. Mounted to the enclosure air intake and air exhaust
    c. Variable frequency drive controlled

L. Enclosure Air Intake: Sound attenuated fixed louvers shall be utilized on the exterior of the enclosure. Air will then go through sound attenuated baffling then through motorized 120 VAC fail-safe dampers into the main enclosure compartment. All louvers shall be designed to help prevent the entrance of driving rain water, but shall have sufficient free area to allow for engine-generator cooling air requirements. Bird screen shall cover entire air intake opening

M. Enclosure Air Exhaust: Engine radiator shall exhaust through gravity dampers into an integral acoustical exhaust plenum. The exhaust plenum shall be incorporated into the design of the enclosure to maintain a square building type appearance. Bird screen shall cover entire air exhaust opening. Exhaust air shall exit thru the top of the container.

N. Insulation material is to be mineral wool held in place with an aluminum perforated metal liner

O. Enclosure Flooring: The floor of the enclosure shall be designed and constructed in such a manner as to prevent the entrance of rodents. This shall be accomplished with diamond plate. The floor must also be provided with fluid containment greater than the capacity of the cooling system. The enclosure floor must be capable of fully supporting any ancillary equipment specified which may be secured to it. The flooring must also accommodate the anticipated weight of maintenance personnel and their tools.

P. Weight: The weight of the entire unit consisting of generator set, enclosure and other specified items including all liquids (i.e., fuel oil and cooling solutions) shall be calculated by the enclosure manufacturer. The base of the unit shall be designed and manufactured as a heavy duty, structural steel construction with lifting provisions to support the calculated weight.

Q. Exhaust Silencer: Silencer must be provided to maintain the enclosure sound level. Exhaust system to include; one Stainless Steel wye-pipe flexible exhaust inlet, Insulated Silencer, mating flanges, gaskets, etc. as required. Silencer exit piping, thimbles, rain cap, etc. resulting in one complete exhaust system must be included and supplied by enclosure manufacturer. Exhaust system to be supported completely and only from roof or sides of enclosure, at no point shall the silencer weight be supported by the engine thus preventing potential damage to engine outlet turbo(s) or exhaust manifold, due to excessive weight of components. All interior exhaust components to be covered in 2” thick calcium silicate blankets.

R. Rain Skirt: At the point where the exhaust pipe penetrates the roof of the enclosure, a suitable “rain skirt: and collar shall be provided by enclosure manufacturer. It shall be designed to prevent the entrance of rain yet allow for expansion and vibration of the exhaust piping without chafing or stress to the exhaust system.

S. Wiring and Connectors: All conduits, wire, cables, interconnections, etc., entering or exiting the generator enclosure shall be furnished and installed by the installing contractor. All wiring shall be in conduits sized in accordance with the NEC with San Diego Amendments. All power and control wiring shall be installed for a complete and operating system. All floor openings to accommodate underground conduits shall be as required based on contract drawings showing number and size of all power and communication conditions. Enclosure vendor shall make all required openings in the enclosure floor to accommodate all required power and communication conduits shown on drawings.

T. Color: Enclosure vendor shall provide a minimum of 10 colors for the owner / architect to select.

U. Provide two (2) welded ground connection lugs on each side of the enclosure at the engine base.

2.5 RADIATOR MOUNTED LOADBANK

A. The system shall be a UL listed, radiator style resistive load bank using the air discharge from the generator radiator for cooling.

B. Ratings

1. The total capacity of the load bank shall be rated (125) KW at (208) Volts, 3-Phase, 3-Wire, 60 Hertz, at unity Power Factor.

2. The load step resolution shall be a nominal 20% of the load bank rating.

3. The load bank shall be designed for continuous duty cycle operation with no limitations.

4. Radiator/Duct mounted load banks are designed as a supplemental load to the generator set, and shall be sized at 50-60% of generator nameplate KW rating (not 100%).

C. Material and Construction

1. The load bank shall be suitable for installation on the generator radiator core, or within the radiator exhaust ductwork.

2. Due to the high radiator exhaust from the generator, the load bank shall be constructed of heavy gauge aluminized steel per ASTM A463. Aluminized steel provides superior corrosion protection and extended service life, with a better tolerance to high heat exposure compared to the more common Galvanized steel.

3. The main input load bus, load step relays, fuses and control relays shall be located within the load bank enclosure.

4. The load bank shall be sized to mount to the radiator core with a self-contained 2” flange on the top and bottom edges for mounting. Load banks with a depth of 13” shall have provisions for overhead lifting and duct adaptors.

5. The load bank shall be designed for installation and operation indoors. All exterior fasteners shall be stainless steel.

D. Resistive Load Elements

1. Load elements shall be Avtron Helidyne™, helically wound chromium alloy rated to operate at approximately ½ of maximum continuous rating of wire. Elements must be fully supported across the entire length within the air stream by segmented ceramic insulators on stainless steel rods. Element supports shall be designed to prevent a short circuit to adjacent elements or to ground.

2. The change in resistance due to temperature shall be minimized by maintaining conservative watt densities.

3. The overall tolerance of the load bank shall be –0% to +5% KW at rated voltage. A –5%, +5% rating allows the load bank to deliver less than rated KW and shall not be used. The load bank must deliver full rated KW at rated voltage.

4. Sealed wire type elements (which have the internal resistance wire totally enclosed) prevent internal cooling of the element wire and shall not be used.

E. Protective Devices

1. An over-temperature switch shall be provided to sense the load bank exhaust. The switch shall be electrically interlocked with the load application controls to prevent load from being applied in the event of an over temperature condition.

2. To provide for major fault protection, branch fuses shall be provided on all three phases of switched load steps above 50KW. Branch fuses shall be current limiting type with an interrupting rating of 200K A.I.C.

3. The exterior of the load bank shall have appropriate warning/caution statements on access panels.

F. Control Panel

1. The control panel shall be a local panel mounted on the load bank. The control panel shall contain the following manual controls:

   a. Power ON/OFF switch

   b. Master load ON/OFF switch.

   c. Load step switches for ON/OFF application of individual load steps.

2. Control panel visual indicators shall be as follows:

   a. Power ON indication light.

   b. Over-temperature light.

3. A standard remote load dump circuit shall be provided as part of the load bank control circuit. Provisions shall be provided to remove the load bank off-line from the operation of a remote normally closed set of auxiliary contacts from a transfer switch or other device. In the event of the remote contact opening, all load is removed.

4. Remote 19” control panel housed in a NEMA 4 type wall mount enclosure shall be provided.

5. An Automatic Load Step Controller shall be provided for maintaining a minimum load on the generator set. The controller shall monitor the connected downstream loads and will automatically add or subtract load steps in response to building load changes as to maintain a minimum load level on the generator set. The controller includes an initial time-delay circuit, and automatic time delayed load step application circuit. A remote contact closure is required for activation and transfer of control. A separate current transformer shall be supplied loose for mounting and sensing of downstream loads.

6. (OPTIONAL) An integral control power transformer shall be provided to supply 120V, 1 phase, 60 Hz to the load banks control and safety circuitry. Transformer primary and secondary control circuits shall be fuse protected.

PART 3 - EXECUTION

3.1 PREDELIVERY TESTING

A. Each engine, generator, and generator set shall be subjected to production performance tests and quality controls to insure reliable operation. These tests and controls shall include but not be limited to:

1. Specific observances of engine blowby, slobber, combustion gas leaks, inlet air leaks, excessive vibration, and unusual noise.

2. Fuel system setting confirmation, which shall not be altered to rectify nonconformance to, established performance specifications.

3. Retest after any change affecting airflow through the engine, fuel injected into the engine, engine combustion, or any reassembly which potentially affects mechanical integrity.

B. Periodic extended tests to confirm baseline data.

C. Recording of:

1. Engine RPM

2. Frequency

3. Average voltage

4. Line to line voltages, all three phases

5. Average current

6. Line currents for all three phases

7. Observed power

D. Readings to be taken at 0.8 Power Factor

E. The generator set supplier shall provide test reports to the owner upon successful completion of the test.

F. Optional Witness Test

1. Load bank testing shall be done in the presence of the owner's engineer or his appointed representative. All travel and lodging expenses for attendees shall be included in this contract for the factory test. Testing shall be for a minimum of four (4) hours under full load.

G. All safety shutdown and pre alarm functions shall be tested to demonstrate their functionality.

H. Test transient response of genset by loading gensets in 20% load increments up to 100%

I. All transient load steps must be recorded on a chart recorder or light beam oscilloscope to verify generator set operation meets criteria.

J. Load testing shall be performed as follows:

1. In a period of four (4) hours with a loading of 100 percent of rated load at unity power factor. The following readings shall be taken at 15 minute intervals:

a. Voltage

b. Amperage (3 phase)

c. Frequency

d. Oil pressure

e. Water temperature

f. Ambient temperature

g. Kilowatts

K. The generator set supplier shall provide test reports to the owner upon successful completion of the test.

L. The bidder shall furnish all consumables necessary for testing. Any defects, which become evident during the test shall be corrected by the bidder at his own expense prior to shipment to the jobsite.

3.2 INSPECTION

A. Examine areas, equipment bases, and conditions, with installing Contractor present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.

B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. The installation shall be performed in accordance with shop drawings, specifications, and the manufacturer's instructions, and with recognized industry practices, to ensure proper performance in accordance with the specifications. Comply with applicable NEMA standards pertaining to installation of engine-generator sets and accessories and with NFPA 110.

B. Provide enclosure manufacturer’s site personnel to supervise reassembly of the enclosure as well as provide engine manufacturer's certified technicians to perform reassembly of the generator set on site to maintain integrity of the product and warranty.

C. Coordinate with the work of other trades including piping, breeching, post exhaust treatment and accessories as necessary to provide a complete operational system.

D. Include the installation of control and monitoring and power panels, battery charger, integral tank, batteries and racks and other appurtenances to the extent that such appurtenances are not factory installed and wired.

E. Include field inter wiring and power supply and control connections for load bank, batteries, battery chargers, pumps, heaters, float switches, solenoid valves, damper operators and other miscellaneous items as required in accordance with manufacturers wiring diagrams. Such wiring shall include (but not be limited to):

1. Wiring between battery and engine control panel and battery charger and power supplies thereto.

2. Power supply wiring and control wiring for engine jacket water heater.

3. Power supply wiring and control wiring for fuel pumps, integral fuel tank, float switches, valves and other fuel supply system components.

4. Power supply and control wiring for automatic louver damper operators.

5. Emergency stop break glass switch match type and number of cables and conductors to control and communications requirements of transfer switches as recommended by manufacturer.

F. Ground equipment.

3.4 FIELD QUALITY CONTROL

A. The complete installation shall be checked for procedural and operational compliance by a representative of the system manufacturer's authorized local dealer. The engine lubricating oil and antifreeze, as recommended by the system manufacturer, shall be provided by the generator set dealer. If different manufacturers furnish switchgear and generator sets, technical representatives of both manufacturers' authorized dealers shall verify the installation meets requirements. Any deficiencies shall be noted and corrected by the Contractor.

B. The system manufacturer's dealer representative shall be present to assist the Contractor during start-up, systems check, adjusting, and any site testing required after the installation is complete.

3.5 POST-INSTALLATION TESTING

A. Following installation, the following tests shall be performed by the system manufacturer's local dealer representative(s) in the presence of the owner's engineer or designated appointee:

B. Prestart Checks:

1. oil level

2. water level

3. day tank fuel level

4. battery connection and charge condition

5. air start supply pressure (if so equipped)

6. engine to control interconnects

7. engine generator intake/exhaust obstructions

8. engine room ventilation obstructions

9. removal of all packing materials

C. Operation

1. Load - Four hours operation at 100% of full load rating. After the first fifteen minute stabilization period at full load, the following shall be recorded at fifteen-minute intervals:

    a. Voltage and amperage (3 phase), frequency

    b. Fuel pressure, oil pressure and water temperature

    c. Exhaust gas temperature at engine exhaust outlet

    d. Ambient temperature

2. If equipped with appropriate instrumentation:

    a. Kilowatts

    b. Power Factor

    c. KVARS

    d. Generator Temperature

3. Proper operation of controls, engine shutdown, and safety devices shall be demonstrated.

D. The manufacturer's representative shall provide resistive load banks and field engineer for the test. Building load shall not be used.

E. Upon satisfactory completion of the load bank test, a pull the plug building test shall be performed utilizing building load and all equipment associated with the emergency generator set system.

F. Should these tests indicate that the equipment does not meet the specified performance requirements, National Electric Code and Local codes, the cost of all corrective measures shall be borne by the manufacturer's representative.

3.6 TRAINING

A. The system manufacturer's authorized dealer shall provide a complete training for the owner's engineering and maintenance personnel. Training shall include both classroom and hands-on instruction. Topics covered shall include control operation, schematics, wiring diagrams, meters, indicators, warning lights, shutdown system and routine maintenance.

B. Provide 2 days of on-site training (one day- 8 hours during regular working hours and one day- 8 hours during off hours) to instruct the owner's personnel in the proper operation and maintenance of the equipment. All training shall be recorded by professional videographer and shall provide electronic copies of the training to owner. Review operation and maintenance manuals, parts manuals, and emergency service procedures.

3.7 SERVICE MANUALS AND PARTS BOOKS

A. The system manufacturer's authorized local dealer shall furnish one copy each of the manuals and books listed below for each unit under this contract:

1. Operating Instructions - with description and illustration of all switchgear controls and indicators and engine and generator controls.

2. Parts Books - which illustrate and list all assemblies, subassemblies and components, except standard fastening hardware (nuts, bolts, washers, etc.).

3. Preventative Maintenance Instructions - on the complete system that cover daily, weekly, monthly, biannual, and annual maintenance requirements and include a complete lubrication chart.

4. Routine Test Procedures - for all electronic and electrical circuits and for the main AC generator.

5. Troubleshooting Chart - covering the complete generator set showing description of trouble, probable cause, and suggested remedy.

6. Recommended Spare Parts List - showing all consumables anticipated to be required during routine maintenance and test.

7. Wiring Diagrams and Schematics - showing function of all electrical components.

B. All manuals and books described above shall be contained in rigid plastic pouches.

3.8 TESTING

A. After final connections are made and prior to authorizing payment, specified equipment shall be tested for compliance with all specified features in the presence of the Engineer using acceptance procedures provided by the manufacturer.

3.9 CLEANUP

A. Touch-up damage to painted finishes.

B. Wipe and clean equipment of any oil, grease, and solvents, and make ready for use.

C. Clean area around equipment installation and remove packing or installation debris from job site.

D. Notify Engineer for acceptance inspection.

PART 4 – ATTACHMENTS

4.1 Data Sheets for Generator System

ATTACHMENT NO. 1 - ENGINE/GENERATOR PERFORMANCE DATA SHEET

E N G I N E

Engine Continuous Capacity kW	1,000
Electrical efficiency	*
Manufacturer / Model No.	*
Type	Reciprocating Gas Engine
Lubrication	Oil
Exhaust (flue) gas temperature at 100% load ° F	*
Exhaust (flue) gas temperature at 75% load ° F	
Exhaust (flue) gas temperature at 50% load ° F	
Exhaust (flue) gas temperature at 30% load ° F	
Exhaust gas flow (dry) lb/hr / SCFM	*
Engine Starter type:	Electric Battery *
Engine Jacket Cooling Btu/hr- In-Out temp.° F	*
Engine Lube Oil Cooling Btu / hr- In-Out temp.° F	*
Percentage Propylene Glycol Mixture fluid %	*

G E N E R A T O R

Generator Continuous Capacity/Nominal Power output	1000 kW /1000kW
Manufacturer / Model No.	* / *
Type	Permanent Magnet
Lubrication	*
Power factor:	0.8 PF
Voltage:	480V
Amps:	* amps
Frequency:	60 hz
Poles	*
Phase	3 phase
RPM:	*
Connection:	*
Pitch:	*
Insulation class	“H”
Excitation Requirements	
Efficiency At Full Load	*
Reactances (% at KVA rating)	*
Direct axis synchronous reactance;	*
Direct axis transient reactance:	*
Direct axis sub-transient reactance:	*
Short circuit current values:	*
Three phase:	*
Line to Line:	*
Line to Neutral:	*
Electrical data	*
Auxiliary power requirements	*
Space heaters (Watts & Volts):	*
Cooling fan(Watts & Volts):	*
Total Weights:	*
Shipping / Erection Lbs	*
Operating / Flooded Lbs	*
Overall Dimensions	*

**Note: Supplier to Confirm all listed information and to furnish information marked with *

ATTACHMENT NO. 2 – EMISSIONS AND FUEL

EMISSION REQUIREMENTS ON DISCHARGE OF THE Generator

ALL CONCENTRATIONS BELOW CORRECTED TO 3% OXYGEN ON A DRY BASIS	TECHNICAL DATA	
	gr/BHP-Hr	PPM
NOx:	1.0	82
CO:	2.0	270
VOC:	0.7	60
Minimum efficiency at 100% capacity at 15 percent excess air at 5 percent excess air.		

FUEL – NATURAL GAS

Fuel Pressure Required at the Engine: Psig	0.5-5
Natural Gas Firing Rate at Engine: SCFM	*
Fuel Oil Firing Rate: GPH (MAX/MIN)	Not Applicable
Natural Gas heat value (HHV) Min/Max Btu/scf	990/1150
Turn Down	30%
Jacket water heat rejection Btu/Hr	*
Oil cooler heat rejection Btu/Hr	*
Heat rejection to atmosphere Btu/Hr	*
Location: ( ) Indoors (x) Outdoors	

ATTACHMENT NO. 3 – ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT

DESCRIPTION	INFORMATION	DESCRIPTION	INFORMATION
Power	480V, 3 ph., 3 wire, 60 Hz	**Lighting:**	By Supplier as defined in Specification.
Area Classification Per NEC & FM Supplier shall confirm Rating of equipment	Class: General Purpose Division: Group: Temp Rating	**Heat Tracing**	NA
Motors	480V, 3 ph, 60 Hz, TEFC, severe duty, energy efficient, type per motor data sheet	**Electr. Equipment** **Nameplates**	White lamicoid with black lettering. Screwed in place

Grounding	Skid - Ground Lugs on frame by Supplier Motors – Separate ground conductor with power supply	**Control System**	By Supplier as defined in Specification.
Control Power	Derived by Supplier from engine batteries	**Convenience Receptacles:**	By Supplier as defined in Specification.
Raceway and Fittings	Rigid galvanized steel unless otherwise required	**Wiring**	Flame retardant, UL VW-1
Motor Controllers	By Supplier	**Control Terminations**	Spade
Branch Feeders	By Supplier	**Wire numbers**	Yes
Equipment Enclosures and Control Stations	NEMA 12, unless otherwise required	**Certifications:**	UL listed components
		Documentation:	Power requirements/ load summary, single line diagram, schematics, panel layouts, interconnect wiring diagrams, bills of materials, raceway routing, and test reports

END OF SECTION

MTS – Imperial Avenue Division Zero Emission Bus Overhead Charging – Phase I

SECTION 26 37 13

MICROGRID ENERGY MANAGEMENT SYSTEM

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:

1. Provide labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, configuration and installation for low voltage Microgrid Energy Management System (also identified as MEMS, Microgrid EMS, Energy Control Center, ECC, Microgrid PCS, Microgrid Power Control System, Distributed Energy Resources Power Control System or DER PCS) as required for the complete performance of the Work, as shown on the Drawings and as specified herein.

2. The low voltage Microgrid Energy Management System shall be provided by a qualified MEMS system supplier. The Contractor shall ultimately be responsible for the MEMS and shall supplement the system supplier's Work as necessary to provide a complete and operable system. The Contractor shall coordinate the equipment and systems provided by others that interface with the MEMS to ensure necessary interconnections and compatibility are provided for the required functionality of the MEMS:

3. MEMS system shall control the following equipment and as indicated in the drawings. System requirements outlined in this specification may need to be revised based on the final work package selected by the Owner as described below. The resources that need to control are as follows:

   a. The breakers for the ten (10) DC electric vehicle supply equipment (EVSE) at Substation B and four (4) future electric vehicle supply equipment (EVSE). A separate charger management system (CMS) would be required to control and receive data from the individual EVSEs.

   b. A permanent stationary generator connected to Substation A. MEMS shall include all equipment & installation labor necessary to monitor & control stationary generator. Contractor shall coordinate with generator supplier as necessary.

   c. Two (2) 1 MWh/500 kW battery energy storage system (BESS) and its respective breakers connected to the Substation B low voltage switchboard. MEMS shall include all equipment & installation labor necessary to monitor & control the battery energy storage system. Contractor shall coordinate with battery energy storage system as necessary.

d. The breakers to the three solar photovoltaic systems and their respective inverters connected to Substation B. MEMS shall include all equipment & installation labor necessary to monitor & control the solar PV system.

e. The utility feed breaker in the medium voltage switchgear.

B. Related Sections: Related sections include but shall not be limited to the following

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

2. Applicable general requirements for electrical Work specified within Division 26 Specification Sections apply to this Section.

3. Refer to the following Specifications for additional requirements

a. Section 26 24 13.11 Switchboards

b. Section 26 11 16 Secondary Unit Substation

c. Section 26 24 16.33 Panelboards

d. Section 26 12 16 Substation Transformers – Dry Type

e. Section 26 13 13 Metal Enclosed MV Switchgear

f. Section 26 31 01 Battery Electrical Supply System (ALT-1)

g. Section 26 31 00 Photovoltaic System (ALT-2)

h. Section 26 32 13 Gas Engine Driven Generator Sets (ALT-3)

1.2 REFERENCES

A. General Publications: The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified:

1. Institute of Electrical and Electronics Engineers (IEEE)

a. IEEE 1547, “IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces

b. IEEE 2030.7, “Standard for the Specification of Microgrid Controllers”

c. IEEE 2030.8, “Standard for the Testing of Microgrid Controllers”

2. International Organization for Standardization (ISO):

a. ISO 9001, “Quality Management Systems – Requirements”

3. National Fire Protection Agency (NFPA):

a. NFPA 70, “National Electrical Code”

b. NFPA 70B, “Electrical Equipment Maintenance

c. NFPA 70E, “Standard for Electrical Safety in the Workplace

4. Underwriters Laboratories, Inc. (UL):

a. UL67, “Standard for panelboards”

b. UL 98, "Standard for Enclosed and Dead Front Switches

c. UL 489, "Standard for Molded Case Circuit Breakers and Circuit Breaker Enclosures."

d. UL 891, "Standard for Dead Front Switchboards

e. UL 943, "Standard for Ground Fault Circuit Interrupters

f. UL 1283, “Standard for Safety for Electro Magnetic Interference Filters

g. UL 1449, "Standard for Surge Protective Devices

h. UL 1741, “Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources

i. UL 1741 SA (Supplement A), “Advanced Inverter Testing

5. International Electrotechnical Commission (IEC):

a. IEC 61850, “Power Utility Automation”

1.3 DEFINITIONS

A. Unless specifically defined within the Contract Documents, the words or acronyms contained within this specification shall be as defined within, or by the references listed within this specification, the Contract Documents, or, if not listed by either, by common industry practice.

1. BESS: Battery Energy Storage System

2. DER: Distributed Energy Resource (e.g. generators, PV arrays, BESS, etc.)

3. ECC: Energy Control Center

4. HMI: Human Machine Interface

5. MEMS: Microgrid Energy Management System

6. PV: Photovoltaic (e.g. solar electric)

1.4 SUBMITTALS

A. General: Submittals shall be in accordance with the requirements specified herein.

1. Submit sufficient information to determine compliance with the Contract Documents. Identify submittal data with the specific equipment tags and/or service descriptions to which they pertain. Submittal data shall be clearly marked to identify the specific model numbers, options, and features of equipment and work proposed.

2. Deviations from the Contract Documents shall be indicated within the submittal. Each deviation shall reference the corresponding drawing or specification number, show the Contract Document requirement text and/or illustration, and shall be accompanied by a detailed written justification for the deviation.

3. Submit required product data and shop drawings specific to each product and accessory proposed. [In addition, include the following information

a. System Architecture Diagram

b. MEMS Sequence of Operations

c. Unwitnessed Factory Acceptance Test report submitted prior to shipment.

B. Operation & Maintenance (O&M) manuals shall be provided in accordance with the minimum requirements specified in Section 01 78 23 Operation and Maintenance Data and additional requirements specified herein

1. Submit required Operations & Maintenance data specific to each product and accessory proposed.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall be a firm engaged in the manufacture of specified products of types and sizes required.

1. The manufacturer shall have a valid ISO 9001 certification and an applicable quality assurance system that is regularly reviewed and audited by a third-party

registrar. Manufacturing, inspection, and testing procedures shall be developed and controlled under the guidelines of the quality assurance system.

2. The manufacturer or their representative shall have service, repair, and technical support services available 24 hours 7 days a week basis.

B. Installer Qualifications: Installer shall be a firm that shall have a minimum of 5 years of successful installation experience with projects utilizing equipment similar in type and scope to that required for this Project and shall be approved by the manufacturer's representative.

C. All work performed and all materials used shall be in accordance with the National Electrical Code, and with applicable local regulations and ordinances. Process controllers, assemblies, materials, and equipment shall be listed and labeled by Underwriter's Laboratories or by a testing agency acceptable to authorities having jurisdiction and marked for intended use.

1.6 DELIVERY, STORAGE AND HANDLING

A. Prior to delivery to the Project site, ensure that suitable storage space is available to store materials in a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity, and corrosive atmospheres. Materials shall be protected during delivery and storage and shall not exceed the manufacturer stated storage requirements. As a minimum, store indoors in clean, dry space with uniform temperature to prevent condensation. In addition, protect electronics from all forms of electrical and magnetic energy that could reasonably cause damage.

B. Deliver materials to the Project site in supplier's or manufacturer's original wrappings and containers, labeled with supplier's or manufacturer's name, material or product brand name, and equipment tag number or service name as identified within the Contract Documents.

C. Inspect and report any concealed damage or violation of delivery storage, and handling requirements to the Engineer.

1.7 WARRANTY

A. General: Refer to Section 01 77 00 - Closeout Procedures

B. The manufacturer shall warrant products against defects in material and workmanship for 24 months from the date of commissioning or 36 months from the date of shipment, whichever comes first, provided that the manufacturer performs functional testing, commissioning and first parameter adjusting of equipment. During the warranty period the manufacturer shall repair or replace defective products. This warranty shall exclude normal wear and tear under normal usage and any damage caused by abuse, modification, or improper maintenance by entities other than the manufacturer or its approved representative.

C. Additional Owner Rights: The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

1.8 SPECIAL TOOLS AND SPARE PARTS

A. The Contractor shall provide a recommended spare parts list with the following information provided as a minimum:

1. Contact information for the closest parts stocking location to the Owner.

2. Critical spare parts shall be identified as those parts being associated with long lead times and/or those being critical to the unit's operation.

3. Maintenance spares shall be identified as being those parts required to regularly perform scheduled maintenance on the furnished equipment. These spares shall include, but shall not be limited to, consumable spares that are required to be exchanged during scheduled maintenance periods.

B. Spare parts shall be provided for each type and size of unit installed. At a minimum, the following shall be provided:

1. Provide the minimum spare parts recommended by the manufacturer.

2. Provide [1] set of each type of power and control fuse installed within equipment

C. Any manufacturer specific special tool, not normally found in an electrician’s toolbox, required to remove and install recommended or furnished spare parts shall be furnished. At a minimum the following shall be provided:

1. If available from manufacturer, provide PC-based configuration software tool and a minimum of one communication interface cable for each type of cable required to connect a PC-based computer to the devices specified herein for configuration and programming.

2. Electronic configuration files, in a media format acceptable by the Owner (e.g. CD, USB stick, etc.), updated to an as-installed and commissioned state.

3. Provide a minimum of one compatible communication interface and programming device and required connection cable for each device specified herein for configuration and programming.

D. Spare parts shall be properly marked and packaged for long term storage. Printed circuit boards shall be provided in separate anti-static containers.

PART 2 PRODUCTS

2.1 PRODUCT MANUFACTURERS

A. Example Product Manufacturers: Products and manufacturers specified are to establish a standard of quality for design, function, materials, and appearance. Products shall be modified as necessary by the manufacturer for compliance with requirements. The listed manufacturers are provided for example only and are not intended to represent all qualified manufactures. Contractor may select an alternate manufacturer provided the product(s) comply with all design requirements.

- Eaton (basis for design)
- ABB
- Schneider Electric

2.2 GENERAL REQUIRMENTS

A. LV Microgrid Energy Management System (MEMS) shall consist of one or more of integrated power distribution equipment (e.g. unit substations, power panels, switchgear, switchboards) items with the required HMI interface(s), microgrid controller(s), communications interfaces, relays, communications converters, communications switches, electrically operated circuit breakers, etc. to perform the required functionality, such as the control and operation of DERs per the sequence of operations, as specified in Section 1.17.

B. The integrated power distribution equipment bus shall be rated as shown on the Drawings and as described in related specification sections.

C. MEMS integrated power distribution equipment shall be constructed in accordance with UL891.

D. The enclosure rating of the MEMS integrated power distribution equipment shall be NEMA 3R. The equipment shall have separate sections for power and controls with a minimum of one for power distribution (e.g. breakers) and one for control hardware, HMI, and auxiliaries (e.g. 24 Vdc power supplies).

E. All main circuit breakers utilized within the MEMS for control shall be electrically operated and capable of being opened and closed by commands over the MEMS Ethernet network. Branch circuit breakers used to supply battery electric bus charging circuits shall at a minimum be capable of being shunt-tripped by the MEMS with manual reset. The circuit breakers should also allow for manual operation.

2.3 All medium-voltage circuit breakers and low voltage main circuit breakers as shown on the Drawings or required for MEMS specified functionality shall have electronic trip units capable of reporting real power (P), reactive power (Q), voltage, frequency, and current over the MEMS Ethernet network. Service Entrance Requirements

A. When the MEMS is serving as the utility service entrance, the system shall include the following:

1. The MEMS shall provide utility pull section(s) within the integrated power distribution equipment. Refer to section 26 13 13 Medium Voltage Switchgear for details.

2. The MEMS shall provide utility metering and current transformers (CT's) within the integrated power distribution equipment. Equipment drawings & specifications shall be approved by San Diego Gas & Electric, and installation shall be coordinated with San Diego Gas & Electric.

3. The MEMS shall include protective relaying to comply with local utility requirements for the parallel operation of distributed energy resources with the electric utility distribution system.

2.4 SYSTEM REQUIREMENTS

A. Communications: The MEMS shall provide Ethernet connections and accept a mixture of standard SCADA Protocols, such as DNP3, Modbus, or IEC 61850 interface for communications to the DERs, circuit breakers, meters, etc. as needed for monitoring and control. The Ethernet network shall be a secure private network capable of being integrated into the existing Building Management System or Charge Management System by the Owner at a later date. Connections between unit substations shall be via multimode fiber for DERs in Substation A and copper for the DERs in Substation B. The type of connectors will be determined by the final equipment selected and design.

B. Monitoring: The MEMS shall include an HMI display, indicator lights and an AUTO-MANUAL selector switch for operator interface of the system. These interfaces shall provide the following:

1. Status indicators

2. One-line diagram showing circuit breaker arrangement, service and status

3. Power, reactive power, voltage, frequency, and current measured by each breaker or meter

4. Status of each load breaker

5. Key information available from DERs, such as power output and status

6. Pertinent alarms, such as breakers tripped for overcurrent or loss of utility feed power

7. Pertinent events, such as breakers opened or closed by commands from the touchscreen or manually, to be stored as a Sequence of Events (SOE)

8. Trends of key measurements, such as power measured by a breaker vs time, minimum of 1 month trend window required.

9. Secured data export capabilities of all stored data

C. Utility Requirements: The MEMS shall be able to comply with a utility requirement to have zero export power and minimum import power. To achieve this compliance, the system shall send commands to decrease the power output from DERs, curtailing output of the PV inverters, and/or send commands to the power flowing into energy storage devices to follow the real-time loads of the individual battery electric vehicle chargers.

D. Resiliency: In the event of a sustained utility grid power outage, the MEMS shall follow the Sequence of Events as detailed in Section 1.17. At any point in time, the MEMs should have the capability to be manually overridden at specific sections of the system.

1. Substation A and B should have clear signage and separate physical buttons for operators to stop the MEMs from controlling specific separate sections of the grid. For example, if manual override is initiated at Substation B, Substation A should not be affected and continue to be controlled by the MEMs and vice versa.

2. After the button is pushed, the operators should have the ability to manually configure the onsite system. When coming back online, the MEMs shall wait for 1 min before resuming normal operations.

2.5 Economic Optimization of Distributed Energy Resources

A. The MEMS shall include the capability to utilize a service integrated for dispatch of DERs for economic optimization according to local utility requirements (e.g. to maximize Return on Investment). The System shall be capable of running multiple use cases simultaneously. The following services shall include:

1. Remote Monitoring, Forecasting, and Data Storage: monitoring power, energy, and other KPI’s for each DER using a web-based interface

2. Demand Charge Reduction (aka Peak Shaving): control DERs (consume/produce/store energy) to reduce peak consumption and resulting charges from utility

3. Self-Consumption: control energy storage to maximize energy consumed and charged directly from solar sources

4. Off Grid Preparation (aka Storm Hardening): control DERs to prepare for likely power outage events (e.g. due to storms)

2.6 Remote Notification of Alarms

A. The MEMS shall offer at least one of the following options for remote notification of alarms (e.g. breaker tripped due to overcurrent):

MTS – Imperial Avenue Division Zero Emission Bus Overhead Charging – Phase I

1. Email: The MEMS shall send an email to designated recipients in the event of an alarm.

2. SMS: The MEMS shall send an SMS to designated recipients in the event of an alarm.

3. Push Notifications: The MEMS shall use a push notification on a mobile app in the event of an alarm.

2.7 Multiple Anchor Resources While Islanding

A. When a MEMS has multiple DERs capable of serving as an anchor resource (e.g. generator and BESS capable of grid-forming mode), the system shall be capable of utilizing a preferred anchor resource over secondary anchor resource(s) within specified parameters.

1. The MEMS shall recognize when use of the primary anchor resource has gone outside the specified parameters (e.g. State-of-Charge below x%), and the system shall switch to a secondary anchor resource. The system will adjust load if necessary.

2. The MEMS shall recognize when the preferred anchor resource can again be utilized (e.g. State-of-Charge above y%), and the system shall switch back to the preferred anchor resource. The system will adjust load if necessary.

2.8 Sequence of Operations

The MEMs shall have five modes: automatic, manual (utility feed), manual (stationary generator), manual (mobile generator), and manual (no microgrid energy management system). The name of the breakers is detailed as below.

POWER SOURCE
- GEN-M BKR – MOBILE GENERATOR BREAKER ON SUBSTATION B
- GEN-S BKR – STATIONARY GENERATOR BREAKER (GEN-S) ON SUBSTATION A
- PV1 BKR – PV INVERTER #1 ON SUBSTATION B
- PV2 BKR – PV INVERTER #2 ON SUBSTATION B
- PV3 BKR – PV INVERTER #3 ON SUBSTATION B
- BESS-A BKR – BATTERY ENERGY STORAGE SYSTEM (BESS) ON SUBSTATION B
- BESS-B BKR – BATTERY ENERGY STORAGE SYSTEM (BESS) ON SUBSTATION B
- UTILITY BKR – UTILITY FEED BREAKER IN MV SECTION AM2 ON SUBSTATION A
- SWGR BL1 – SUBSTATION B MAIN BREAKER AFTER THE SECONDARY TRANSFORMER
- SWGR AL1 – SUBSTATION A MAIN BREAKER AFTER THE SECONDARY TRANSFORMER

ALL BEB CHARGERS' BREAKERS
- CC-1 BKR – BEB CHARGER CC-1 BREAKER ON NORTHSIDE OF SUBSTATION B
- CC-2 BKR – BEB CHARGER CC-2 BREAKER ON NORTHSIDE OF SUBSTATION B
- CC-3 BKR – BEB CHARGER CC-3 BREAKER ON NORTHSIDE OF SUBSTATION B

- CC-4 BKR – BEB CHARGER CC-4 BREAKER ON NORTHSIDE OF SUBSTATION B
- CC-5 BKR – BEB CHARGER CC-5 BREAKER ON NORTHSIDE OF SUBSTATION B
- CC-6 BKR – BEB CHARGER CC-6 BREAKER ON NORTHSIDE OF SUBSTATION B
- CC-7 BKR – BEB CHARGER CC-7 BREAKER ON NORTHSIDE OF SUBSTATION B
- CC-8 BKR – BEB CHARGER CC-8 BREAKER ON NORTHSIDE OF SUBSTATION B
- CC-9 BKR – BEB CHARGER CC-9 BREAKER ON NORTHSIDE OF SUBSTATION B
- CC-10 BKR – BEB CHARGER CC-10 BREAKER ON NORTHSIDE OF SUBSTATION B
- CC-11 (F) BKR – BEB CHARGER CC-11 BREAKER ON NORTHSIDE OF SUBSTATION B
- CC-12 (F) BKR – BEB CHARGER CC-12 BREAKER ON NORTHSIDE OF SUBSTATION B
- CC-13 (F) BKR – BEB CHARGER CC-13 BREAKER ON NORTHSIDE OF SUBSTATION B
- CC-14 (F) BKR – BEB CHARGER CC-14 BREAKER ON NORTHSIDE OF SUBSTATION B

Scenario	GEN-M	GEN-S	PV1	PV2	PV3	BESS-A	BESS-B	UTILITY BKR	BEBS
AUTOMATIC	OPEN	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED
MANUAL - UTILITY	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	CLOSED	CLOSED
MANUAL – STATIONARY GENERATOR	OPEN	CLOSED	OPEN	OPEN	OPEN	CLOSED	CLOSED	OPEN	OPEN*
MANUAL – MOBILE GENERATOR	CLOSED	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN*
MANUAL – NO MEMS	**	**	**	**	**	**	**	**	**

* BEB charger breakers shall be automatically opened to limit connected load to the capacity of the generator. After automatic opening the MEMs shall allow for manual control of BEBs breakers.

**in manual – the MEM is not engaged at all. In this mode, the system shall not attempt to automatically control any circuit breakers or generation sources. All breaker operations shall be controlled by facilities staff.

Assumptions:

- Microgrid energy management system will operate as the charge management system in this draft of the sequence of operations.
- No closed transitions or sensitive loads accounted for in this draft
- If the stationary generator is out of service, avoid manual mode– stationary generator
- If the BESS are out of service, the BESS breakers should be opened and locked out and the PV inverters would need to operate in load curtailing mode
- If PV generation is out of service, the PV breakers should be opened and locked out.
- Stationary generator includes integrated load banks which will be automatically engaged by the generator controls system to meet minimum loading requirements.
- This sequence of operation focuses on resiliency usage. However, the automatic modes include some peak shaving operations. The specific programming would depend on future modeling and load profile results which are not discussed in detail in this document.

The MEMs shall have five modes: automatic, manual (utility feed), manual (stationary generator), manual (mobile generator), manual (no MEMs), normal status

A. Automatic Mode:

Scenario	GEN-M	GEN-S	PV1	PV2	PV3	BESS-A	BESS-B	UTILITY BKR	BEBS
B. AUTOMATIC	OPEN	OPEN*	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	C. CLOSED

* Gen-s breaker may be closed when stationary generator is in operation but will otherwise be open to allow for synchronization process.

1. All on-site generation shall be limited to on-site usage and shall not be exported to the grid. Mems shall provide signals to PV inverters to limit power production based on active loads and state of charge of BESSES.

2. Stationary BESSES shall be charged by PV system when available or by utility power during economically viable modes. BESSES shall be discharged when economically viable (i.e. During "on-peak" utility periods, or to provide peak shaving service during high-demand periods).

3. Stationary generator may be energized and paralleled with utility feed to provide peak shaving service when economically viable. Mems shall confirm generator synchronization with grid prior to closing in the stationary generator breaker (GEN-S).

During prolonged utility outage, in automatic mode, the MEMs

1. If the MEMs detect a prolonged utility outage, all BEBs breakers shall be opened. Mems shall begin to execute an open transition to on-site generation sources.

2. If stationary generator is not energized, it shall be started and stabilized.

3. If stationary generator is energized and paralleled for peak shaving, the generator breaker (GEN-S) shall be opened, and generator shall be stabilized.

4. The utility feed breaker (utility) and PV generation (PV1, PV2, PV3) and BESSES (BESS-A & BESS-AB) breakers shall be opened.

5. Following generator stabilization, the generator breaker (GEN-S) shall be closed, energizing the bus.

6. PV generation and BESS shall be synchronized to the stationary generator. Following synchronization associated circuit breakers (PV1, PV2, PV3, BESS-A, & BESS-B) shall be closed.

7. Facilities staff shall manually close BEB charger breakers and activate charge sessions. A limited number of BEB chargers can be supported by the stationary generator, facilities operators shall monitor generator loading while conducting operations to maintain safe conditions. Mems shall automatically open BEB charger breakers if generator loading exceeds safe operations.

8. BESS shall be utilized to support BEB charger loads. Once discharged, BESS charging shall be low priority and shall only occur if excess capacity is available from stationary generator or PV generations.

D. Manual (Utility Feed only) Mode

Scenario	GEN-M	GEN-S	PV1	PV2	PV3	BESS-A	BESS-B	UTILITY	BEBS
MANUAL - UTILITY	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	CLOSED	CLOSED

1. PV generation and stationary BESS systems shall be controlled to deactivate power usage. associated breakers shall be opened to prevent accidental energization.

2. All generator breakers shall be held in the open position.

3. Only the utility feed breaker (UTILITY) is closed.

E. Manual (Stationary Generator) Mode

Scenario	GEN-M	GEN-S	PV1	PV2	PV3	BESS-A	BESS-B	UTILITY	BEBS
MANUAL – STATIONARY GENERATOR	OPEN	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	OPEN	OPEN*

* Beb charger breakers shall be automatically opened to limit connected load to the capacity of the generator. After automatic opening the MEMs shall allow for manual control of BEBs breakers.

1. If stationary generator is not energized, it shall be started and stabilized.

2. If stationary generator is energized and paralleled for peak shaving, the generator breaker (GEN-S) shall be opened, and generator shall be stabilized.

3. All BEBs breakers shall be automatically opened to limit connected load to the capacity of the generator. Mems shall begin to execute an open transition to on-site generation sources.

4. Utility feed breaker (utility) shall be opened and shall remain open until system is returned to automatic mode.

5. Following generator stabilization, the generator breaker (GEN-S) shall be closed, energizing the bus.

6. PV generation and BESS shall be synchronized to the stationary generator. Following synchronization associated circuit breakers (PV1, PV2, PV3, BESS-A & BESS-B) shall be closed.

7. Facilities staff shall manually close BEB charger breakers and activate charge sessions. A limited number of BEB chargers can be supported by the stationary generator, facilities operators shall monitor generator loading while conducting operations to maintain safe conditions. Mems shall automatically open BEB charger breakers if generator loading exceeds safe operations.

8. BESS shall be utilized to support BEB charger loads. Once discharged, BESS charging shall be low priority and shall only occur if excess capacity is available from stationary generator or PV generations.

F. Manual (Mobile Generation – Substation B) Mode

Scenario	GEN-M	GEN-S	PV1	PV2	PV3	BESS-A	BESS-B	UTILITY	BEBS
MANUAL – MOBILE GENERATOR	CLOSED*	OPEN	OPEN**	OPEN**	OPEN**	OPEN	OPEN	OPEN	OPEN***

*Mobile generator breaker shall not be controlled by MEMs but shall be closed in by facilities staff following mobile generator connection and energization.

** MEMs shall automatically open PV1, PV2, PV3 breakers, however facility staff may choose to close these breakers following generator stabilization.

*** BEB charger breakers shall be automatically opened to limit connected load to the capacity of the generator. After automatic opening the MEMs shall allow for manual control of BEBs breakers.

1. The main breaker of substation B (BL1) will be opened and shall remain open until the system is returned to automatic mode.

2. All BEB charger breakers (BEBs) shall be opened.

3. PV generation breakers (PV1, PV2, PV3) shall be opened.

4. The MEMs shall take no action on the mobile generator connection breaker but will monitor the status. Manual action will be required to connect the mobile generator, energize mobile generator, and then close in the mobile generator connection breaker. Wait for mobile generators stabilization prior to engaging loads

5. Mems shall control PV generation to synchronize to the mobile generator. Manual engagement of PV generation shall be at the facilities' prerogative.

6. Facilities staff shall manually close BEB charger breakers and activate charge sessions a limited number of BEB chargers can be supported by the stationary generator, facilities operators shall monitor generator loading while conducting operations to maintain safe conditions.

G. Full Manual, No MEMS

Scenario	GEN-M	GEN-S	PV1	PV2	PV3	BESS-A	BESS-B	UTILITY	BEBS

MANUAL – MOBILE GENERATOR	CLOSED*	OPEN	OPEN**	OPEN**	OPEN**	OPEN	OPEN	OPEN	OPEN***

1. The system shall not attempt to automatically control any circuit breakers or generation sources. all breaker operations shall be controlled by facilities staff.

H. Return to Automatic mode from Manual

1. Ensure all loads are open and disconnected.

2. Open the stationary generator breaker (GEN-S) and the mobile generator quick connect breaker (GEN-M). Start the stationary generator cooldown process.

3. PV generation and BESS shall be deactivated and circuit breakers (PV1, PV2, PV3, BESS-A, and BESS-B) shall be opened during this transition.

4. Close the utility feed breaker (utility) re-energizing the system.

5. PV generation and BESS systems shall be synchronized to utility source and PV1, PV2, PV3, BESS-A, and BESS-B circuit breakers shall be closed in.

6. All BEB charger breakers (BEBs) shall be automatically closed. Charging sessions will be started manually.

PART 3 EXECUTION

3.1 GENERAL

A. In addition to the requirements specified herein, execution shall be in accordance with the provided engineering Drawings.

B. Examine equipment exterior and interior prior to installation. Report any damage and do not install any equipment that is structurally, moisture, or mildew damaged.

C. Verification of Conditions: Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Owner and the Engineer, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

D. Pre-Installation Conference: Prior to commencing the installation, an onsite pre-installation conference shall review the material selections, installation procedures, and coordination with other trades. Attendees shall include, but shall not be limited to, the Contractor, the Installer, manufacturer’s representatives, and any trade that

requires coordination with the work. Date and time of the pre-installation conference shall be acceptable to the Owner and the Engineer

E. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Installer.

F. Install equipment in accordance with reviewed product data, final shop drawings, manufacturer's written instructions and recommendations, and as indicated on the Drawings.

G. Provide final protection and maintain conditions in a manner acceptable to the manufacturer that shall help ensure that the equipment is without damage at time of Substantial Completion.

3.2 FACTORY ACCEPTANCE TESTING

A. The manufacturer shall perform a witnessed factory acceptance test prior to shipment. A test report shall be generated documenting the tests performed, assumptions, corrective actions and results. The test shall include the manufactures standard test procedures but shall include the following as a minimum:

1. Inspection and proper energization of components

2. Operational

a. Transition from utility grid to islanded operation and return to utility grid operation

3.3 FIELD QUALITY CONTROL

A. Functional testing, commissioning, and first parameter adjusting shall be carried out by a factory-trained manufacturer's field service representative. This manufacturer's field service technician shall provide all material, equipment, labor and technical supervision to perform inspection, testing and adjustments to ensure equipment is installed, adjusted, and tested in accordance with the manufacturer's recommendations and is ready for operation. The manufacturer's field service technician shall replace damaged or malfunctioning equipment and report to the Engineer any discrepancies or issues with the installation.

B. The manufacturer's representative shall, upon satisfactory completion of inspection and testing, attach a label to all serviced devices indicating the date serviced and testing company responsible.

3.4 FIELD TESTING AND COMMISSIONING

A. Functional testing, commissioning, and first parameter adjusting shall be carried out by a factory-trained manufacturer's field service representative. This manufacturer's field service technician shall provide all material, equipment, labor and technical

supervision to perform inspection, testing and adjustments to ensure equipment is installed, adjusted, and tested in accordance with the manufacturer's recommendations and is ready for operation. The manufacturer's field service technician shall replace damaged or malfunctioning equipment and report to the Engineer any discrepancies or issues with the installation.

B. Operational Readiness Testing

1. The Contractor shall inspect and test furnished equipment and associated systems for conformance to the contract documents, including equipment manufacture's recommendations, and readiness for operation. The test shall include the following as a minimum:

   a. Visually inspect for physical damage and proper installation

   b. Perform tests in accordance with manufacturer's instructions

   c. Perform tests to ensure compliance with Contract Documents

   d. Perform tests that equipment is ready for operation

   e. Touch-up paint all chips and scratches with manufacturer-supplied paint and transfer remaining paint to Owner

2. Contractor shall submit an operational readiness test report documenting all test results, including all assumptions, conditions, allowances and corrections made during the test. The report shall provide a listing of all modifications and adjustments made onsite to include any settings / parameters not identified as factory defaults within the equipment's O&M documentation. The test report shall include a signed statement from the Contractor, installer(s) and the factory-trained manufacturer's representative(s) certifying that the furnished equipment and associated system have been installed, configured, and tested in accordance with the manufacturer's recommendations, completely conforms to the requirements of the Contract Documents and is ready for operation.

C. Functional Demonstration Testing

1. Prior to scheduling functional demonstration testing the Contractor shall submit a signed statement from the Contractor, installer(s) and the factory-trained manufacturer's representative(s) certifying that the furnished equipment and associated system have been installed, configured, and tested in accordance with the manufacturer's recommendations, completely conforms to the requirements of the Contract Documents and is ready for operation.

2. The Contractor shall completely demonstrate the functionality and performance of the equipment and associated systems in the presence of Owner and Engineer, observing and documenting complete compliance with the Contract Documents.

3. The Contractor shall submit a written report documenting successful completion of functional demonstrating testing including all assumptions, conditions, allowances and corrections made during the test.

3.5 TRAINING

A. O&M Training: Onsite training specific to the equipment furnished shall be provided to the Owner's staff by a factory trained manufacturer's representative. Training duration shall be sufficiently adequate to cover the operation and maintenance of the equipment and shall consist of not less than [1] repeated session(s) with [4] hours of onsite classroom and hands-on instruction for a minimum of [4] attendees per session, or as agreed upon by the Owner in writing.

1. The instructor shall provide sufficient time and detail in each session to cover the following as a minimum:

a. Theory of operation

b. Major components of equipment

c. Operation of equipment

d. Configurations of equipment

e. Maintenance, troubleshooting and repair

f. Replacement of component level parts

2. The submitted O&M manuals shall be used for training.

3.6 SUPPORT

A. The OEM microgrid energy management system should offer long-term support and troubleshooting during the lifetime of the management system.

END OF SECTION

SECTION 26 41 13

LIGHTNING PROTECTION SYSTEM FOR STRUCTURES

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall provide labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install complete lightning protection system for standby generator.

2. This shall be included as part of Add Alternate 1.

B. Related Sections:

1. 26 05 26 Grounding And Bonding for Electrical Systems

1.2 MEASUREMENT AND PAYMENT

A. This item is to be bid as lump sum as part of Add Alternate 1.

1.3 REFERENCES

A. NFPA 780 – Standard for the Installation of Lightning Protection Systems (Current Edition)

1.4 SUBMITTALS

A. Product Data: Manufacturer’s descriptive and technical literature or catalog cuts.

B. Shop Drawings:

1. Layout of the lightning protection system, specifically for the building(s), structures or equipment included in the contract drawings.

2. Installation details of the products to be used in the installation.

C. Manufacturer’s Instructions: Installation instructions shall be provided for lightning protection components that require field assembly or fabrication.

D. Qualification data for firms or persons specified in “Quality Assurance” Article to demonstrate their capabilities and experience. Include data on listing or certification by a Nationally Recognized Testing Laboratory (NRTL).

E. Certification, signed by standby generator contractor, that structural adhesive and installation method for air terminals and conductors is approved by manufacturers of the lightning protection components and components of the standby generator and/or generator enclosure.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Installing contractor shall provide building owner with an operation and maintenance manual.

B. Warranty Documentation: The completed installation shall carry a one-year guarantee against defects in material or installation.

1. Exclusions: Routine preventative maintenance, accidental or intentional damage shall not be included as part of the warranty service.

C. Record Documentation: Installing contractor shall provide building owner a copy of the pre-installation site report, post-installation site report and (3) full-size plots of accurate as-built shop drawings.

1.6 EXTRA STOCK MATERIALS

A. Provide extra stock materials to building owner in a single, durably packed container labeled with “26 41 13 – Lightning Protection for Structures”, installing contractor contact information, date and complete listing of contents.

1. (3) Air Terminal Assemblies

2. (3) Secondary sized bonding lugs

3. (3) Main sized bonding lugs or bonding plates

4. (5) Cable-to-Cable splice connectors

5. (25’) Main sized conductor

6. (10) Cable fasteners/holder with related hardware

1.7 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer shall maintain current lightning protection material listings from a Nationally Recognized Testing Laboratory (NRTL).

2. Installer Qualifications: the system shall be installed by a firm actively engaged in the installation of Underwriters Laboratories Inc. Master Labeled Lightning Protection Systems. The persons performing the work of this section and their supervisor shall be personally experienced in lightning protection systems.

B. The system shall be physically inspected by a Nationally Recognized Testing Laboratory (NRTL), such as LPI-IP, to the current edition of NFPA 780. The certification shall be provided to the Owner at completion of the project.

PART 2 PRODUCTS

2.1 AIR TERMINALS

A. Basis of Design: Subject to compliance with requirements, provide Harger Lightning and Grounding safety tip air terminals or equivalent.

B. Substitution Limitations: Project conditions may dictate the use of an air terminal not shown, installing contractor shall coordinate with lightning protection manufacturer to determine proper materials.

C. Product Options:

1. Length: 10” minimum when installed around the perimeter or along the ridge of a building and 24” minimum when installed in mid-roof areas.

2. Point Type: Gently tapered air terminals shall be used in all areas. Exception, mid-roof mounted air terminals shall be safety tipped to prevent personnel injury.

3. Material Type: Where applicable, copper air terminals shall be used. Exception, copper materials shall not be mounted on aluminum, Galvalume ®, galvanized steel, zinc or directly onto other ferrous metal surfaces. In these instances, aluminum air terminals shall be used.

2.2 AIR TERMINAL BASES

A. Basis of Design: Subject to compliance with requirements, provide Harger Lightning and Grounding air terminal bases or equivalent.

B. Substitution Limitations: Project conditions may dictate the use of an air terminal base not shown. Installing contractor shall coordinate with lightning protection manufacturer to determine proper materials.

2.3 CONDUCTORS

A. Basis of Design: Subject to compliance with requirements, provide Harger Lightning and Grounding conductors or equivalent.

B. Material type: Where applicable, bare copper conductors shall be used. Exception, copper materials shall not be mounted on aluminum, Galvalume ®, galvanized steel, zinc or directly onto other ferrous metal surfaces. In these instances, aluminum conductors shall be used.

2.4 CONDUCTOR FASTENERS

A. Basis of Design: Subject to compliance with requirements, provide Harger Lightning and Grounding conductor fasteners or equivalent.

B. Material type: Where applicable, bare copper fasteners shall be used. Exception, copper materials shall not be mounted on aluminum, Galvalume ®, galvanized steel, zinc or directly onto other ferrous metal surfaces. In these instances, aluminum fasteners shall be used.

2.5 ABOVE GRADE CONNECTORS

A. Basis of Design: Subject to compliance with requirements, provide Harger Lightning and Grounding connectors or equivalent.

B. Material type: Where applicable, bare copper connectors shall be used. Exception, copper materials shall not be mounted on aluminum, Galvalume ®, galvanized steel, zinc or directly onto other ferrous metal surfaces. In these instances, aluminum connectors shall be used.

2.6 BONDING LUGS AND PLATES

A. Basis of Design: Subject to compliance with requirements, provide Harger Lightning and Grounding bonding lugs and plates or equivalent.

B. Material type: Where applicable, bare copper bonding connections shall be used. Exception, copper bonding materials shall not be mounted on aluminum, Galvalume ®, galvanized steel, zinc or directly onto other ferrous metal surfaces. In these instances, aluminum or bi-metallic bonding connections shall be used.

2.7 THRU-ROOFS / THRU-WALLS

A. Basis of Design: Subject to compliance with requirements, provide Harger Lightning and Grounding thru-walls or thru-roofs or equivalent.

2.8 GROUNDING ELECTRODES

A. Basis of Design: Subject to compliance with requirements, provide Harger Lightning and Grounding grounding electrodes or equivalent as specified in section 26 05 26 Grounding and Bonding for Electrical Systems.

B. Substitution Limitations: Soil conditions may dictate the use of a grounding electrode not shown. Installing contractor shall coordinate with lightning protection manufacturer to determine proper materials.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install lightning protection system as indicated on approved shop drawing, according to manufacturer's written instructions.

B. Installation shall comply with all aspects of NFPA 780.

C. Conductors shall be concealed from public view where possible.

3.2 CORROSION PROTECTION

A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture, unless moisture is permanently excluded from the junction of such materials.

B. Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors, such as tin.

3.3 FIELD QUALITY CONTROL

A. The system shall be physically inspected by a Nationally Recognized Testing Laboratory (NRTL), such as LPI-IP, to the current edition of NFPA 780. The certification shall be provided to the building owner at the completion of the project.

END OF SECTION

SECTION 26 43 13

SURGE PROTECTION DEVICES

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:

1. The Surge Protection Device (SPD) covered under this section includes all service entrance type SPD suitable for use as Type 1 or Type 2 devices that are applied to the line or load side of the utility feed.

2. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install surge protection devices with size and trip rating as shown or specified.

B. Coordination:

1. Review installation procedures under other Sections and coordinate installation of items to be installed with or before surge protection devices.

C. Related Sections:

1. Section 26 05 05, General Provisions for Electrical Systems.

2. Section 26 05 53, Identification for Electrical Systems.

3. Section 26 13 13, Medium-Voltage Switchgear.

4. Section 26 11 16, Secondary Unit Substation.

5. Section 26 24 13, Switchboards.

6. Section 26 24 16, Panelboards.

1.2 MEASUREMENT AND PAYMENT

1. This item is to be included in lump sum cost for Unit Substations.

1.3 REFERENCES

A. Standards referenced in this Section are:

1. UL 1449, 4th Edition – Standard for Surge Protection Devices.

2. UL 1283, 7th Edition – Standard for Electromagnetic Interference Filters.

3. UL 96A, 13th Edition – Standard for Installation Requirements for Lightning Protection Systems.

4. ANSI/IEEE C62.41 – Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.

5. ANSI/IEEE C62.45 – Guide for Surge Testing for equipment connected to Low-Voltage AC Power Circuits.

6. IEEE C62.62 – Standard Test Specification for Surge Protection Devices for Low-Voltage AC Power Circuits.

7. IEEE 1100 Emerald Book

8. NFPA 70 Article 285, National Electrical Code.

9. NFPA 70E, Electrical Safety in the Workplace

1.4 DEFINITIONS

A. Definitions referenced in this section are:

1. I-nominal: Nominal discharge current.

2. MCOV: Maximum continuous operating voltage.

3. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies.

4. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.

5. OCPD: Overcurrent protective device.

6. SCCR: Short-circuit current rating.

7. SPD: Surge protective device.

8. VPR: Voltage protection rating.

1.5 SUBMITTALS

A. Action Submittals. Submit the following:

1. Product Data:

a. Surge Protection Devices - Product Data

1) Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

2) Include maximum conductor length for all external SPDs.

3) Include manufacturer's suggested OCPD size and rating.

B. Informational Submittals. Submit the following:

1. Test and Evaluation Reports

a. Surge Protection Devices – Test and Evaluation Reports

b. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, Inominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.

2. Manufacturers' Instructions

a. Surge Protection Devices - Manufacturers' Instructions

1) Submit instructions for each type.

3. Source Quality Control Submittals (NOT USED)

4. Field Quality Control Submittals

a. Surge Protection Devices - Field Quality Control

1) Results of Field Quality Control Reports.

C. Closeout Submittals. Submit the following:

1. Operation and Maintenance Data

a. Surge Protection Devices - Operation and Maintenance Data

1) Submit complete installation, operation and maintenance manuals including test reports, maintenance data and schedules, and description of operation.

2. Warranty Documentation

a. Surge Protection Devices - Warranty Documentation

1) Submit manufacturer's warranty per the requirements of this Section.

D. Maintenance Material Submittals. (NOT USED)

1.6 QUALITY ASSURANCE

A. SPDs shall bear the UL label.

B. National Electrical Code (NEC): Components and installation shall comply with National Fire Protection Association (NFPA) 70.

C. Testing Agency Qualifications: Independent testing agency shall meet OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907, or shall be full member company in InterNational Electrical Testing Association (NETA).

D. Manufacturer:

1. Manufacturer shall have not less than five years of experience producing substantially similar equipment to that required and, upon request, shall submit documentation of not less than five installations in satisfactory operation for not less than five years in the United States.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by the following or equivalent:

1. External SPDs:

a. ASCO Power Technologies

b. Current Technologies

2. Internal SPDs:

a. Eaton.

b. Siemens

c. Square D.

2.2 GENERAL SPD REQUIREMENTS

A. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Comply with UL 1449.

D. MCOV of the SPD shall be the nominal system voltage.

2.3 SERVICE ENTRANCE, SEPARATELY DERIVED SYSTEM AND TRANSFER SWITCH SUPPRESSOR

A. SPDs: Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1449, Type 1.

B. SPDs with the following features and accessories:

1. Integral disconnect switch.

2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.

3. Indicator light display for power and protection status.

4. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.

5. Surge counter.

C. Comply with UL 1283.

D. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than [480 kA]. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

E. Protection modes and UL 1449 VPR for grounded wye circuits with [480Y/277 V] three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: [1200 V for 480Y/277 V].

2. Line to Ground: [1200 V for 480Y/277 V].

3. Line to Line: [2000 V for 480Y/277 V].

F. Protection modes and UL 1449 VPR for grounded wye circuits with [208Y/120 V], three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: [700 V for 208Y/120 V].

2. Line to Ground: [V for 208Y/120 V].

3. Line to Line: [1000 V for 208Y/120 V].

G. SCCR: Equal or exceed [100 kA].

H. I-Nominal Rating: 20 kA.

2.4 PANEL SUPPRESSORS

A. SPDs: Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1449, Type 2.

B. SPDs with the following features and accessories:

1. Integral disconnect switch.

2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.

3. Indicator light display for power and protection status.

4. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.

5. Surge counter.

C. Comply with UL 1283.

D. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than (480 kA). The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

E. Protection modes and UL 1449 VPR for grounded wye circuits with [480Y/277 V] three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: [1200 V for 480Y/277 V].

2. Line to Ground: [1200 V for 480Y/277 V].

3. Line to Line: [2000 V for 480Y/277 V].

F. Protection modes and UL 1449 VPR for grounded wye circuits with [208Y/120 V], three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: [700 V for 208Y/120 V].

2. Line to Ground: [1200 V for 208Y/120 V].

3. Line to Line: [1000 V for 208Y/120 V].

G. SCCR: Equal or exceed 100 kA.

H. I-nominal Rating: 20 kA.

2.5 ENCLOSURES

A. Indoor Enclosures: NEMA 250, Type 12.

2.6 CONDUCTORS AND CABLES

A. Power Wiring: Same size as SPD leads complying with Section 26 05 19, Low-Voltage Electrical Power Conductors and Cables.

1. External SPDs:

a. Contractor shall not exceed manufacturer’s recommended maximum length of cabling.

b. Contractor shall consult with Engineer for all cable installations longer than manufacturer’s recommended maximum length.

B. Class 2 Control Cables: Multi-conductor cable with copper conductors not smaller than No. 18 AWG, complying with Section 26 05 19, Low-Voltage Electrical Power Conductors and Cables.

C. Class 1 Control Cables: Multi-conductor cable with copper conductors not smaller than No. 14 AWG, complying with Section 26 05 19, Low-Voltage Electrical Power Conductors and Cables.

PART 3 EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.

C. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads.

1. Do not splice and extend SPD leads unless specifically permitted by manufacturer.

2. Do not exceed manufacturer's recommended lead length.

3. Do not bond neutral and ground.

D. Use crimped connectors and splices only. Wire nuts are unacceptable.

E. Wiring:

1. Power Wiring: Comply with wiring methods in Section 26 05 19, Low-Voltage Electrical Power Conductors and Cables.

2. Controls: Comply with wiring methods in Section 26 05 19, Low-Voltage Electrical Power Conductors and Cables.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. Compare equipment nameplate data for compliance with Drawings and Specifications.

2. Inspect anchorage, alignment, grounding, and clearances.

3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

B. An SPD will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.3 STARTUP SERVICE

A. Complete startup checks according to manufacturer's written instructions.

B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests, and reconnect them immediately after the testing is over.

C. Energize SPDs after power system has been energized, stabilized, and tested.

3.4 DEMONSTRATION

A. Train Owner’s maintenance personnel to operate and maintain SPDs.

END OF SECTION

SECTION 26 56 00

EXTERIOR LIGHTING

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install lighting fixtures and associated controls.

2. Provide luminaires and accessories in accordance with the Contract Documents.

3. Lamps shall be of the same manufacturer.

4. Drivers and power supplies shall be of the same manufacturer for each fixture type.

5. Equipment shall be certified for use in the State of the project and shall meet the State Energy Code and local energy ordinances.

B. Section Includes:

1. Fixtures And Fixture Components

2. Fixture Mounting & Support Components

3. Lighting Control Devices

4. Emergency Lighting

C. Coordination:

1. Coordinate location of fixtures with piping, ductwork, openings, and other systems and equipment and locate clear of interferences.

D. Related Sections:

1. Section 26 05 05, General Provisions for Electrical Systems.

2. Section 26 05 53, Identification for Electrical Systems.

1.2 MEASUREMENT AND PAYMENT

1. This item is to be included in lump sum cost for Exterior Lighting.

1.3 REFERENCES

A. Standards referenced in this Section are:

1. ANSI C2, Safety Code
2. ANSI C78, Electric Lamps
3. ANSI C78.51, Electric Lamps - LED
4. ANSI C82.4, Ballasts for High Intensity Discharge
5. ANSI C82.16, LED Drivers
6. ASTM A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
7. ASTM A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
8. ASTM B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
9. NEC Article 410, Luminaires, Lampholders, and Lamps.
10. California Electrical Code
11. California Energy Commission Title 24, Part 6
12. National Fire Protection Association (NFPA) 70.
13. NEMA SSL 1, Electronic Drivers for LED Devices, Arrays, or Systems.
14. UL 773, Plug-In Locking Type Photocontrols for Use with Area Lighting
15. UL 844, Luminaires for Use in Hazardous (Classified) Locations.
16. UL 1029, Safety of High-Intensity- Discharge Lamp Ballasts.
17. UL 1572, High Intensity Discharge Lighting Fixtures
18. UL 8750, Standard for LED Equipment for Use in Lighting Products
19. UL 8752, Standard for OLED Panels
20. UL 8753, Standard for Field-Replaceable LED Light Engines

1.4 DEFINITIONS

A. Fixture: Complete lighting device. Fixtures include lamp or lamps and parts required to distribute light, position and protect lamps, and connect lamps to power supply.

B. Lighting Unit: Fixture or assembly of fixtures with common support, including bracket plus mounting and support accessories.

C. Luminaire: Fixture.

1.5 SUBMITTALS

A. Action Submittals. Submit the following:

1. Product Data

a. Exterior Lighting – Product Data

1) For proposed fixtures, lamps, ballasts, supports, and accessories. Arrange Product Data for fixtures in order of fixture designation.

2) Include data on features, support, accessories, finishes, and following:

- Outline drawings indicating dimensions and principal features of fixtures and support.

- Electrical Ratings and Photometric Data: Certified results of laboratory tests for fixtures and lamps meeting requirements of California Energy Code and information submitted by Owner to AHJ on form NRCC-LTO-E.

b. Lighting Control

1) Provide lighting control scheme based on lighting control system described in drawings.

2) Include data on control devices in Section 2.4.

2. Shop Drawings

a. Nonstandard Fixtures and Support Shop Drawings

1) Indicating dimensions, weights, method of field assembly, components, and accessories.

b. Wiring Diagrams

1) Detailing wiring for control system showing both factory-installed and field-installed wiring for specific system of this Project, and differentiating between factory-installed and field-installed wiring.

c. Anchor-Bolt Templates

1) Keyed to specific poles and certified by manufacturer.

B. Informational Submittals. Submit the following:

1. Field Quality Control Submittals

a. Exterior Lighting – Field Quality Control Reports

1) Results of required field quality control tests and inspections.

2) Reports indicating and interpreting test results.

C. Seismic restraint calculations.

D. Closeout Submittals. Submit the following:

1. Operation and Maintenance Data

a. Exterior Lighting – Operation and Maintenance Data

1) Maintenance data for products to include operation and maintenance information.

E. Maintenance Material Submittals. Submit the following:

1. Extra Stock Materials

a. Exterior Lighting - Extra Material

1) Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

- Lamps: 10 lamps for every 100 of each type and rating installed. Furnish at least one of each type.
- Glass and Plastic Lenses, Covers, and Other Optical Parts: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
- Ballasts: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
- Globes and Guards: 1 for every 20 of each type and rating installed. Furnish at least one of each type.

1.6 QUALITY ASSURANCE

A. Comply with ANSI C2.

B. Items provided under this section shall be listed or labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).

1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.

2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.

C. Regulatory Requirements:

1. National Electrical Code (NEC): Components and installation shall comply with National Fire Protection Association (NFPA) 70.

2. NEC Article 410, Luminaires, Lamp holders, and Lamps.

3. California Electrical Code

4. California Energy Code Title 24 Requirements for Outdoor Lighting: Form NRCC-LTO-E.

D. Fixtures for Hazardous Locations: Conform to UL 844. Provide units that have Factory Mutual Engineering and Research Corporation (FM) certification for indicated class and division of hazard.

1.7 DELIVERY, STORAGE AND HANDLING

A. Delivery:

1. Upon delivery, inspect equipment for evidence of water that may have entered equipment during transit.

B. Storage:

1. Store lighting fixtures, controls, related materials and equipment in clean, dry location with controls for uniform temperature and humidity. Protect materials and equipment with coverings and maintain environmental controls.

2. Store materials and equipment for easy access for inspection and identification. Keep materials and equipment off ground, using pallets, platforms, or other supports. Protect materials and equipment from corrosion and deterioration.

1.8 WARRANTY

A. LED Drivers and lamps shall be warranted for a minimum of 5 years as a unit.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

1. Lithonia Lighting (basis for design)

2. Hubbell Lighting

3. Eaton Lighting

4. Philips Lighting

2.2 FIXTURES AND FIXTURE COMPONENTS

A. Metal Parts: Free from burrs, sharp edges, and corners.

B. Sheet Metal Components: Corrosion-resistant aluminum, except as otherwise indicated. Form and support to prevent warping and sagging.

C. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed fixtures.

D. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position. Provide for door removal for cleaning or replacing lens. Arrange for door opening to disconnect ballast.

E. Exposed Hardware Material: Stainless steel.

F. Reflecting Surfaces: Minimum reflectance as follows, except as otherwise indicated:

1. White Surfaces: 85%

2. Specular Surfaces: 83%

3. Diffusing Specular Surfaces: 75%

G. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

H. Lenses and Refractors: Materials as indicated. Use heat- and aging-resistant, resilient gaskets to seal and cushion lens and refractor mounting in fixture doors.

I. Photoelectric Relays: Conform to UL 773.

1. Contact Relays: Single throw, arranged to fail in ON position and factory set to turn light unit on at 1.5 to 3 foot-candles (16 to 32 lux) and off at 4.5 to 10 foot-candles (48 to 108 lux) with 15 sec minimum time delay.

2. Relay Mounting: In fixture housing.

3. Photocell shield deflector to minimize nuisance activation.

J. Light Emitting Diodes (LED)

1. Driver shall be accessible for easy replacement.

2. Weatherproof fixture housing shall be sealed completely against moisture and environment contaminants.

3. 4000K temperature, Color rendering index (CRI) greater than 70.

4. LED driver shall have power factor greater than 90% and THD less than 20%.

5. CSA Certified to US standards for 40°C ambient.

K. LED Fixtures:

1. Conform to UL 8750 and UL 8752.

2. LED fixtures shall be modular and allow for separate replacement of lamps and drivers. User serviceable LED lamps and drivers shall be replaceable from the room side.

3. Dimmable LED fixtures shall have either a 0-10 volt, three wire dimming driver or a two-step (50%, 100%) dimming driver.

L. LED Drivers: Electronic type, labeled as compliant with RFI requirements of FCC Title 47, Part 15, Level “A” sound rating, minimum of 0.8 power factor, and THD less than 20%.

1. Conform to UL 8753.

2. Certification by Electrical Testing Laboratory (ETL).

3. Dimming Drivers shall be 0-10 volt dimming with low end dimming to 10%.

4. Dimming drivers shall be strobe and flicker-free across the full dimming range.

5. Voltage: 120-277 volt unless listed on fixture schedule.

6. Conform to IEEE C62.41, Category A, for resistance to voltage surges for normal and common modes.

M. Outdoor Fixtures: Provide each fixture to be installed outdoors with cut-off lens to reduce the fixture’s light pollution emissions.

2.3 FIXTURE MOUNTING & SUPPORT COMPONENTS

A. Wind-load strength of total support assembly, including support, arms, appurtenances, base, and anchorage, is adequate to carry itself plus fixtures indicated at indicated heights above grade without failure, permanent deflection, and be able to withstand seismic event.

B. Mountings, Fastenings, and Appurtenances: Corrosion-resistant items compatible with support components. Use materials that will not cause galvanic action at contact points. Use mountings that correctly position luminaire to provide indicated light distribution.

C. Trapeze: Used to mount linear fixture. Can be anchored to steel structure with seismic wire bracing, and support cables.

D. Metal Support Brackets: Used to mount floodlights. Designed to match support metal. Provide cantilever brackets without underbrace, in sizes and styles indicated, with straight tubular end section to accommodate fixture.

E. Supply pole luminaires with davit arms, brackets, pole hand-hole covers, base components, and all other accessories complete by specified manufacturer who will be responsible for proper fitting of all elements.

F. Manufacturer will supply pole luminaire assembly to withstand a minimum of 100-mile-per hour winds with a 1.3 gust factor without permanent deflection.

G. Manufacturer shall be responsible for the structural integrity of complete pole luminaire. Contractor shall provide below grade concrete base as needed for each bollard or pole mount type light fixture.

2.4 LIGHTING CONTROL DEVICES

A. Relay Panels

1. Product: nLight Relay Panel ARP INTENC16 NLT w/ 16-single pole relays or equal.

2. Relay and dimming panel shall be available with 4, 8, 12, 16, 24, 32, 40, or 48 individual relays per panel, with an equal number of individual 0-10V dimming outputs.

3. Optional Field Configurable Relays (FCR) used shall have the following required properties:

a. Configurable in the field to operate with single, double, or triple pole relay groupings

b. Configurable in the field to operate with normally closed or normally open behavior

c. Provides visual status of current state and manual override control of each relay

d. Listed for the following minimum ratings

1) 40A@120-480VAC ballast

2) 16A@120-277VAC electronic

3) 20A@120-277VAC tungsten

4) 20A@48VDC resistive

5) 2HP@ 120VAC

6) 3HP@ 240-277VAC

7) 65kA SCCR @ 480VAC

4. 0-10 dimming outputs shall support a minimum of 100kA sink current per output.

5. Relay and dimming outputs shall be individually programmable to support all standard sequence of operations as defined in this specification.

6. Panel shall be UL924 listed for control of emergency lighting circuits

7. Panel shall power itself from an integrated 120-277VAC supply.

8. Panel shall provide a configurable low-voltage sensor input with the following properties:

a. Configurable to support any of the following input types:

1) Indoor photocell

2) Outdoor photocell

3) Occupancy sensor

4) Contact closure

b. Low voltage sensor input shall provide +24VDC power for the sensor so that additional auxiliary power supplies are not required

c. Sensor input supports all standard sequence of operations as defined in this specification.

9. Panel shall provide a contact closure input for each group of 8-relays that acts as a panel override to activate the normally configured state of all relays (i.e.

normally open or normally closed) in the panel. This input is intended to provide an interface to alarm systems, fire panels, or BMS system to override the panel.

10. Panel shall supply current limited low voltage power to other networked devices connected via low voltage network cable.

11. Panels shall be available with NEMA 3R rated enclosure with the following mounting and cover options:

    a. Surface mounted for all panel sizes

    b. Flush mounted for up to 16 relay panel sizes

    c. Screw-fastened for up to 16 relay panel sizes

    d. Hinged cover with keyed lock for all panel sizes

12. Surface-mounted screw cover options for 8 and 16 relay panel sizes shall be plenum rated

13. Panel shall be rated form 0-50C for 8 and 16 enclosure sizes, and 0-45C for 32 and 48 enclosure sizes.

B. Digital Electronic Time Clock

1. Product: Sensor switch DTC or equal

2. DTC shall control and program a linear bus of lighting devices and supply all time functions without connection to a system controller.

    a. Programming of the linear bus of lighting devices shall not require additional hardware, including computers, specialized dongles, or other connection devices.

    b. Programming of the linear bus shall be exclusively done through the touch screen interface.

3. DTC shall be capable of up to 32 schedules. Each schedule shall consist of one set of On and Off times per day for each day of the week and for each of two holiday lists. The schedules shall apply to any individual relay or group of relays.

4. DTC shall be run from non-volatile memory so that all system programming is retained indefinitely.

5. DTC shall be optionally mounted inside of a relay panel.

6. DTC shall have a capacitive 3.5” full color touch screen.

C. Wired Networked Wall Switches

1. Product Series: nPODM or equal

2. Devices shall recess into single gang switch box and fit a standard GFI opening.

3. Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.

4. All switches shall have the ability to detect when it is not receiving valid communciation and blink its LED in a pattern to visually indicate a potential wiring issue. Devices with mechanical push buttons shall provide tactile and LED user feedback

5. Devices with mechanical push buttons shall be made available with custom button labeling.

6. Wall switches and dimmers shall support the following device options:

    a. Number of control zones: 1, 2, or 4

    b. Control types supported:

        1) On/Off

        2) On/Off/Dimming

        3) On/Off/Dimming/Correlated Color Temperature Control for specific luminaire types

    c. Control types supported:

        1) Ivory, white, light almond, gray, black, red

2.5 EMERGENCY LIGHTING

A. General
1. Provide emergency lighting as required by referenced standards and indicated on the Contract Documents. The main function of emergency lighting is to direct building occupants safely out of the building in the event of an emergency.
2. Connect emergency lighting to the emergency power distribution systems.
3. Provide integral battery ballast power for emergency lighting where an emergency power distribution system does not exist. Provide all long-life batteries. High temperature, maintenance free, nickel-cadmium batteries are acceptable, however, lead-calcium type are not.
4. All battery ballasts shall be capable of providing full illumination in emergency mode.

B. Exit Signs
1. Exit signs shall have cast-aluminum housings and stencil edge-lit faces. Letters shall be red and 8” high. Light source shall be light emitting diodes (LED). Exit

signs shall employ a diffuser lens for even illumination of letters. Products that exhibit “dots” or “hot spots” shall not be acceptable. Exit signs shall have internal sealed lead calcium maintenance free battery rated for 90 minutes.

C. LED Battery Systems
   1. Emergency battery power supply suitable for installation remote from or in the driver compartment of the LED luminaire. Unit shall be capable of providing normal fixture operation in a switched fixture. Include “TEST” switch and “AC ON” indicator light capable of installation in the luminaire or remote from the luminaire. Power supply shall have self-test diagnostic feature.
   2. Emergency battery power supply shall be capable of operating the LED fixtures specified.
   3. Provide LED battery with the following:
      a. Rated input and output voltage and wattages.
      b. Temperature rating.
      c. Illumination time (minimum 90 minutes).
      d. Suitable for indoor and damp locations and for sealed and gasketed features.
   4. LED battery shall meet all associated UL ratings, including UL924.

2.6 FINISHES

A. Metal Parts: Manufacturer's standard finish, except as otherwise indicated, applied over corrosion-resistant primer, free of streaks, runs, holidays, stains, blisters, and similar defects.

B. Other Parts: Manufacturer's standard finish, except as otherwise indicated.

PART 3 – EXECUTION

3.1 TEMPORARY LIGHTING

A. New lighting fixtures **SHALL NOT** be used for temporary lighting.

3.2 INSTALLATION

A. General:

1. Fixture mounting heights and locations indicated on the Drawings are approximate and are subject to revision in the field where necessary to clear conflicts and obstructions.

2. Mounting Heights: Mounting heights or elevations are to bottom of fixture or to centerline of device.

3. Install fixtures in accordance with Laws and Regulations, the Contract Documents, and manufacturer instructions and recommendations.

4. Provide mounting and support fittings and accessories including but not limited to anchors, screws, conduit stems, aircraft cable, trapeze, universal framing channels as required to support light fixtures from structure as appropriate for environmental, weather, and seismic conditions of the installed location

5. Mount fixtures so that sufficient access is available for ready and safe maintenance.

6. Securely fasten equipment to walls or other surfaces on which equipment is mounted.

B. Suspended Fixtures:

1. Pendant-mount using manufacturer’s recommended diameter conduit stems, hangers, cables, etc.

2. Ground to outlet box.

3. Attach mounting to building structure with expansion anchors, beam clamps, or other appropriate fitting.

4. Fixtures shall not be dependent on the outlet box cover screws for support.

C. Surface Mounted Fixtures:

1. Attach to appropriate outlet box.

2. Attach to surface using fasteners and sealing washers when mounting fixture in damp or wet locations.

D. Boxes and Fixtures:

1. For units mounted against masonry or concrete walls, provide suitable 1/4-inch spacers to prevent mounting back of box directly against wall.

2. Bolt units rigidly to building with expansion anchors, toggle bolts, hangers, or Unistrut.

3. Do not install boxes with open conduit holes.

4. Cable each circuit and identify with tag.

E. Set units plumb, square, level, and secure according to manufacturer's written instructions and approved submittals.

F. Concrete Foundations: Construct according to Section 03 30 00.

1. Comply with details and manufacturer's recommendations for reinforcing, anchor bolts, nuts, and washers. Verify anchor-bolt templates by comparing with actual support bases furnished.

2. Finish: Trowel and rub smooth parts exposed to view.

G. Fixture Attachment: Fasten to indicated structural supports.

H. Fixture Attachment with Adjustable Features or Aiming: Attach fixtures and supports to allow aiming for indicated light distribution.

I. Lamp fixtures with indicated lamps according to manufacturer's written instructions. Replace malfunctioning lamps.

3.3 GROUNDING

A. Ground fixtures and metal support according to Section 26 05 26.

1. Metallic Support: Install 10 ft (3 m) driven ground rod at each support.

2. Nonmetallic Support: Ground metallic components of lighting unit and foundations. Connect fixtures to grounding system with No. 6 AWG conductor.

3.4 FIELD QUALITY CONTROL

A. Inspect each installed unit for damage. Replace damaged fixtures and components.

B. Tests and Observations:

1. Give advance notice of dates and times for field tests.

2. Provide instruments to make and record test results.

3. Verify normal operation of lighting units after installing fixtures and energizing circuits with normal power source. Include following:

a. Photometric Tests: Measure light intensities at night at locations where specific illumination performance is indicated. Use photometers with calibration referenced to National Institute of Standards and Technology (NIST) standards.

b. Check for intensity of illumination.

c. Check for uniformity of illumination.

d. Check for excessively noisy ballasts.

e. Prepare written report of tests indicating actual illumination results.

4. Replace or repair damaged and malfunctioning units, make necessary adjustments, and retest. Repeat procedure until units operate properly.

3.5 ADJUSTING AND CLEANING

1. Clean units after installation. Use methods and materials recommended by manufacturer.

2. Adjust aimable fixtures to provide required light intensities.

END OF SECTION

SECTION 28 33 00

FUEL GAS DETECTION AND ALARM

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The General Provisions of the Contract, including General and Special Conditions and the requirements of Division 1, apply to the Work in this Section.

B. Equipment and all necessary accessories as designated in this section for a multiple-station gas system which shall include the following.

1. Standalone Detectors.

2. Multi-Zone Control Panels.

3. Remote Sensors/Transmitters.

1.2 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum five years documented experience.

B. Installer Qualifications: Company specializing in performing Work of this section with minimum two years documented experience with projects of similar scope and complexity.

C. Source Limitations: Provide each type of product from a single manufacturing source to ensure uniformity.

1.3 STANDARD AND REGULATORY REQUIREMENTS

A. All materials, design, fabrication, assembly and test procedures shall be in accordance with the requirements of all applicable codes, standards or regulations having jurisdiction over the work.

B. Reference to any code, standard or regulation shall mean the latest published editions, including addenda, supplements and revisions thereto, which are in effect when the purchase order is awarded.

C. In the event of conflict between codes, standards or regulations, the conflict shall be referred to the Engineer for resolution.

D. The organizations having jurisdiction include, but are not limited to, the following:

1. AGA American Gas Association

2. ANSI American National Standards Institute

3. ASME American Society of Mechanical Engineers

4. FCC Federal Communications Commission

5. NEMA National Electrical Manufacturers Association

6. NFPA National Fire Protection Association.

7. OSHA Regulations of the Occupations Safety and Health Administration.

8. RoHS Restriction of Hazardous Substances Directive

9. UL Underwriter's Laboratories Inc.

10. The state, county or municipal laws and regulations governing the location where the equipment is to be installed.

E. Equipment indicated within this specification section shall comply with all applicable national, state and local codes and regulations, including seismic and fire codes and regulations. Additional, more specific compliance requirements may be listed under individual equipment headings.

F. 'Buy America' Requirements: All manufactured products listed within this specification section are part of a federally assisted procurement involving funds granted by the Federal Transit Administration (FTA), and shall comply with Buy America requirements as delineated by Title 49 Code of Federal Regulations (CFR) Subsection 661.

1.4 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.5 SUBMITTALS

A. Design Data: Include details of materials, construction, and finish. Include relationship with adjacent construction.

B. Manufacturers Installation Instructions: Submit installation instructions for material and equipment.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

D. Shop Drawings - Submit in accordance with Division 1 -General Requirements of these specifications.

1. Submitted shop drawings shall be project specific and shall include a minimum 1/8 inch to 1 foot scaled (or larger standard architectural imperial scale), dimensioned, graphical representation of the size, orientation, and location for the submitted equipment. The drawings shall further include dimensions from structural elements or architectural grid lines, operational clearances, locations of any utility service connection points, mounting requirements, and structural supports required for the submitted equipment.

2. Provide product data for each equipment indicated and include the following:

    a. Manufacturer's data sheets on each product to be used.

    b. Preparation instructions and recommendations.

    c. Storage and handling requirements and recommendations.

    d. Typical installation methods.

    e. Product dimensions including required clearances.

    f. Drawings showing physical dimensions, mounting requirements and terminations.

    g. General arrangement or component drawing.

    h. Panel layout drawing.

    i. Wiring Diagram.

3. All Product Data submittals shall identify proposed project specific items marked by arrow, circle, underline, reproducible highlight, or other markings clearly discernable by the reviewer, to show which specific items, parts and accessories are being submitted for the project product data review. Non-marked or generic product data submittals with no marks indicating specific items, parts and accessories will be a cause for rejection.

4. Restrict submitted material to pertinent data. For instance, do not include manufacturer's complete catalog when pertinent information is contained on a single page.

E. Startup service reports.

1. Certificate: Contractor’s start-up and demonstration affidavit

F. Operation and Maintenance Manual:

1. Provide a Complete parts list, operating instructions, and maintenance manual covering equipment at time of installation including, but not limited to:

a. Commissioning instructions.

b. Calibration Instructions/schedule frequency

c. Trouble shooting guide and instructions.

d. Vendor data or “cut sheets” on major components.

e. Printed listing of periodic preventive maintenance items and recommended frequency required to validate warranties. Failure to provide maintenance information will indicate that preventive maintenance is not a condition for validation of warranties.

f. List of original manufacturer's parts, including suppliers' part numbers and cuts, recommended spare parts stockage quantity and local parts and service source.

2. Assemble and provide copies of manual in 8-1/2 by 11 inch format. Foldout diagrams and illustrations are acceptable. Manual to be reproducible by dry copy method. Provide copies per provisions of Division 1 - General Requirements.

G. ’Buy America’ Certificates: ‘Buy America’ certificates required during bidding shall also be required as part of each product submittal. Certificates shall be complete and accurate. Certificates shall indicate either compliance or non-compliance with the ‘Buy America’ regulations. Certificates of non-compliance shall also include copies of any granted waivers. Waivers still being applied for or being processed at the time of submittal shall be indicated as such.

1.6 WARRANTY

A. The Manufacturer shall warrant that all materials and equipment furnished under this contract will be new and of good quality, free from defects in design, workmanship, and materials.

B. Each item of equipment, or part thereof, proving to be defective within the specified period of the warranty shall be replaced, free of defect, without cost to the Owner.

C. The warranty period shall be the Manufacturer's standard warranty period, but not less than a minimum of twelve (12) months after startup, or 18 months after delivery of the equipment at the site (whichever comes first).

D. Warranty shall include materials and labor necessary to correct defects.

E. Defects shall include, but not be limited to noisy, rough, or substandard operation; loose, damaged, and missing parts; and abnormal deterioration of finish.

F. Submit warranties in accordance with Division 1 - General Requirements of these specifications.

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Store and handle in strict compliance with manufacturer's written instructions and recommendations.

B. Protect from damage due to weather, excessive temperature, and construction operations.

1.8 COORDINATION

A. Coordinate with electrical and controls contractor all device locations, power and wiring requirements and any special wiring requirements.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers, subject to compliance with requirements of this specification, are as follows:

1. American Gas Safety.

2. Emerson.

3. Honeywell.

4. MSA.

5. Sensidyne.

6. Siemens.

2.2 GENERAL

A. Provide a system with electrically supervised detection and noncoded alarm of combustible gas within natural gas generator enclosure, conforming to the applicable requirements of NFPA 70 and NFPA 72.

2.3 CONTROLLER

A. The Gas Detection Controller shall have the following features:

1. Multi-Channel Gas Controller shall be microprocessor based with 7-inch LCD touchscreen display 800 X 480 resolution and capacitive multi-touch TN panel for easy screen navigation.

2. The controller shall be capable of operating over a temperature range of 32 to 125 degrees F, capable of monitoring multiple detectors.

3. The controller shall be housed in a weatherproof cabinet suitable for wall] mounting in a Class I, Division 1, Group D location] with solid-state plug-in-type relays and solid-state rectifiers

4. The system uses an RS-485 communication protocol that accommodates 128 channels through four digital ports. In addition, there are 128 analog inputs from any 4-20 mA device and equally 128 4-20 mA outputs.

5. The system can accommodate up to 128 binary inputs and 128 binary outputs.

6. Communications:

   a. Modbus RS485

   b. BACnet IP

7. The system communicates wirelessly for programming and downloading of data through smartphone or tablet device.

8. Input/output boxes can be installed at any location on the RS-485 network for ease of installation of additional sensors.

9. A touch screen graphic display is used for programming.

10. All relevant gas detection data, such as relay status, historical data, location and addresses of sensors are displayed by scrolling through multiple screens.

11. The controller has a scheduler that can be programmed to activate relays and deactivate relays several times a day based on a frequency of day, weekday or weekend only.

12. An auto-configure program searches for connected devices.

13. The unit can accept any 4-20 mA signal, which is ideal for additional monitoring such as temperature humidity and other parameters that may be of interest.

14. Controllers can be connected together to a centralized system that will display gas detection concentrations of an entire facility. Remote monitors are an optional item that can be used to observe the concentration of gases prior to entering the space.

2.4 SENSORS/TRANSMITTERS

A. Provide the quantity and type of gas detection sensors as shown on the drawings

B. Natural Gas/Methane sensor(s) shall have a catalytic bead sensing element, with a typical life of three (3) years.

   1. Pre-calibrated sensors can be purchased and installed by the user thereby reducing calibration costs and minimizing downtime.

C. Transmitter electronics

1. Microprocessor based.

2. Housed in a NEMA 4X enclosure

3. The controller shall have an alphanumeric LCD display for gas concentration and unit configuration, five LED's for communication and relay status, and three function keys for operation/configuration.

4. Programming and calibration is nonproprietary and is accessed through a user selectable password that protects system integrity

5. The sensors can be installed as stand-alone, digitally networked with controller through a standard RS-485, Modbus communication port.

6. A user configured 4-20 mA, 2-10 VDC, or 1-5 VDC analog output that is fully assignable over a chosen range is standard.

7. Three user programmable relays

   a. The relays can be configured to energize at a preselected concentration or based on a time-weighted average concentration.

8. 80 dB buzzer.

D. The natural gas sensors shall be powered by a 24VAC class 2 power supply. Class 2 power supply will be provided by the gas monitoring equipment supplier and installed by the electrician or controls contractor.

2.5 ACCESSORIES

A. External Audible Alarm:

1. Basis of Design: Vibratone Horns, Model 350; as manufactured by Federal Signal.

2. Operating Temperature: Minus 65 to 150 degrees F (minus 54 to 66 degrees C).

3. Weight: 1.4 pounds (0.6 kg).

4. Size (WxHxD): 4.06 x 4.06 x 2.19 inches (103 x 103 x 55.6 mm).

5. Model 350-024-30:

   a. Power Requirements: 24 VAC, 0.90 A, 50/60 Hz.

   b. Decibels: 100 at 10 feet (110 at 1 M).

6. Model 350-120-30:

   a. Power Requirements: 120 VAC, 0.18 A, 50/60 Hz.

b. Decibels: 100 at 10 feet (110 at 1 M).

B. External Strobe:

1. Operating Temperature: Minus 31 to 150 degrees F (minus 35 to 66 degrees C).

2. Weight: 0.1 pounds (0.06 kg).

3. Size (WxHxD): 3.94 x 3.95 x 1.6 inches (100 x 100 x 40.6 mm).

4. Flash Rate: 80 per minute.

5. Candela Peak: 108,000.

6. Mounting: Surface.

7. Model VALS-024:

a. Power Requirements: 24 VAC, 0.08 A.

8. Model VALS-120:

a. Power Requirements: 120 VAC, 0.06 A, 50/60 Hz.

C. Fuse:

1. Basis of Design: Radial Lead Fuse, 374 Series, TR5 Fuse, Time Lag; as manufactured by Littelfuse.

2. Compliance: UL 248.

3. Halogen free and lead-free.

4. Reduced PCB space requirements.

5. Low internal resistance.

D. Modbus:

1. Basis of Design: Modbus TRNS Gen 2 as manufactured by Brasch Environmental Technologies, LLC

a. Communicates across a two-wire RS-485 bus using the Modbus RTU protocol.

b. Addressable with up to 128 unique addresses

c. Supports Function Code (FC) 04

d. Provides gas sensor readings and error codes

e. Data on This Bus: Readable by a remote device capable of interfacing with this protocol. The remote device is the client and the TRNS is the server.

1) Baud Rate: 9600

2) Data: 8 bits

3) Stop: 1 bit

4) Parity: None

5) Flow Control: None

f. DIP Switch: 7-position. Used to set the device address.

g. Programmed and configured at the factory; field adjustable.

h. Address is assigned using a binary counting system.

2.6 SYSTEM SEQUENCE OF OPERATION

A. Natural gas alarm shall be set at 20% (low) and 50% (high) LEL within the 0 - 100% LEL measuring range.

B. When natural gas concentration from the sensors exceeds the low alarm setpoint, the audible alarms shall sound, the light indicator associated with that alarm will be activated at the Multi-Channel Gas Controller, the alarm will be transmitted to the Remote Alarm Panel and BMS system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until mounting surfaces have been properly constructed and prepared. If mounting surface preparation is the responsibility of another installer, notify Owner in writing of unsatisfactory preparation before proceeding.

B. Before installation, Contractor shall verify actual locations, and note any conditions affecting installation, routine maintenance, and operation.

1. Final locations indicated on Drawings are approximate. Determine exact locations before roughing-in for electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions, approved submittals, and in proper relationship with adjacent construction.

B. Equipment Mounting: Mount all sensors at or as close as possible to the recommended heights.

1. Sensor Mounting Heights

a. Natural Gas Sensor HT = 2’ – 0” below ceiling.

C. Install in locations that will allow access for calibration and testing.

D. The Contractor shall wire the sensors to their respective channels inside the controller with shielded cables specified by the equipment manufacturer to certify length and maximum loop resistance as required.

E. Ensure that the installation of combustible-gas detection and alarm systems complies with ICC IFGC, NFPA 70 and applicable requirements of NFPA 72.

3.3 FIELD QUALITY CONTROL

A. Field Inspection: Coordinate field inspection in accordance with appropriate sections in Division 01.

B. Manufacturer's Services: Coordinate manufacturer's services in accordance with appropriate sections in Division 01

3.4 TESTING

A. General: Test system either in its entirety or in sections after system is installed or cleaned.

B. Conduct performance tests in accordance with ANSI/ISA 60079-29-1.

C. Test operation of the entire system in operational and alarm modes. Activate each detector by a gas calibration bottle representing the adjusted Lower Flammable Limit (LFL). Test the malfunction feature for each control unit.

3.5 CLEANING

A. Clean products in accordance with the manufacturer's recommendations.

B. Touch-up, repair or replace damaged products before Substantial Completion.

3.6 TRAINING

A. Provide on-site operator training services to be performed by a factory trained field experienced professional.

B. Train Owner's maintenance and operations personnel on how to adjust, operate, and maintain the gas detection system.

END OF SECTION

SECTION 31 20 00

EXCAVATION

PART 1 - GENERAL

1.1 Excavation shall include the removal of existing material to the elevations required for over excavation per geotechnical recommendations; removal, disposal or stockpiling of material excavated as required; subgrade preparation; re-use of excavated material; placement and compaction of re-used material or imported engineered fill to the required elevations shown in the plans and in accordance with the Caltrans Standard Specifications, APWA Standard Specifications for Public Works Construction, Latest Edition and these Special Provisions.

1.2 SECTION INCLUDES

A. Excavation

B. 1-Sack Cement Slurry Backfill

C. Engineered Fill

D. Buried Man-made Objects

E. Dust Control

F. Surplus Material

G. Hazardous Materials in Excavation

H. De-watering

I. Utility Trenches

1.3 RELATED SECTIONS

A. Not Used

1.4 REFERENCE STANDARDS

A. Caltrans Standard Specifications, Latest Edition

1. Section 5.120, “Coordination with Other Entities”
2. Section 14-11, “Hazardous Waste and Contamination”
3. Section 18, “Dust Palliatives”
4. Section 19, “Earthwork”

B. APWA Standard Specifications for Public Works Construction (Greenbook), Latest Edition

1.5 SUBMITTALS

A. Engineered Fill Product Data: Submit source, gradation, R-value, sand equivalent, and durability for the proposed fill material.

B. Engineered Fill Certified Test Results: At least seven calendar days in advance of desired date of ENGINEER'S approval, submit certified test results performed by an independent testing laboratory certifying that the proposed base material complies with the specifications. Test results shall not be more than 30 days old. Test results shall indicate type of aggregate, gradation, R-value, sand equivalent, and durability.

C. Documentation: Submit delivery tickets from each load of fill delivered to the Worksite which include, as a minimum the supplier, material and its composition, and material weight.

D. Health and Safety Plan: Contractor shall prepare a site specific Health And Safety Plan (HASP) that complies with the HAZWOPER requirements for excavation and other work related to excavating, handling or otherwise coming into contact with hazardous materials in excavation (impacted soil). Non-HAZWOPER trained personnel shall not excavate, handle or otherwise come in contact with impacted soil. Contractor shall designate, mark, and enforce an exclusion zone to prevent unauthorized contact with impacted soils. Contractor shall also supply, construct, and maintain a decontamination area for personnel and equipment at the perimeter of the exclusion zone.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Engineered Fill

Onsite excavated material may be used as engineered fill provided it is free of oversized rock, organic materials and deleterious debris. Oversized material is defined as material exceeding 8 inches in diameter. Oversize material shall not be placed within 10 vertical feet of finish grade or within 2 feet of future utilities or underground construction.

B. 1-Sack Cement Slurry Backfill: a self-compacting, cementitious flowable material requiring no vibration or tamping to achieve consolidation, may be used. The Contractor must submit a mix design in writing to the Engineer for approval. The design shall provide:

1. A minimum 28 day strength of 50 psi and a maximum 28 day strength not to exceed 150 psi.
2. Consistency shall be flowable (6 to 8 IN slump)

Onsite excavated material may be used as engineered fill provided it is free of oversized rock, organic materials and deleterious debris. Oversized material is defined as material exceeding 8 inches in diameter. Oversize material shall not be placed within 10 vertical feet of finish grade or within 2 feet of future utilities or underground construction.

C. Unsuitable Material
Onsite excavated material that is soft or yielding is considered unsuitable and may not be used as engineered fill and must be disposed of offsite as surplus material.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Pavement and Trench Areas: The existing asphalt pavement, including base, sections are assumed to be 20” thick, or as shown on the contract drawings. Contractor to verify and match existing pavement section.

B. Upon removal of the existing asphalt pavement areas, contractor shall have MTS contracted geotechnical engineer test soils for constituents of concern prior to excavation. Stockpiles shall not be allowed on-site.

C. Overexavation is required on this project as specified in the geotechnical report and the plans. The upper 3 feet from existing grade or 3 feet below the planned finish grade elevations, whichever results in a deeper excavation, shall be removed and replaced with properly compacted fill. Additional removals may be required if undocumented fill exists at the base of the planned excavation and for structures under shallow foundations. This determination shall be made by the field geotechnical engineer. Prior to placing fill, the upper one foot of the exposed ground surface shall be scarified, moisture conditioned as necessary, and compacted.

3.2 PLACEMENT OF ENGINEERED FILL

A. Engineered fill shall be placed in uniform, loose lifts of approximately 8 inches and then compacted to prior to the placement of subsequent lifts. Engineered fill shall be moisture conditioned to at least 4 percent above optimum moisture content. Onsite excavated material shall be compacted to a minimum of 90 percent relative compaction based on ASTM D 1557. Material placed in the upper 12 inches of pavement subgrade shall be scarified then moisture conditioned to a moisture content of 3% above optimum content and compacted to a minimum 95 percent relative compaction.

3.3 BURIED MAN-MADE OBJECTS

A. Buried man-made objects discovered during excavation and not previously known or otherwise identified in the plans shall be removed and disposed of according to Section 19-1.03D, “Buried Man-made Objects”, of the Caltrans Standard Specifications and these Special Provisions. The CONTRACTOR shall immediately inform the ENGINEER of the discovery of any buried man-made objects. Depressions left by removed buried man-made objects shall be backfilled with engineered fill.

3.4 DUST CONTROL

A. The Contractor Watering for dust control shall comply with Section 18, “Dust Palliatives”, of the Caltrans Standard Specifications.

3.5 SURPLUS MATERIAL

A. Surplus excavated material not designated or determined to contain hazardous waste shall become the property of the Contractor and shall be disposed of offsite in conformance with Caltrans Standard Specifications, except that MTS shall be absolved from responsibility

instead of the Department. Surplus material shall not be disposed of in any MTS or public street right of way.

3.6 HAZARDOUS WASTE IN EXCAVATION

A. There is the possibility that there is undocumented hazardous material onsite. If the Contractor encounters hazardous waste in excavation, as defined by Section 25117 of the Health and Safety Code, the Contractor shall immediately so notify the Engineer in writing. The Engineer shall notify the City of San Diego Solid Waste Local Enforcement Agency (LEA) and MTS during earthwork. Excavation in the immediate area of the suspected hazardous material shall be suspended until the Engineer authorizes it to be resumed. If such suspension delays the current controlling operation, the Contractor will be granted an extension of time as provided in Section 8-1.07, "Liquidated Damages," of the Standard Specifications.

If such suspension delays the current controlling operation more than 2 working days, the delay will be considered a right-of-way delay and the Contractor will be compensated for each such delay as provided in Section 8-1.08, "Right of Way Delays," of the Standard Specifications.

MTS reserves the right to use other forces for exploratory work to identify and determine the extent of such material and for removing hazardous material from such area.

B. Should TPH- and pesticide-impacted soil or other contaminants be encountered during excavation, the Contractor excavation work shall be modified as follows:

1. Comply with requirements outlined in the Soil Management Plan.
2. Comply with San Diego County Department of Environmental Health (SDCDEH) requirements and guidance (e.g., guidance for sampling subsequent to UST and associated piping removal and oil/water separator system removal).
3. Comply with the SDCDEH Site Assessment and Mitigation (SAM) Program Manual, dated September 2, 2010 or any later revision. Specifically refer to Section 5-XI – waste characterization and soil reuse.
4. Comply with California Code of Regulations, Title 22, Division 4.5, “Environmental Health Standards for the Management of Hazardous Waste” regarding identification of hazardous waste.
5. During excavation, segregate impacted from non-impacted soil. This may be done on a bucket-by-bucket load basis. Contractor shall also take various monitoring instrument readings and samples. Contractor will evaluate which bucket load or scraped run is impacted or not impacted based on visual observations, odor, and photoionization detector (PID) readings, except for those areas predetermined as pesticide impacted.
6. Should potentially impacted soil be discovered, the Resident Engineer shall be contacted immediately.
7. Place impacted and non-impacted soil in separate stockpiles on-site. In some cases a third soil stockpile may be needed for “questionable” soils.
8. Maintain soil stockpiles as required. Contractor shall collect soil samples for environmental analytical testing and waste characterization.
9. Cover all stockpiles daily with Visqueen or similar plastic sheeting with a minimum thickness of 10-millimeters. The sheeting will be anchored with sand bags to minimize rain or water used for dust control from contacting the waste and collecting in the stockpile areas. The temporary stockpiles shall be constructed to a maximum height of 7 feet with flat tops to facilitate sampling, if necessary. All stockpiles shall be kept covered

when not actively being worked on. When the stockpiles are actively worked on, light misting will be used to minimize generation of dust. Load stockpiles for disposal as requested by the ENGINEER.

C. Contractor shall hire an environmental consultant to be onsite during all soil management activities. The environmental consultant's onsite personnel shall be trained and have at least 3 years of experience in the use and calibration of appropriate instrumentation used in the testing and classification of soil that is potentially impacted by TPH and pesticides. All testing results and reports shall be delivered to the Engineer as soon as they are available.

D. Contractor shall have the Soil stockpiles remain in-place until soil sampling and waste characterization has been completed to allow for proper disposal. It is anticipated that excavated impacted soil will need to be stockpiled for a period not to exceed 30 days. Stockpiling of excavated soil at the Site shall be coordinated with the Engineer. Should the potentially non-impacted stockpile be found to be free of contamination, the soil shall be re-used or disposed of offsite, as required by the Contractor.

E. Regulatory Requirements for Permitting for Dust and Emissions Controls: Contractor shall comply with the requirements outlined in the construction drawings for dust control as well as erosion control. Regarding the impacted soil stockpile shall be continuously covered with plastic sheeting. Plastic sheeting shall consist of Visqueen or similar plastic sheeting (minimum 10-mil thickness). Sand bags, staking or other means shall be applied to maintain plastic sheeting cover from possible winds. Impacted soil stockpiles shall also be placed on plastic sheeting.

F. Regulatory Requirements For Construction Contractor and Personnel: Excavation and handling of impacted soils shall be performed by an appropriately licensed California construction contractor with Hazardous Substance Removal Certification (California Code of Regulations [CCR], Division 9, Title 16, Article 3. Classification). In addition, all personnel working on sites exposed to hazardous substances, health hazards, or safety hazards and their supervisors shall be trained and covered under the Hazardous Waste Operations and Emergency Response (HAZWOPER) requirements (Code of Federal Regulations [CFR] Standard 29 Part 1910.120) including current 8-hour HAZWOPER refresher training. Contractor shall comply with all elements of the HAZWOPER requirements including:

1. Training;
2. Training Refreshers;
3. Medical Surveillance; and
4. Safety and Health Program Implementation.

G. Regulatory Requirements For Soil Profiling, Transportation And Disposal:

1. Soil Profiling: Prior to removal from Site, the impacted soil and other potential hazardous or regulated waste must be profiled. Sample and analytical test data from Site investigations may be used for profiling; preferably data for the impacted oil stockpile should be used. The hired environmental consultant shall assist with waste profiling; however, the waste generator is responsible for profiling the waste and determining the following:

    a. Hazardous waste determination
    b. The proper documentation (e.g. hazardous waste manifest or bill-of-lading)

c. The proper disposal (or treatment) facility.
d. Waste manifest or bill-of-lading shall be signed by the waste generator, transporter, and disposal facility.

2. Soil Transportation: Hazardous waste shall only be transported by a Department of Transportation (DOT) licensed hazardous waste hauler. Hazardous waste and petroleum-impacted (nonhazardous) waste shall utilize shipping documents acceptable to the receiving facility and in compliance with state and federal requirements. Each load must be accompanied by a signed hazardous waste manifest or bill-of-lading. Each load must be completely covered with a secured tarp.
3. Upon exiting the Contractor's exclusion zone at the Site, all soil shall be removed from the exterior of the truck and truck tires by means such as, but not limited to, brushing/sweeping to prevent spreading of impacted soil beyond the construction excavation exclusion zone and on to streets.
4. Soil disposal: Impacted soil shall be transported only to the generator's approved disposal facilities soil profiles shall be approved prior to shipment. Trucks shall be released only under the following conditions:

   a. Loads leaving the Site are logged by the Contractor (i.e. truck number/name, date and time);
   b. Facility is approved in advance by the waste generator;
   c. Each load transported to facility is accompanied by a hazardous waste manifest or bill-of-lading;
   d. Each load is weighed and tared; and
   e. Each load is documented by the Contractor.

5. Contractor's documentation shall include the following:

   a. Copies of all disposal facility-signed hazardous waste manifests or bill-of-lading;
   b. Log of each load;
   c. Log of each load's weight and tare weight; and
   d. Certificate from disposal facility documenting acceptance/treatment for total quantity of impacted soil and other wastes disposed.

6. Impacted soil shall be disposed at a facility authorized to receive contaminate soil.

H. Dust Control and Air Monitoring Compliance. The Contractor shall take action to prevent, reduce, or mitigate contaminated dust emissions through use of best management practices (BMPs). Dust suppression shall be performed by the Contractor, as required, by spraying with a light mist of water. Watering for dust suppression shall comply with Section 17, "Watering", of the Caltrans Standard Specifications. It should be noted that there are no specific air monitoring requirements in San Diego County for sites where TPH- or pesticide-impacted soil is the main constituent of concern. For soil that is to be temporarily stockpiled, the Contractor shall contain and cover the soil using 10-mil Visqueen or similar plastic sheeting for dust suppression purposes.

I. Water Pollution Control Plan (WPCP). The Contractor shall follow the WPCP for all on-site and disposal activities. See also 3.21 Compliance with General Construction Permit and MTS Stormwater Standards.

J. Contractor must secure and maintain graded/excavated areas in the event of a storm. BMPs shall be used to prevent soil (impacted or otherwise) from washing into storm drains, being tracked, or washing off Site. BMPs should also protect open excavations to the extent practical, to prevent flooding and the subsequent need for over-excavation.

K. For soil that is to be temporarily stockpiled, the Contractor shall contain and cover the soil using 10-mil Visqueen or similar plastic sheeting, to the extent necessary to prevent soil transport by storm water from the stockpile. The Contractor shall use erosion control bags around the stockpile perimeters if rain is forecast or if rain occurs.

L. Spills of Soil or Other Materials. Contractor shall maintain appropriate required BMPs to prevent and mitigate potential spills of potentially hazardous materials. If a spill of potentially hazardous material occur, the Contractor shall take all appropriate steps required to clean up the spill in a timely manner. Contractor will also immediately notify the RWQCB (as required), local Fire Department, and MTS of the spill. Contact Information follows:

a. MTS
Mr. Eli Belknap
Manager of Capital Projects
100 16th St.
San Diego, CA 92101
Tel: (619) 595-7039
Eli.Belknap@sdmts.com

b. Fire-Rescue Department– San Diego
Emergency: 911
Non-Emergency: (619) 533-4300
sdfd@sandiego.gov

M. Tracking and Reporting of Impacted Soil.

1. Photographs of Construction Excavations: Contractor shall photograph obvious features within the construction area that are associated with contamination and with the construction activities. Photographs shall be taken, as necessary, to assist in documenting pre-existing environmental conditions encountered during construction grading and excavation.
2. Photographs shall be numbered and a brief description compiled for each photograph, including location (i.e. location number), orientation (i.e. facing east, on the west end of the excavation area), date, and description of feature. In addition, general photographs of Site activities shall also be taken to document construction progress and environmental procedures.
3. Field documentation Organization: Contractor shall compile field documentation related to environmental conditions. Field reporting shall be performed by completing standard forms that will be compiled as the job progresses. This documentation shall be organized into several files as follows:
   a. Map(s) of the Site showing the location and dimensions of each excavation;
   b. Estimated quantities of soil temporarily stockpiled on-Site;
   c. Estimated quantities of soil removed from Site and transported to a disposal facility (based on field notes);
   d. Actual quantities of soil removed from the Site and transported to a disposal facility (based on weight tickets);

e. Photographs organized by Site area that document relevant features, such as apparent preferential pathways or observed indications of contamination;
f. Copies of bills of lading and manifests for soil removed and transported to an off-Site treatment or disposal facility; and
g. Miscellaneous correspondence.

3.7 UTILITY TRENCH EXCAVATIONS

A. Trenches and excavations shall be designed and constructed in accordance with OSHA and other applicable government safety codes and regulations. Excavations deeper than 5 feet shall be shored or laid back on a slope no steeper than 1.5:1 (H:V). For trench excavations, Contractor shall meet OSHA requirements regarding personnel safety with the appropriate use of shoring or laying back of slopes. If seepage is encountered, the Contractor shall immediately inform the Engineer. The Engineer or his designee shall evaluate the seepage and determine if de-watering is required. Contractor shall keep vibrations away from the immediate excavation area. The Contractor shall setback all stockpiled materials from the trench a distance of at least one half the excavation depth. Shoring and/or bracing may be required. The material excavated from the trench may not be re-used as backfill and must be treated and disposed of as contaminated waste pending sampling and testing in accordance with Article 3.5. of these Special Provisions.

B. The project site contains existing utilities that are shallow. Contractor shall pothole and inform the Engineer of the location of all existing utilities at crossings prior to excavation. The Contractor shall determine alternative duct bank configurations at each crossing where conflicts exist and obtain approval from Engineer prior to excavation.

C. Not all utilities are shown on the project plan sheets. It is the responsibility of the contractor to provide utility locating to ensure no additional utilities are on the project.

3.8 DE-WATERING

A. De-watering is not anticipated on this project. If groundwater or water drainage from excavated soils is encountered during construction, the Contractor shall immediately inform the Engineer, sample and control the runoff in a manner that is consistent with the Water Pollution Control Plan (WPCP). De-watering shall be considered Force Account Work if required and shall conform Section 9-1.04, “Force Account”, of the Caltrans Standard Specifications.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. Excavation shall be measured by the cubic yard based on the dimensions of material in place, as shown within the construction plans and these Special Provisions. Includes excavation of trench and any miscellaneous excavation. It shall NOT include the concrete and asphalt material removed as part of Demolition.

B. 1-Sack Cement Slurry shall be measured by the cubic yard and completed in accordance with the Contract Documents and as measured by the Engineer.

C. Loading, Hauling, and Disposing Clean Export shall be measured by the cubic yard and completed in accordance with the Contract Documents and as measured by the Engineer or Owner's representative. Does not include excavation of the material.

D. ADD ALT: Loading, Hauling, and Disposing CAL Hazardous Waste (manifest required) and importing clean material will be measured by the cubic yard and completed in accordance with the Contract Documents and as measured by the Engineer or Owner's representative. The quantities as contained on the Bid Form, Schedule of Quantities and Prices, or approved schedule of values, as applicable, as derived from the Plans will be used as the basis for this measurement. Does not include excavation of the material.

4.2 PAYMENT

A. Excavation shall be paid by the cubic yard based on the dimensions within the construction plans. Full compensation for Excavation shall include furnishing the labor and materials, equipment, tools and incidentals involved in excavation, subgrade preparation, placement of engineered fill, stockpiling and re-use of suitable excavated material and disposal of surplus material. Includes excavation of trench and any miscellaneous excavation. Pavement removed as part of Demolition shall NOT be included in the payment made for Excavation.

B. 1-Sack Cement Slurry furnished and completed in accordance with the Contract Documents will be paid for at the Contract Price, as listed on the Bid Form or Schedule of Quantities and Prices, as applicable. This price shall include full compensation for furnishing all labor, materials, tools, equipment, supplies, supervision, and incidentals, to furnish and place 1-sack cement slurry, as shown on the Plans, and as specified in these Specifications, and as directed by the Engineer.

C. Loading, Hauling, and Disposing Clean Export furnished and completed in accordance with the Contract Documents will be paid for at the Contract Price, as listed on the Bid Form or Schedule of Quantities and Prices, as applicable. This price shall include full compensation for furnishing all labor, materials, tools, equipment, supplies, supervision, and incidentals, and doing all work for loading, hauling and disposing of clean material, as shown on the Plans, and as specified in these Special Provisions, and as directed by the Engineer. Does not include excavation of the material.

D. ADD ALT: Loading, Hauling, and Disposing CAL Hazardous Waste (manifest required) and importing clean material to be furnished and completed in accordance with the Contract Documents will be paid for at the Contract Price, as listed on the Bid Form or Schedule of Quantities and Prices, as applicable. This price shall include full compensation for furnishing all labor, materials, tools, equipment, supplies, supervision, and incidentals, as shown on the Plans, as specified in these Special Provisions, and as directed by the Engineer. Work shall include obtaining any necessary permits, any required state, federal, municipality or disposal facility testing and analysis, stockpiling, handling, sample storage, and disposal at a legal facility, reuse, documentation, and relevant disposal fees. Does not include excavation of the material.

E. Full compensation for workers to attend OSHA accepted HAZWOPPER 40 Hour Training and possess a certificate showing proof of acceptable training as described in this section shall be included in various items of work involved and no additional compensation will be allowed therefor.

F. The cost to engage an Environmental Consultant to test for Hazardous Materials in Excavation and the cost for all testing and reporting services performed by the Environmental Consultant shall be considered incidental to the contract price paid per cubic foot of Excavation. No separate payment shall be made therefor.

END OF SECTION

SECTION 31 23 33

GAS LINE TRENCHING, BACKFILL, AND RESURFACING

PART 1 - GENERAL

1.1 SCOPE

A. This specification covers requirements for excavation, backfill, base (bedding), shading material and resurfacing for trenches intended for buried gas utilities.

1.2 SECTION INCLUDES

A. Excavation

B. Buried Man-Made Objects

C. Dust Control

D. Surplus Material

E. Hazardous Waste in Excavation

F. Utility Trench Excavation

G. De-watering

H. Resurfacing

1.3 RELATED SECTIONS

A. 31 20 00 EXCAVATION

1.4 REFERENCE STANDARDS

A. Caltrans Standard Specifications, Latest Edition

B. APWA Standard Specifications for Public Works Construction (Greenbook), Latest Edition

C. SDG&E Service Standards & Guide, 2023 Edition

D. SDG&E Underground Construction Standards, 2019 Edition

1.5 SUBMITTALS

A. Product Data: Submit manufacturer’s information, material source, gradation, R-value, sand equivalent, and durability for the shading and base (bedding) material.

B. It is the responsibility of the contractor to provide material whose constituents meet all applicable requirements of this specification. The Supplier must be capable of supplying a consistent

material. Subsequent to Supplier approval, the Supplier shall make no changes to the material without satisfying the following conditions:

- Prior written notice to the engineer and SDG&E of intent to change material.
- Written notification from the engineer and SDG&E approving the change.

1.6 DEFINITIONS

A. Sand: Natural, manufactured, or recycled granular material, or a combination thereof, free of deleterious amounts of contaminants defined in this specification.

B. Manufactured Sand: Material made by crushing existing native natural material.

C. Recycled Sand: Material made by crushing concrete, asphalt-concrete, or concrete and asphalt mixture.

D. Supplier: Manufacturer, vendor, contractor, or developer who supplies trench bedding, shading, and material for use in installing gas utilities.

E. Base (bedding): A layer of select materials, normally screened sand, placed at trench bottom for the purpose of providing uniform support of the buried utility and protection from substructures, trench irregularities, rock projections or other features that could cause damage to the utility.

F. Shading: A layer of select material, normally screened sand, to surround the utility after installation for the purpose of protecting it from damage by the backfill material.

G. ASTM: American Society for Testing and Materials

PART 2 - PRODUCTS

2.1 MATERIALS

A. Base (bedding) and shading material intended for buried gas utilities consist of natural sand, equivalent native natural material, manufactured sand, or recycled sand, or a combination thereof, and shall meet SDG&E Underground Standard specifications UG3370 and UG3371 and the requirements of this specification.

B. Base (bedding) and shading material shall be free of hazardous material. Oblong rocks (cobbles) or angular pieces of rock that resemble arrowheads, as described in ASTM D2488, shall not be included in the base or shading material. Beach sand shall not be used under any circumstance.

C. The manufactured sand, recycled sand, or a combination thereof, submitted for testing shall meet the specifications provided in Table 1.

Table 1 – Sand Requirements

Property	Test Method	Requirements
Sand Equivalent	California Test 217 or ASTM D2419	≥ 20
Durability Index	California Test 229	≥ 35
pH Value	California Test 643	Case-by-case evaluation by the Company, with a minimum value of 6.0
Electrical Resistivity (ohm- cm)	California Test 643	Case-by-case evaluation by the Company, with a minimum value of 4,500 ohm-cm
Organic Impurities	ASTM C40	Shall not be darker than the Plate #3 when compared to standard Gardner Color Series
Sieve Size	ASTM C136 Size (inch)	Total percentage of material passing by weight (%)
	½ (0.500)	100
	#4 (0.187)	91 - 100
	#8 (0.0937)	72 - 100
	#16 (0.0469)	50 -100
	#30 (0.0232)	30 - 90
	#50 (0.0117)	12 - 46
	#100 (0.0059)	1 - 26
	#200 (0.0029)	0 - 16
Compaction Test	ASTM D1557	Relative compaction of 95% or greater

PART 3 - EXECUTION

3.1 EXCAVATION

A. The contractor shall obtain all permits and traffic control approvals prior to construction within the public right of way at K Street. The trench location shown on the plans is approximate and shall be coordinate by the contractor with SDG&E from the gas meter station to the point of connection. All base material, shading and backfill must be approved by the Engineer and SDG&E prior to placement and acceptance of material. The contractor shall obtain all traffic control approvals and permits required to complete the work prior to the start of construction. State law requires the contractor to contact DigAlert at least 2 working days prior to excavation.

3.2 BURIED MAN-MADE OBJECTS

A. Buried man-made objects discovered during excavation and not previously known or otherwise identified in the plans shall be removed and disposed of according to Section 19-1.03D, “Buried Man-made Objects”, of the Caltrans Standard Specifications and these Special Provisions. The CONTRACTOR shall immediately inform the ENGINEER of the discovery of any buried man-made objects. Depressions left by removed buried man-made objects shall be backfilled with engineered fill.

3.3 DUST CONTROL

A. The Contractor Watering for dust control shall comply with Section 18, “Dust Palliatives”, of the Caltrans Standard Specifications.

3.4 SURPLUS MATERIAL

A. Surplus excavated material not designated or determined to contain hazardous waste shall become the property of the Contractor and shall be disposed of offsite in conformance with Caltrans Standard Specifications, except that MTS shall be absolved from responsibility instead of the Department. Surplus material shall not be disposed of in any MTS or public right of way.

3.5 HAZARDOUS WASTE IN EXCAVATION

A. There is the possibility that there is undocumented hazardous material. If the Contractor encounters hazardous waste in excavation, as defined by Section 25117 of the Health and Safety Code, the Contractor shall immediately so notify the Engineer in writing. The Engineer shall notify the City of San Diego Solid Waste Local Enforcement Agency (LEA) and MTS during earthwork. Excavation in the immediate area of the suspected hazardous material shall be suspended until the Engineer authorizes it to be resumed. If such suspension delays the current controlling operation, the Contractor will be granted an extension of time as provided in Section 8-1.07, "Liquidated Damages,” of the Standard Specifications.

3.6 UTILITY TRENCH EXCAVATIONS

A. Trenches and excavations shall be designed and constructed in accordance with OSHA and other applicable government safety codes and regulations. Excavations deeper than 5 feet shall be shored or laid back on a slope no steeper than 1.5:1 (H:V). For trench excavations, Contractor shall meet OSHA requirements regarding personnel safety with the appropriate use of shoring or laying back of slopes. If seepage is encountered, the Contractor shall immediately inform the Engineer. The Engineer or his designee shall evaluate the seepage and determine if de-watering is required. Contractor shall keep vibrations away from the immediate excavation area. The Contractor shall setback all stockpiled materials from the trench a distance of at least one half the excavation depth. Shoring and/or bracing may be required.

3.7 DE-WATERING

A. De-watering is not anticipated on this project. If groundwater or water drainage from excavated soils is encountered during construction, the Contractor shall immediately inform the Engineer, sample, and control the runoff in a manner that is consistent with the Water Pollution Control Plan (WPCP). De-watering shall be considered Force Account Work if required and shall conform Section 9-1.04, “Force Account”, of the Caltrans Standard Specifications.

3.8 RESURFACING

A. Gas line trenching and resurfacing through K Street is within the public right of way and is subject to City of San Diego requirements and standard drawings. SDG&E shall approve the trench, tie-in excavation, base shading and backfill material prior to installing the gas service and energizing the system. The SDG&E inspector must approve installation of shading material prior to backfill and resurfacing the trench. The contractor shall replace all sidewalk, curb and gutter, asphalt, and striping to restore the existing condition as shown in the plans and to the satisfaction of the City representative.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. Gas Line Trenching, Backfill, and Resurfacing is part of Add-Alternate 3 and shall be measured by the linear foot of trench construction, as shown within the construction plans and these Special Provisions. Gas Line Trenching, Backfill, and Resurfacing shall include all pavement and concrete removal, saw cutting, backfill, base/bedding, shading material, and resurfacing of the trench. SDG&E shall inspect/approve the trench and install the gas service line and energize the system prior to backfill and resurfacing.

4.2 PAYMENT

A. Gas Line Trenching, Backfill, and Resurfacing shall be paid by the linear foot based on the dimensions within the construction plans. Final alignment and exact point of connection to be coordinate with SDG&E prior to the start of construction. Full compensation for Gas Line Trenching, Backfill, and Resurfacing shall include furnishing the labor and materials, equipment, tools and incidentals involved in demolition, excavation, subgrade preparation, placement of backfill, stockpiling and re-use of suitable excavated material, disposal of surplus material, traffic control, encroachment permits, and resurfacing of the trench.

END OF SECTION

SECTION 31 63 29

DRILLED CONCRETE PIERS AND SHAFTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Dry-installed drilled piers.

B. Related Specification Sections:

1. Section 033000 Cast-in-Place Concrete
2. Section 032000 Concrete Reinforcing

1.2 UNIT PRICES

A. Drilled Piers: Actual net volume of drilled piers in place and approved. Actual length, shaft diameter, and bell diameter if applicable, may vary, to coincide with elevations where satisfactory bearing strata are encountered. These dimensions may also vary with actual bearing value of bearing strata determined by an independent testing and inspecting agency. Adjustments are made on net variation of total quantities, based on design dimensions for shafts and bells.

1. Base bids on indicated number of drilled piers and, for each pier, the design length from top elevation to bottom of shaft, extended through the bell, if applicable, and the diameter of shaft and bell.
2. Unit prices include labor, materials, tools, equipment, and incidentals required for excavation, trimming, shoring, casings, dewatering, reinforcement, concrete fill, testing and inspecting, and other items for complete drilled-pier installation.

B. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed outside dimensions of drilled piers cast against rock. Unit prices for rock excavation include replacement with approved materials.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture.

C. Shop Drawings: For concrete reinforcement.

1.5 INFORMATIONAL SUBMITTALS

A. Material certificates.

B. Material test reports.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Record drawings.

1.7 FIELD CONDITIONS

A. Project-Site Information: A geotechnical report will be prepared for this Project and will be available for information only. Piers as currently shown on the Drawings are designed based on minimum criteria as per the 2015 California Building Code.

B. Survey Work: Engage a qualified land surveyor or professional engineer to perform surveys, layouts, and measurements for drilled piers. Before excavating, lay out each drilled pier to lines and levels required. Record actual measurements of each drilled pier's location, shaft diameter, bottom and top elevations, deviations from specified tolerances, and other specified data.

1. Record and maintain information pertinent to each drilled pier and indicate on record Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Drilled-Pier Standard: ACI 336.1 except as modified in this Section.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60 (Grade 420), deformed.

B. Plain-Steel Wire: ASTM A82/A82M, galvanized.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C150/C150M, Type I/II. Supplement with the following:

a. Fly Ash: ASTM C618, Class F.

B. Normal-Weight Aggregate: ASTM C33/C33M, graded, 1-1/2-inch (37-mm-) nominal maximum coarse-aggregate size.

1. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C94/C94M and potable.

D. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
3. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
4. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

2.4 STEEL CASINGS

A. Steel Pipe Casings: ASTM A283/A283M, Grade C, or ASTM A36/A36M, carbon-steel plate, with joints full-penetration welded according to AWS D1.1/D1.1M.

2.5 CONCRETE MIXTURES AND MIXING

A. Refer to Section 033000.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Unclassified Excavation: Excavate to bearing elevations regardless of character of surface and subsurface conditions encountered.

1. Standard excavation includes excavation accomplished with conventional augers fitted with soil or rock teeth, drilling buckets, or underreaming tools attached to drilling equipment of size, power, torque, and downthrust necessary for the Work.

B. Excavate shafts for drilled piers to indicated elevations. Remove loose material from bottom of excavation.

C. Notify and allow testing and inspecting agency to test and inspect bottom of excavation. If unsuitable bearing stratum is encountered, make adjustments to drilled piers as determined by owner's representative.

1. Do not excavate shafts deeper than elevations indicated unless approved by owner's representative.
2. Payment for additional authorized excavation is according to Contract provisions for changes in the Work.

D. Temporary Casings: Install watertight steel casings of sufficient length and thickness to prevent water seepage into shaft; to withstand compressive, displacement, and withdrawal stresses; and to maintain stability of shaft walls.

1. Remove temporary casings, maintained in plumb position, during concrete placement and before initial set of concrete, or leave temporary casings in place.

E. Tolerances: Construct drilled piers to remain within ACI 336.1 tolerances.

3.2 INSTALLATION

A. Install steel casings of minimum wall thickness indicated and of diameter not less than diameter of drilled pier.

B. Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

C. Place concrete in continuous operation and without segregation immediately after inspection and approval of shaft by a qualified testing agency.

D. Place concrete to fall vertically down the center of drilled pier without striking sides of shaft or steel reinforcement.

E. Coordinate withdrawal of temporary casings with concrete placement to maintain at least a 60-inch (1500-mm) head of concrete above bottom of casing. Vibrate top 60 inches (1500 mm) of concrete after withdrawal of temporary casing.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Drilled-Pier Tests and Inspections: For each drilled pier, before concrete placement.

1. Soil Testing: Bottom elevations, bearing capacities, and lengths of drilled piers indicated have been estimated from available soil data. Actual elevations and drilled-pier lengths and bearing capacities are determined by testing and inspecting agency. Final evaluations and approval of data are determined by owner’s representative.

C. Concrete Tests and Inspections: ACI 301 (ACI 301M).

3.4 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION

SECTION 32 11 23

AGGREGATE BASE COURSES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Aggregate Base Material

B. Installation Standards

C. Spreading of Material

D. Compacting

E. Field Quality Control

1.2 RELATED SECTIONS

Not Used

1.3 REFERENCE STANDARDS

A. Caltrans Standard Specifications, Latest Edition

1. Section 26, "Aggregate Bases”

1.4 SUBMITTALS

A. Product Data: Submit source, gradation, R-value, sand equivalent, and durability for the proposed material.

B. Certified Test Results: At least seven calendar days in advance of desired date of ENGINEER'S approval, submit certified test results performed by an independent testing laboratory certifying that the proposed base material complies with the specifications. Test results shall not be more than 30 days old. Test results shall indicate type of aggregate, gradation, R-value, sand equivalent, and durability.

C. Documentation: Submit delivery tickets from each load delivered to the Worksite which include, as a minimum the supplier, material and its composition, and material weight.

PART 2 - PRODUCTS

2.1 AGGREGATE BASE MATERIAL

A. Aggregate base shall be in Class 2, 3/4 in accordance with Section 26, Aggregate Bases, Caltrans Standard Specifications.

2.2 SOURCE QUALITY CONTROL

A. Once the material has been approved, change source of supply only after obtaining approval of the new source material.

B. Approval of a source of supply does not relieve the Contractor from the obligation to furnish material which conforms to the specified requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect in accordance with the Contractor's Quality Management Plan and document in writing acceptance of the prepared subgrade before proceeding with the placement of aggregate course.

B. The subgrade to receive aggregate course, immediately prior to spreading, shall conform to the compaction and elevation tolerances indicated for the material involved and shall be free of standing water and loose or extraneous material.

3.2 INSTALLATION STANDARDS

A. Aggregate base course shall be spread over the prepared subgrade in accordance with Section 26 of the Caltrans Standard Specifications.

B. Aggregate base course shall be compacted to a minimum of 95 percent relative compaction as obtained by the ASTM D 1557 test procedure.

C. Aggregate course shall have minimum uniform thickness after compaction of dimensions indicated on the Plans. Where not indicated, compacted thickness shall be 6 inches. Grade tolerances shall be in accordance with Section 26 of the Caltrans Standard Specifications.

3.3 FIELD QUALITY CONTROL

A. Field testing shall be performed in accordance with the test methods specified in Caltrans Standard Specifications Section 26. Tests shall be performed by Contractor -hired independent testing laboratory.

B. Perform sampling and tests of the aggregate base materials for grading, sand equivalent, resistance (R-value) and durability to determine compliance with specified requirements. Samples shall be taken from material as delivered to the site. Tests shall represent no more than 500 cubic yards of base course material or one day's production, whichever is the lesser amount.

C. Perform field tests to determine compliance with requirements for compaction and moisture content of aggregate bases. Testing frequency shall be not less than one test for every 2,000 square feet of aggregate base material, per layer or lift.

D. Measure thickness of the aggregate bases. Perform a minimum of one test for each unit of 2000 square yards of aggregate bases installed at a location selected by the ENGINEER. For units of aggregate bases less than 2000 square yards, perform a minimum of one test. In that

unit where the aggregate subbase or base is deficient by more than 0.05 foot in thickness, the deficiency shall be corrected to meet the required grade and thickness using a method approved by the ENGINEER.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. Aggregate Base to be measured by the cubic yard in accordance with the Standard Specifications and these Special Provisions. The quantity is determined from the dimensions shown in the Construction Plans and Details.

4.2 PAYMENT

A. Aggregate Base to be paid by the cubic yard in accordance with the Standard Specifications and these Special Provisions.

END OF SECTION

SECTION 32 12 16

ASPHALT PAVING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Asphalt Materials

B. Aggregate materials.

C. Asphalt paving base course and wearing course

D. Asphalt paving overlay for existing paving

E. Field quality control.

1.2 REFERENCE STANDARDS

A. APWA Standard Specifications for Public Works Construction (Greenbook), Latest Edition

B. Caltrans Standard Specifications, Latest Edition

1. Section 39, “Asphalt Concrete”

1.3 SUBMITTALS

A. Product Data:

1. Submit product information for asphalt and aggregate materials.

2. Submit mix design with laboratory test results supporting design.

B. Certified Test Results: At least seven calendar days in advance of desired date of ENGINEER'S approval, the CONTRACTOR shall submit certified test results performed by an independent testing laboratory certifying that each batch of the proposed asphalt binder material complies with the specifications. Test results shall not be more than 12 months old.

PART 2 - PRODUCTS

2.1 TRENCH RESURFACING

A. Trench resurfacing for asphalt paving areas shall be per Detail 5 per Civil Details.

2.2 ASPHALT PAVING

A. Asphalt Concrete paving depth and horizontal dimensions as shown on construction plans.

2.3 SOURCE QUALITY CONTROL

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of state in which Project is located.

B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.

C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of the City of San Diego for asphalt paving work.

PART 3 - EXECUTION

3.1 EQUIPMENT

A. Spreading and Compacting Equipment

1. Spreading and compacting equipment shall conform to Section 39-2.01C(2), "Spreading and Compacting Equipment" of the Caltrans Standard Specifications.

3.2 PATCHING

A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. Asphalt Concrete will be measured by the ton of asphalt actually placed and verified by the ENGINEER by the certified weight tickets. Recorded batch weights or truck scale weights will be used to determine the basis for the tonnage.

4.2 PAYMENT

A. The contract unit price paid per ton of Asphalt Concrete actually placed and shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all work involved in installing Asphalt Concrete complete in place, including testing, job mix formula preparation and approval process, tack coat, and asphalt cold joint adhesive (as required) as shown on the construction drawings and as specified in these Special Provisions.

END OF SECTION

SECTION 32 13 13

VEHICULAR CONCRETE PAVING

PART 1 – GENERAL

1.1 SECION INCLUDES

A. Vehicular Concrete Paving

1.2 REFERENCE STANDARDS

A. APWA Standard Specifications for Public Works Construction (Greenbook), Latest Edition
B. Caltrans Standard Specifications, Latest Edition

1.3 SUBMITTALS

A. Provide mix designs for each class of concrete used in accordance with Section 201-1 of the Standard Specifications for Public Works Construction.

B. Contractor shall provide a jointing plan to be approved by the Engineer.

C. Mock-Ups: Provide sample panels not less than 20 square feet in size on the project site showing the proposed texture, finish, and workmanship. Upon approval, each panel shall become the standard of comparison for all concrete indicated to receive that finish.

Sample panels shall be approved before proceeding with the respective work. Sample panels, if approved, may be left in place as part of the completed construction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cement, Aggregate, Water and Admixtures: Conform to Section 201-1 Portland Cement Concrete, Subsection 201-1.2 Materials of the Standard Specifications for Public Works Construction.

B. Reinforcing Bars and Mesh: Conform to Section 201-2 of the Standard Specifications for Public Works Construction.

C. Expansion Joint Filler and Joint Sealants: Conform to Section 201-3 of the Standard Specifications for Public Works Construction.

D. Concrete Curing Materials: Conform to Section 201-4 of the Standard Specifications for Public Works Construction.

E. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement. Use flexible spring steel forms or laminated boards to form radius bends.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Scarify and recompact earth subgrade in conformance with geotechnical recommendations and as shown, on plans.

3.2 CONCRETE PLACEMENT

B. Construct all pavement, including placement or construction of concrete, forms and joints, curing, repairing, backfilling, cleanup, etc., in conformance with Section 303-5 of the Standard Specifications for Public Works Construction.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. Concrete paving will be measured by the cubic yard of concrete placed. Recorded batch weights or truck scale weights will be used to determine the basis for the tonnage.

4.2 PAYMENT

B. The contract unit price paid per CY of concrete shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all work involved in installing Concrete Paving, as shown on the construction drawings and as specified in these Special Provisions.

END OF SECTION

SECTION 32 17 23

PARKING STRIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnish all labor, materials, tools, equipment, incidentals, layout, removal of existing striping, and markings and for doing all work involved in placing the striping, and markings as called on the Plans and in these Special Provisions.

1.2 RELATED SECTIONS

NOT USED

1.3 REFERENCE STANDARDS

A. Caltrans Standard Specifications, Latest Edition

1. Section 84, “Markings”

B. California Manual on Uniform Traffic Control Devices, 2014 (Revision 6)

1.4 SUBMITTALS

A. Product Data:

1. Submit name of manufacturer.

2. Submit dimensions.

3. Submit item identification number.

B. Certificate of Compliance: At least seven calendar days in advance of desired date of ENGINEER'S approval, the CONTRACTOR shall submit a certificate of compliance for all pavement markings material.

PART 2 - PRODUCTS

2.1 TRAFFIC STRIPES AND PAVEMENT MARKINGS

A. Traffic Stripes and Pavement Markings and Curb Paint shall conform to Section 84, “Markings”, Caltrans Standard Specifications, the California Manual on Uniformed Traffic Control Devices and these Special Provisions.

PART 3 - EXECUTION

3.1 INSTALLATION AND REMOVALS

A. Installation and Removals of traffic stripes and pavement markings shall conform to Section 84, “Markings”, Caltrans Standard Specifications.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT AND PAYMENT

A. The contract unit price paid per EA for Install Lane Number shall also include full compensation to supply all labor, materials, tools, equipment, incidentals, layout, removal of existing striping, legends, and markings and for doing all work involved in placing the striping, legends and markings as called on the Plans and in these Special Provisions.

B. The contract unit price paid per LF for Install Yellow Stripe With Contrast shall also include full compensation to supply all labor, materials, tools, equipment, incidentals, layout, removal of existing striping, legends, and markings and for doing all work involved in placing the striping, legends and markings as called on the Plans and in these Special Provisions.

C. The contract unit price paid per LF for Install 4” Red Stripe shall also include full compensation to supply all labor, materials, tools, equipment, incidentals, layout, removal of existing striping, legends, and markings and for doing all work involved in placing the striping, legends and markings as called on the Plans and in these Special Provisions.

END OF SECTION

SECTION 32 31 13

BOLLARDS AND BOLLARD COVERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Steel pipe bollards for equipment and structure protection.

B. Bollard covers: Protective pipe sleeves for steel pipe bollards.

1.2 RELATED SECTIONS

A. Not used.

1.3 REFERENCE STANDARDS

A. Not used.

1.4 SUBMITTALS

A. Product Data: Submit to the Engineer per Section 3.9, "Submittals" under General Conditions, the manufacturer's or supplier's certification that the materials delivered to the site are in compliance with the Specifications.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Bollards shall be 6" diameter (unless otherwise noted on the plans) and 4’-0” tall standard galvanized pipe and concrete filled bollard per Civil Details of the plans.

B. Bollard Covers shall be yellow high-density polyethylene with a dome top.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Bollards are to be set in holes which shall have been formed or drilled as shown on the plans or as directed by the Engineer. After the bollards have been set in place and properly supported to hold them in line and grade, the remaining space shall be filled with concrete as specified in the project plans.

B. After bollards are placed, install yellow high-density polyethylene bollard covers as specified in the project plans and per the manufacturer’s recommendations.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. Bollards and Bollard Covers shall be measured by each bollard with cover and installed.

4.2 PAYMENT

A. The contract price for Bollard and Bollard Cover shall include the full compensation for furnishing all labor, materials, tools, equipment, and incidentals, for acquiring and installing the bollards complete in place, touch-ups, concrete foundation, and yellow bollard cover, as shown on the plans, as specified in the Standard Specifications and these Special Provisions, and as directed by the Engineer.

END OF SECTION

SECTION 32 39 13

REMOVABLE BOLLARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. 6 Inch Removable Bollard
B. Embedment Sleeve for Removable Bollard
C. Bollard Cover

1.2 RELATED SECTIONS

A. Not Used.

1.3 REFERENCES

A. ASTM International (ASTM):
   1. ASTM A53: Standard Specification for Pipe, Steel, Black and Hot-Dipped Zinc-Coated, Welded and Seamless.

1.4 SUBMITTALS

A. Product Data:
   1. Manufacturer's printed product literature, specifications, and data sheet.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Maintenance and service instructions.

B. Shop Drawings: Submit installation drawings indicating bollard locations, materials, dimensions, weights, sizes, and finishes.

PART 2 - PRODUCTS

2.1 MATERIALS

A. 6 Inch Removable Bollard
   1. Lock type: Padlock Removable
   2. Height: 42 inches.
   3. Depth: 18 inches.
   4. Pipe diameter: 6 inches.
   5. Material: Schedule 40 Steel
   6. Cap style: Dome
   7. Finish: Galvanized

B. Embedment Sleeve for Removable Bollard
   1. Size: 7 inch
   2. Depth: 18 inches

3. Material: Stainless steel with attached lid

C. Bollard Cover
   1. Yellow high-density polyethylene with a dome top

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project conditions and completed Work with Installer present and verify compliance for level finished grade, mounting surfaces, installation tolerances, and other conditions impacting performance of the Work.
B. Immediately correct all deficiencies and conditions which would cause improper execution of Work specified in this Section and subsequent Work.
C. Proceeding with Work specified in this Section shall be interpreted to mean that all conditions were determined to be acceptable prior to start of Work.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation. Ensure all surfaces are clear of dirt and debris.
B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
C. Store bollards indoors until installation to protect from weather.

3.3 INSTALLATION

A. Ensure all bollard equipment to be installed is located at the site.
B. Install in accordance with approved submittals and in proper relationship with adjacent construction.
C. Protect all surfaces from debris, dirt, and concrete pour during installation.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. Removable Bollards shall be measured by each installed.

4.2 PAYMENT

A. The contract price for Removable Bollard shall include the full compensation for furnishing all labor, materials, tools, equipment, and incidentals, for acquiring and installing the bollards complete in place, touch-ups, yellow bollard cover, foundation, and embedment sleeve, as shown on the plans, as specified in the Standard Specifications and these Special Provisions, and as directed by the Engineer.

END OF SECTION

REMOVABLE BOLLARDS

SECTION 44 13 73

CATALYTIC REDUCTION EQUIPMENT

PART 1 - GENERAL

The General Provisions of the Contract, including General and Special Conditions and the requirements of Division 1, apply to the Work in this Section.

1.1 WORK INCLUDED

A. The installation of the catalytic reduction system shall include the following:

1. Horizontal catalyst/oxidation reactor vessel, including catalyst.
2. Mixer assembly with injection tubes.
3. Urea storage tank, with valving and instrumentation.
4. Metering/Injection system complete with metering pump, dosing box, and atomizing air compressor.
5. Engine exhaust gas continuous sampling system.
6. Flexible connections, as required.
7. Urea injection control and instrumentation system.
8. PLC controls with indicators, alarms, and shutdown annunciators.
9. All necessary trim, pipe, valves instruments and fittings within the boundaries of equipment furnished by Suppliers (interconnecting tubing is by others).
10. Bolts, nuts, and gaskets at system flanged interfaces.
11. Electrical wiring, conduit and all electrical components within the boundaries of manufacturer's scope of supply.
12. Prime and finish painting of equipment, components and structure, auxiliary equipment and piping, and other exposed steel surfaces.
13. Shop testing.
14. Startup and two-year operational spare parts.
15. Special tools required for erection, operation, or maintenance.
16. Foundations, structural steel, anchor bolts, washers, and nuts.

17. Insulation and painting.

18. On-site technical support and supervision during installation and start-up.

19. Operator Training.

B. The SCR system shall be installed outdoors in the exhaust duct of one (1), natural gas fueled, engine/generator set (refer to specification 263213). The SCR system shall reduce the exhaust emissions to the level as listed in Attachment No. 2. The scope of equipment supplied shall be as specified herein, and in the Equipment Data Sheets on which the operating conditions and special requirements are listed.

C. In the event the Engine exhaust temperature exceeds 975 deg F (including all exhaust temperature tolerances) thus causing ammonia slip above CA limits at any load point, an additional oxidizing catalyst or a pre-cooler shall be provided to cool the exhaust prior to the SCR catalyst and to limit the ammonia slip to the level acceptable by EPA. The SCR catalyst shall be able to handle the elevated flue gas temperatures during the engine low load operations.

1.2 QUALITY ASSURANCE

A. The Supplier shall be responsible for satisfactory total operation of the SCR and its certification. This supplier shall have had experience with three (3) or more installations of SCRs of comparable size and complexity in regards to coordinating, engineering, testing and supervising. Each of these installations shall have been in successful operation for three (3) or more years. Prior to review of submittals, the Engineer reserves the right to:

1. Have the Supplier submit a list of locations of similar installations.

2. Inspect any of these installations and operations of the SCR system, and question the user concerning the installations without the presence of the Supplier.

B. Factory authorized representative shall be capable of providing emergency maintenance and repairs at the project site within four (4) hours maximum of notification.

C. Supplier shall be responsible for coordination of all sub-suppliers, and for overall guarantees relating to the mechanical and electrical compatibility of equipment, including the proper functioning of instrumentation, control and the interaction of the overall system.

D. Manufacturer's quality plan shall be available for review and shall specify how Manufacturer shall ensure that:

1. All engineering, design, drafting, calculations, specifications, and other related work performed by Supplier, his sub-suppliers, or his subcontractors is ensured of being accurate, technically correct, and in

compliance with all specifications, codes, standards, and other technical requirements of the specification.

2. All applicable Standards and Engineering specifications, documents, and other requirements are communicated to and complied with by sub-suppliers and subcontractors.

3. All materials can be verified as to origin and conformance to requirements.

4. Fabrication is in accordance with approved drawings and procedures. Non-conforming work is subject to corrective action or replacement.

5. Non-conforming items are not shipped without Owner's authorization.

6. Verification equipment is correctly calibrated and adjusted.

E. Experience: Equipment shall be produced by a manufacturer of established reputation with a minimum of five years experience supplying specified equipment.

F. Manufacturer's Representative:

1. Installation: Provide a qualified manufacturer's representative at site to supervise work related to equipment installation, check out and start up.

2. Training: Provide technical representative to train Owner's maintenance personnel in operation and maintenance of specified equipment.

1.3 STANDARD AND REGULATORY REQUIREMENTS

A. All materials, design, fabrication, assembly and test procedures shall be in accordance with the requirements of all applicable codes, standards or regulations having jurisdiction over the work.

B. Reference to any code, standard or regulation shall mean the latest published editions, including addenda, supplements and revisions thereto, which are in effect when the purchase order is awarded.

C. In the event of conflict between codes, standards or regulations, the conflict shall be referred to the Engineer for resolution.

D. The organizations having jurisdiction include, but are not limited to, the following:

1. ANSI American National Standards Institute

2. ASME American Society of Mechanical Engineers

3. EPA Federal, State and Local Environmental Protection Agencies

4. IBC International Building Code, California Edition

5. ISA Instrument Society of America.

6. NEC National Electrical Code.

7. NEMA National Electric Manufacturer's Association.

8. NFPA National Fire Protection Association.

9. OSHA Regulations of the Occupations Safety and Health Administration.

10. UL Underwriter's Laboratories Inc.

11. The state, county or municipal laws and regulations governing the location where the equipment is to be installed.

E. Equipment indicated within this specification section shall comply with all applicable national, state and local codes and regulations, including seismic and fire codes and regulations. Additional, more specific compliance requirements may be listed under individual equipment headings.

F. 'Buy America' Requirements: All manufactured products listed within this specification section are part of a federally assisted procurement involving funds granted by the Federal Transit Administration (FTA), and shall comply with Buy America requirements as delineated by Title 49 Code of Federal Regulations (CFR) Subsection 661.

1.4 SUBMITTALS

A. Refer to Drawing Q9.06 Shop Equipment Schedule for submittal requirements listed in the "Submittals" column of the equipment list. In the event of conflict between Drawing Q9.06 Shop Equipment Schedule and the following expanded submittal descriptions, Drawing Q9.06 Shop Equipment Schedule is to govern.

B. Product Data:

1. Submit Product Data in accordance with Division 1 - General Requirements of these specifications.

2. All Product Data submittals shall identify proposed project specific items marked by arrow, circle, underline, reproducible highlight, or other markings clearly discernable by the reviewer, to show which specific items, parts and accessories are being submitted for the project product data review. Non-marked or generic product data submittals with no marks indicating specific items, parts and accessories will be a cause for rejection.

3. Restrict submitted material to pertinent data. For instance, do not include manufacturer's complete catalog when pertinent information is contained on a single page.

C. Operation and Maintenance Manual:

1. Provide a Complete parts list, operating instructions, and maintenance manual covering equipment at time of installation including, but not limited to:

   a. Description of system and components.

   b. Schematic diagrams of electrical, plumbing and compressed air systems.

   c. Manufacturer's printed operating instructions.

   d. Printed listing of periodic preventive maintenance items and recommended frequency required to validate warranties. Failure to provide maintenance information will indicate that preventive maintenance is not a condition for validation of warranties.

   e. List of original manufacturer's parts, including suppliers' part numbers and cuts, recommended spare parts stockage quantity and local parts and service source.

2. Assemble and provide copies of manual in 8-1/2 by 11 inch format. Foldout diagrams and illustrations are acceptable. Manual to be reproducible by dry copy method. Provide copies per provisions of Division 1 - General Requirements.

D. Shop Drawings: Submit in accordance with Division 1 -General Requirements of these specifications. Refer to Drawing Q9.06 Shop Equipment Schedule for the equipment mark numbers requiring shop drawings.

1. Submitted shop drawings shall be project specific and shall include a minimum 1/8 inch to 1 foot scaled (or larger standard architectural imperial scale), dimensioned, graphical representation of the size, orientation, and location for the submitted equipment. The drawings shall further include dimensions from structural elements or architectural grid lines, operational clearances, locations of any utility service connection points, mounting requirements, and structural supports required for the submitted equipment.

E. ’Buy America’ Certificates: ‘Buy America’ certificates required during bidding shall also be required as part of each product submittal. Certificates shall be complete and accurate. Certificates shall indicate either compliance or non-compliance with the ‘Buy America’ regulations. Certificates of non-compliance shall also include copies of any granted waivers. Waivers still being applied for or being processed at the time of submittal shall be indicated as such.

1.5 SPARE PARTS

A. With his proposal, the Supplier shall identify all spare parts, including source, cost and identification of the manufacturer and associated model number, critical to initial startup that are recommended for the Engineer/Owner to have on-hand to

minimize unplanned construction delays or equipment downtime, as well as a standard priced spare parts list for replacement of components as needed. The Supplier shall recommend spare parts expected for replacement during startup and two (2) years of operation.

1.6 PRODUCT SUBSTITUTIONS

A. Follow requirements specified in Division 1 - General Requirements.

B. Additional costs resulting from substitution of products other than those specified, including drawing changes and construction, will be at the expense of the Contractor.

C. Substitution Approval: Manufacturers listed for each equipment item may bid without submittal for that item. Manufacturers not listed shall submit for approval in accordance with "Instructions to Bidders". Prior to installation, submittals for each equipment item by Mark Number shall be provided in accordance with Division 1 - General Requirements.

1.7 WARRANTY

A. The Manufacturer shall warrant that all materials and equipment furnished under this contract will be new and of good quality, free from defects in design, workmanship, and materials.

B. Each item of equipment, or part thereof, proving to be defective within the specified period of the warranty shall be replaced, free of defect, without cost to the Owner.

C. The warranty period shall be the Manufacturer's standard warranty period, but not less than a minimum of twelve (12) months after startup, or 18 months after delivery of the equipment at the site (whichever comes first).

D. Warranty shall include materials and labor necessary to correct defects.

E. Defects shall include, but not be limited to noisy, rough, or substandard operation; loose, damaged, and missing parts; and abnormal deterioration of finish.

F. Submit warranties in accordance with Division 1 - General Requirements of these specifications.

G. All parts shall be readily available locally in the United States.

1.8 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment in manufacturer's containers, appropriately packaged and/or crated for protection during domestic shipment and storage in humid, dusty conditions.

B. Indelibly label all containers, including those contained in others, on outside with item description(s) per title and Mark Number of this specification.

C. Provide equipment and materials specified complete in one shipment for each equipment item. Split or partial shipments are not permissible.

1.9 LABELING

A. Manufacturer shall securely attach in a prominent location on each major item of equipment a non-corrosive nameplate showing manufacturer's name, address, model number, serial number, and pertinent utility or operating data.

B. All electrical equipment and materials shall be new and shall be listed by Underwriter's Laboratories, Inc. (U.L.), or other National Recognized Testing Laboratory (NRTL), in categories for which standards have been set by that agency and labeled as such in the manufacturer's plant.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers, subject to compliance with requirements of this specification, are as follows:

1. Safety Power Inc.

2. Miratech Corp.

3. Steuler

4. Johnson Matthey

2.2 GENERAL

A. Asbestos or asbestos filled materials shall not be used for any component.

B. The SCR system shall be guaranteed to achieve reduction of emissions to levels below the maximum site emissions from a minor stationary source located in a Severe Non-Attainment area as defined by Title V of the Federal Clean Air Act of 1990, as well as the emissions reduction criteria stipulated by the San Diego Air Permit and Control District.

C. Urea is the only reducing agent that will be accepted for use in the SCR system.

D. Supplier shall ensure the total back pressure imparted on the engine exhaust by the SCR System, and other in-line exhaust components shall be less than the engine manufacturer recommends

2.3 SELECTIVE CATALYTIC REDUCTION SYSTEM

A. SCR Reactor Vessel

1. The SCR catalyst reactor housing shall be fabricated from non-scaling heat resistant stainless steel, of rigid reinforced construction. The SCR catalyst

reactor housing shall be equipped with ANSI flanges at both ends. The SCR housing and all components in contact with engine exhaust shall be suitable for continuous operation at the maximum engine exhaust temperature without scaling, deformation or any other physical damage for the life of the system.

2. The SCR reactor housing shall be equipped with insulation supports. Insulation shall be supplied and installed by others.

3. The SCR reactor housing shall be designed to be mounted horizontally in the engine exhaust gas duct and be supported from overhead. The SCR supporting steel shall be provided by Supplier.

4. The reactor housing shall be equipped with sample gas ports, maintenance and inspection doors for easy access and catalyst bed loading and unloading, instrumentation connections and other connections as deemed necessary by the Supplier.

5. The SCR vessel catalyst core shall consist of an adequate number of layers of catalyst material, with room for one (1) additional layer of material in the reactor housing. Each layer of catalyst material shall be of a modular design. Catalyst modules shall be of size and weight to facilitate manual loading.

6. The catalyst shall be type as recommended by the SCR manufacturer and shall be designed for operation at the maximum and minimum exhaust temperatures achievable by the engine.

B. Catalyst

1. General

a. Shall be extruded, ceramic blocks with square monolithic channels (honeycomb type). The catalyst material shall be mixed into the substrate prior to extrusion. The catalyst material composition shall be tungsten, vanadium, titanium and other base metals. The catalyst shall have a proven track record in similar applications.

b. Shall operate and perform properly without the use of a guard bed or filter which may become masked, coated and clogged and require frequent cleaning and/or change-out due to compounds and particulates such as soot or ash.

c. Shall be shop assembled with a high temperature fiberglass gasket material. The modules should be approximately 6 inches x 6 inches in cross section and 6, 12 or 18 inches in depth for ease of field installation and removal from the reactor housing.

d. Shall be designed to minimize the SO2 to SO3 conversion rate.

e. Shall be of sufficient mass such that the natural frequency in or around the engine is far above the resonant frequency of the engine firing so it will not resonate.

2. SCR Catalyst

a. Shall have a minimum active surface area of 270 sq ft/cu ft.

b. Shall have an operating range of 572°F to 986°F

3. Ammonia Reduction Catalyst

a. Shall have a minimum active surface area of 270 sq ft/cu ft

b. Shall have an operating range of 572°F to 986°F

c. Shall reduce the concentration of residual ammonia in the exhaust gas without creation of NOx

4. Oxidation Catalyst

a. Shall have an operating range of 572°F to 986°F

b. May be located within the SCR Converter Housing or in a separate housing upstream of the injection lance.

C. Catalytic System Accessories

1. The SCR system shall include a static exhaust gas mixer to be mounted upstream of the SCR catalyst reactor housing. The mixer shall insure full and complete mixing of the atomized injected reducing agent with the engine exhaust gas under all engine load conditions. The static mixer shall be fabricated from non-scaling heat resistant stainless steel. The static mixer shall be equipped with a stainless steel injection lance, through which the atomized reducing agent is introduced into the exhaust stream. The static mixer shall be equipped with ANSI flanges at both ends.

2. The static mixer shall be equipped with insulation supports. Insulation shall be supplied and installed by others.

3. The SCR system shall be supplied with a reducing agent storage, injection and control system which shall included but not necessarily limited to the follow: Urea storage tank, metering/injection pump, dosing box, atomizing air compressor, and all appurtenances required to form a complete and operable system. The capacity shall by as recommended by the SCR supplier.

4. Injection Lance

a. The reducing agent injection lance constructed of 304 Stainless Steel shall be installed on the engine exhaust upstream from the

reactor housing at a location to achieve proper reducing agent distribution and atomization. Injection nozzles shall be oriented with respect to engine exhaust gas flow for optimum dispersion of the reducing agent into the engine exhaust gas upstream of the catalyst bed.

b. The injection lance shall be of the two-phase type using compressed air to atomize the reducing agent.

c. The injection lance assembly shall be designed for ease of installation and service. The catalyst manufacturer shall supply mating flange for saddle connection of the lance to the exhaust duct

5. Compressed air system, for urea atomization shall be provided by the Supplier.

6. The reducing agent metering and control system shall be capable of insuring, that the maximum ammonia slip to atmosphere from the SCR system does not exceed the limits specified in Attachment No. 2 under all engine operation conditions. Use of an oxidation catalyst mounted downstream of the SCR catalyst to eliminate excess ammonia slip to atmosphere is prohibited.

7. The Urea/water solution shall be directed into the exhaust gas stream by means of a metered injection nozzle system.

8. The Supplier shall provide one (1) 360 gallon, polyethylene storage tank for urea/water solution. The tank supplied shall be installed indoors within the generator enclosure and be of vertical design. The Urea tank should be manufactured from High Density Cross linked Polyethylene or steel. It should be one piece seamless molded designed with wall thicknesses conforming to ASTMD-1998 standards for liquid storage. Accessories included with the tank:

a. Level Indication

b. High/Low Level Alarms

c. Fill system with vacuum break

D. Piping/Tubing

1. All Urea solution and compressed air pipe/tube materials and components shall be stainless steel. Minimum tube size shall be 1/2 inch nominal. Minimum tubing thickness is 0.063 of an inch.

2. Stainless steel tubing sizes shall be limited to 1" and below. Carbon steel, cast, ductile, or malleable iron piping material shall not be used

3. All stainless steel Urea piping shall be welded. Threaded connections shall be minimized. Pipe threads shall conform to ANSI B2.1, Taper Pipe Threads. Taper threaded connections are unacceptable in stainless steel.

2.4 INSTRUMENTATION AND CONTROLS

A. PLC based, closed loop analysis and reactant injection system to maximize reactant injection efficiency by continuously sampling and analyzing the treated exhaust gas.

B. The SCR control system shall be equipped with an interface display and with a serial interface to permit communication and monitoring of the SCR system from the Building Automation System (BAC). The Supplier shall provide and configure the Modbus communications interface, provide programming of all parameters required to effectively monitor the SCR system from the BAC.

C. Completely pre-wired Control panel, built in accordance to manufacturer standards, with UL listed components, shall be provided.

D. The Temperature and Urea flow information shall be continuously stored in an electronic data storage for the EPA compliance record.

E. General

1. All Control system components shall be designed to operate on 208VAC, Single Phase, 60Hz power with a maximum current draw of 10 Amps per engine set.

2. The control system shall be Programmable Logic Controller based and provide automatic SCR system start-up, operation, shutdown, monitoring and annunciation of abnormal conditions.

3. All tubing within the system shall be either Type 316 stainless steel tubing or heavy wall Teflon. Tubing shall be laid out to minimize elbows and bends, and to present neat, orderly assembly.

4. Wiring within the panel shall be arranged in wire tray to not interfere with routine servicing. All wiring shall be numbered at both ends. Analog signal wiring shall be routed away from power wiring to avoid potential interference. All wiring to and from the metering panel shall terminate on easily accessible, numbered terminal blocks. All components shall be identified with a device tag corresponding to the wiring diagrams and P&ID supplied with the equipment.

5. The control system shall control and provide automatic SCR system start-up, operation, shutdown, monitoring and annunciation of abnormal conditions.

6. The metering panel shall control the amount of reducing agent injected into the exhaust gas stream. The panel shall contain the reducing agent

metering equipment and their controls. Controls shall include a main disconnect breaker for power supply; indication of operating status; a PLC to perform all interlock, sequencing, alarm, and injection rate control functions; 24 Volt DC power supply.

7. The reducing agent to be used in the SCR system shall be technical grade urea dissolved in demineralized water to provide a 32 to 40 percent aqueous solution or 19% aqueous ammonia solution.

F. Closed Loop Control Unit

1. Reactant injection rate shall be based on NO emission values and may not be solely dependent on engine speed or power output feed back.

2. Analysis of the NO concentration shall be via a redundant integrated electrochemical cell based sample system. Interfacing with 3rd party analysis systems shall not be allowed

3. Measuring system accuracy and zero must be confirmed on 5 minute intervals by the control system without the use of external calibration/span gas.

4. Data shall be available to the operator via an LCD display. The following data shall be included:

   a. Emission Value

   b. Emission Target

   c. Reactant Injection Rate

   d. Operational Alarms with ID Number and Description

5. The system shall automatically stop and re-start under the following conditions:

   a. Catalyst bed temperature less than 572 °F

   b. Engine shutdown

6. Data Logging capabilities. The Controller should be able to data log every 5 minutes and store up to 3 months of data for troubleshooting purposes the following items.

   a. Date

   b. Time

   c. Engine Load (%)

   d. Dosing Valve Opening

e. NO after SCR (ppm)

f. NO emissions (ppm)

g. Reactant flow (l/hr)

h. Temperature after converter (C)

i. Temperature in Converter (C)

j. Pressure drop across converter (mbar)

7. Networking: The controller platform will utilize TCP / IP networking and can accommodate up to 16 control panels and 2 pump controllers on the same network. This network will allow visualization of the network from any controller. Remote access to network via internet for visualization or troubleshooting should be available via dedicated IP address.

2.5 FINISHES

A. All carbon steel surface and equipment shall be primed and finished painted in accordance with manufacturer's standards. In the absences of specific manufacturer's standards, prime paint with a Zinc rich primer (dry film thickness - 2.0 mils min, 2.5 mils max), finish coat shall be of Aliphatic Polyurethane (dry film thickness - 2.0 mils min, 2.5 mils max) or standard manufacturer epoxy paint.

B. Stainless steel components shall not be painted.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas, equipment bases, and conditions, with installing Contractor present, for compliance with requirements for installation and other conditions affecting SCR installation and performance.

B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before SCR system installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. The installation shall be performed in accordance with shop drawings, specifications, and the manufacturer's instructions, and with recognized industry practices, to ensure proper performance in accordance with the specifications.

B. Provide enclosure manufacturer’s site personnel to supervise reassembly of the enclosure as well as provide engine manufacturer's certified technicians to perform reassembly of the generator set on site to maintain integrity of the product and warranty.

C. Coordinate with the work of other trades including piping, breeching, electrical power and accessories as necessary to provide a complete operational system.

D. Include the installation of control and monitoring and power panels and other appurtenances to the extent that such appurtenances are not factory installed and wired.

E. Include field inter wiring and power supply and control connections for air compressor, air dryer, urea pumps, switches, solenoid valves and other miscellaneous items as required in accordance with manufacturers wiring diagrams. Such wiring shall include (but not be limited to):

1. Wiring between urea control panel and power supplies thereto.

2. Power supply wiring and control wiring for engine jacket water heater.

3. Power supply wiring and control wiring for fuel pumps, integral fuel tank, float switches, valves and other urea supply system components.

F. Ground equipment.

3.3 FIELD QUALITY CONTROL

A. The complete installation shall be checked for procedural and operational compliance by a representative of the system manufacturer's authorized local dealer. The engine lubricating oil and antifreeze, as recommended by the system manufacturer, shall be provided by the generator set dealer. If different manufacturers furnish switchgear and generator sets, technical representatives of both manufacturers' authorized dealers shall verify the installation meets requirements. Any deficiencies shall be noted and corrected by the Contractor.

B. The system manufacturer's dealer representative shall be present to assist the Contractor during start-up, systems check, adjusting, and any site testing required after the installation is complete.

3.4 POST-INSTALLATION TESTING

A. The bidder shall furnish all consumables necessary for testing. Any defects, which become evident during the test shall be corrected by the bidder at his own expense prior to shipment to the jobsite.

1. Furnish one full tank of urea.

B. After final connections are made and prior to authorizing payment, specified equipment shall be tested for compliance with all specified features in the presence of the Engineer using acceptance procedures provided by the manufacturer.

C. Following installation, the following tests shall be performed by the system manufacturer's local dealer representative(s) in the presence of the owner's engineer or designated appointee:

D. Operation

1. Load - Four hours operation at 100% of full load rating. After the first fifteen minute stabilization period at full load, the following shall be recorded at fifteen-minute intervals:

a. Voltage and amperage (3 phase), frequency

b. Fuel pressure, oil pressure and water temperature

c. Exhaust gas temperature at engine exhaust outlet

d. Ambient temperature

2. Proper operation of controls, engine shutdown, and safety devices shall be demonstrated.

3.5 CLEANUP

A. Touch-up damage to painted finishes.

B. Wipe and clean equipment of any oil, grease, and solvents, and make ready for use.

C. Clean area around equipment installation and remove packing or installation debris from job site.

D. Notify Engineer for acceptance inspection.

3.6 TRAINING

A. The Supplier shall provide on-site training for operating and maintenance personnel. This service shall include operating instructions and training for Owner's personnel. Instructions shall include, but not be limited to, training materials, hands-on and classroom instruction and complete review of all manuals. Classroom training shall be performed in a maximum of 8-hour daily sessions. The hands-on instructions shall include start-up, operation (normal and expected transients), shutdown and maintenance of all systems.

3.7 SERVICE MANUALS AND PARTS BOOKS

A. The system manufacturer's authorized local dealer shall furnish one copy each of the manuals and books listed below for each unit under this contract:

B. Operating Instructions - with description and illustration of all SCR controls and indicators.

C. Parts Books - which illustrate and list all assemblies, subassemblies and components, except standard fastening hardware (nuts, bolts, washers, etc.).

D. Preventative Maintenance Instructions - on the complete system that cover daily, weekly, monthly, biannual, and annual maintenance requirements and include a complete lubrication chart.

E. Troubleshooting Chart - covering the complete SCR system showing description of trouble, probable cause, and suggested remedy.

F. Recommended Spare Parts List - showing all consumables anticipated to be required during routine maintenance and test.

G. Wiring Diagrams and Schematics - showing function of all electrical components.

H. All manuals and books described above shall be contained in rigid plastic pouches.

3.8 SPECIAL TOOLS

A. The Supplier shall furnish one (1) set of special tools required for the SCR system proposed.

PART 4 – ATTACHMENTS

4.1 Data Sheets for SCR System, Emissions Data and Electrical Requirements

ATTACHMENT NO. 1 - SCR SYSTEM DATA SHEET

Service: Selective Catalytic Reduction system (SCR) for one (1) 1000 (+/-5%) kW engine generator set. The SCR system shall reduce the exhaust gas emissions to the level as listed in Attachment No. 2.

Scope: Supplier shall supply, as a minimum, SCR system components as follows:

(1) SCR Reactor housing for horizontal gas flow (with support steel and insulation supports) loaded with SCR catalyst material

(1) Static Mixer

(1) 360 gallon Urea Storage Tank with level transmitter and tank trim

(1) Urea injection system, pumps, dosing box, atomizing air compressor

(1) Electrical equipment and control system

Note: Supplier to furnish information marked with * with the BID

Operating Data	**Specified Information**	**Information by**
Natural Gas Engine Manufacturer	By Supplier	*
Natural Gas Fuel Consumption	By Engine Supplier	*
Load, [%] HP/ kW	By Engine Supplier	*
Exhaust flow rate, wet basis	By Engine Supplier	*

Exhaust flow rate, dry basis	By Engine Supplier	*
Engine exhaust gas temperature	By Engine Supplier °F	*
Consumption of Urea	By SCR Supplier	*
Consumption of water	By SCR Supplier	*
Pressure drop across SCR	By SCR Supplier	*
Pressure drop across Static Mixer	By SCR Supplier	*
Guarantee for SCR catalyst	By SCR Supplier (operating hours)	*

SCR SYSTEM DATA:

Description	Specified Information	Information by Supplier
Urea Consumption – 32.5% solution	N/A	*
SCR Pressure Loss, inches WC	N/A	*

SCR REACTOR DIMENSIONS:

Description	Specified Information	Information by Supplier
Length / Width / Height	N/A	*
Cross section approx.	N/A	*
Reactor material	Stainless Steel	*
Weight without catalyst material	N/A	*
Weight of Catalyst material	N/A	*
Inlet/outlet flange Type/Size	ASME B16.5	*

SCR-CATALYST MODULE

Description	Specified Information	Information by Supplier
Make / Model / Manufacturer	By SCR Supplier	*
Catalyst Module	(*) layers Catalysts + (1) spare layer	*
Catalyst type /material	By SCR Supplier	*
Catalyst module dimensions	Incl. stainless steel wire mesh	*
Length / Width / Height	By SCR Supplier	*
Catalyst module quantities	By SCR Supplier	*
Arrangement	By SCR Supplier	*
Total catalyst surface	By SCR Supplier	*
Guarantee life of catalyst	By SCR Supplier (operating hours)	*
Min / Max Catalyst Bed Temp	By SCR Supplier	*
Min / Max Temp at Urea Injection	By SCR Supplier	*
Min/Max exhaust gas Temp. at SCR	By SCR Supplier	*
Min / Max press drop across catalyst	By SCR Supplier	*
Ammonia Slip (ppmvd)	< 8 ppmvd	*

CO-CATALYST MODULE

Description	Specified Information	Information by Supplier
Make / Model / Manufacturer	By SCR Supplier	*
Catalyst Module	(*) layer(s)	*
Catalyst type /material	By SCR Supplier	*

Catalyst module dimensions	Incl. stainless steel wire mesh	*
Length / Width / Height	By SCR Supplier	*
Catalyst module quantities	By SCR Supplier	*
Arrangement	By SCR Supplier	*
Total catalyst surface	By SCR Supplier	*
Guarantee life of catalyst	By SCR Supplier (operating hours)	*
Min / Max Catalyst Bed Temp	By SCR Supplier	*
Min / Max Temp at Urea Injection	By SCR Supplier	*
Min / Max press drop across catalyst	By SCR Supplier	*

SCR STATIC MIXER DIMENSIONS

Description	Specified Information	Information by Supplier
Length / Width / Height	N/A	*
Cross section approx.	N/A	*
Material	Stainless Steel	*
Weight	N/A	*
Inlet/outlet flange Type/Size	ANSI/ASME B16.5	*

UREA SUPPLY, METERING and INJECTION SYSTEM:

Metering pump w/speed controlled drive (Capacity to be confirmed by Supplier)

Injection lance nozzle with high temperature protection, to be mounted into the static mixer

Injection lance material including set of stainless steel fittings.

80 microns (Supplier to confirm) filter to precipitate suspended particulate from Urea solution with SS screen. Air Compressor with accessories for atomization of urea solution.

ELECTRICAL and CONTROL SYSTEM

Automatic urea metering and control system shall be equipped with closed loop gas analysis system that shall inject urea in accordance with engine load.

SCR Supplier shall furnish temperature sensors for field installation by Contractor, to measure the operating temperature across the SCR catalyst and to release the urea injection upon the catalyst temperature exceeds the required minimum operating temperature for the exothermal reaction of the NOx oxidation. The temperature sensors shall de-energize the injection system upon the Engine shut down. Completely pre-wired UL listed Control panel, built in accordance to manufacturer standards, shall be provided.

UREA STORAGE TANK:

Manufacturer: * Model Number: * Type: Vertical

Capacity: 360 gal (Nominal) Dimensions: * Material: Polyethylene or Steel

Manhole: *” Dia. Flanged w/cover * Mounting : *

Tank wall thicknes: * Level Transmitter (LT) Required: (X) Yes ( ) No

Tank Connections (sizes and type to be confirmed by Supplier):

Fill (w/internal dip tube if located on top): *" NPT *

System Return (w/internal dip tube if located on top): *" NPT *

Level Transmitter: *" NPT *

Drain: *" NPT Overflow: *" NPT Pump Suction: *" NPT Vent: *" NPT

Spare connection on the top of the Tank: *" NPT (w/blind flange)

UREA METERING PUMP:

Manufacturer: * Model Number: * Type: *

Horsepower: * Flowrate Required: * gpm Pressure Required: * Pump Speed: * Spm

Pump Material: * housing / * internals / * Non wetted parts

All necessary piping/tubing and associated hardware between urea tank and urea injection nozzle shall be provided including, but not limited to, th following:

Pump air mufflers, strainers/filters, check valves and ball type shut-off valves.

Valve Material: 304 SS or 316 SS * Pipe/Tube Material: 304 SS or 316 SS

UREA ATOMIZING AIR COMPRESSOR:

Manufacturer: * Model Number: * Type: *
Horsepower: * Flowrate Required: * scfm Pressure Required:
Speed: * rpm Materials of construction: *

ATTACHMENT NO. 2 - EMISSION DATA

EMISSION DATA	
EMISSION REQUIREMENTS (see note)	**PERFORMANCE DATA**
Nitrogen Oxides (Nox) Grams/BHP-hr Lbs/Mw-hr Ppmvd @ 15% O2 Percent Reduction	 * * 5 *
Carbon Monoxide (CO) Grams/BHP-hr Ppmvd @ 15% O2 Percent Reduction	 * 52 *
VOC Grams/BHP-hr Ppmvd @ 15% O2	 * 16
Ammonia Slip Ppmvd @15% O2	 10
NOTE: Supplier shall confirm emission performance data is in accordance with latest Federal, State and Local Codes for natural gas fueled internal combustion reciprocating engines. All testing requirements shall conform to the regulations set by the County of San Diego Air Pollution Control District.	

END OF SECTION

PWB411.0-25 - MTS Imperial Ave Division Zero Emission Bus Overhead Charging - Phase 1
Bid Form

No.	ITEM DESCRIPTION	QTY	UOM	UNIT COST	TOTAL COST
DIVISION 01 GENERAL REQUIREMENT					
1	Mobilization	1	LS	$ 613,340.90	$ 613,340.90
2	Construction Staking and Survey	1	LS	$ 37,245.65	$ 37,245.65
3	Temporary Storm Water Pollution Control	1	LS	$ 5,757.36	$ 5,757.36
DIVISION 02 EXISTING CONDITIONS					
4	Sawcut	1,461	LF	$ 22.81	$ 33,320.01
5	Remove Existing Asphalt	18,110	SF	$ 25.49	$ 461,608.38
6	Remove Existing UST Asphalt Section	5,205	SF	$ 26.83	$ 139,653.84
7	Remove Existing Concrete Section	6,450	SF	$ 36.22	$ 233,626.69
8	Remove Existing Striping	145	LF	$ 87.20	$ 12,644.29
DIVISION 03 CONCRETE					
9	CIP Concrete Housekeeping Pads at utility switch, main switchgear, bus parking, Substation A and SDGE equipment	87	CY	$ 2,322.53	$ 201,874.30
10	CIP Concrete for Support Frame Regular concrete (4000 psi) 6" slab; Drilled Piers, caps & misc. foundations; Grade beams & Tie beams	293	CY	$ 1,244.60	$ 364,622.50
DIVISION 05 METALS					
11	Fire Extinguisher, Cabinet and Mounting	6	EA	$ 314.78	$ 1,888.70
12	Conduit/Cable Tray Support Rack (galvanized)	2,961	LF	$ 31.76	$ 94,033.53
13	Structural Steel Columns W14X96 (22' columns); HSS5X5X3/8 (20' columns); 2" Steel Plate; 1-1/2" Dia. 30" long steel ancor rods	1	LS	$ 334,502.18	$ 334,502.18
14	Support Beams W33X130 (Edge girders under platform); W36x231 (Center girder under platform); W27X94 (beams under platform); W24X55 (Edge girder open framing); W24X84 (Center girder open framing); W24X68 (Moment frame beams & cantilever); W16X31 (Cantilevered beams); W16X31 (Edge beams at Cantilever); 30K7 (Bar joists open framing); HSS6X6X1/2 (K Bracing); W12X19 (Walkway)	1	LS	$ 2,130,637.39	$ 2,130,637.39
15	1.5" Steel Decking, 16 ga.	3,130	SF	$ 40.08	$ 125,438.59
DIVISION 09 FINISHES					
16	Prep Columns & Framing	18,863	SF	$ 47.18	$ 889,990.08
17	Low Clearance "Headache" Bars (Metal)	8	EA	$ 5,241.42	$ 41,931.37
DIVISION 11 EQUIPMENT					
18	DC Charging Cabinets and Pantograph Installation Owner Furnished DC Charging Cabinet - 180 kW; and Pantograph (includes outlet box); Installation and Comissioning	1	LS	$ 288,782.63	$ 288,782.63
DIVISION 13 SPECIAL CONSTRUCTION					
19	Tire Shop Cabinet, Flammable Material Storage, Large; Cabinet, Storage, Shop; Desk, Stand-up; Workbench, Severe Use; Vise, Combination, Swivel Base, 6"; Drops, Electric / Air, Trapeze; Handwash Station, Shop; Shower, Drench, w/ Eyewash; Air Compressor; Equipment Install and comissioning; Structure Cost, Overall Structure, and all other work noted on drawings and specifications.	1	LS	$ 1,304,314.29	$ 1,304,314.29
20	Tire Shop - Electrical Install Power Panel in Tire Shop; Install HVAC Power Feeders in Tire Shop; Install Equipment Power in Tire Shop; Install Outlet Power in Tire Shop; Install Lighting in Tire Shop	1	LS	$ 258,723.89	$ 258,723.89
DIVISION 23 HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)					
21	3" Gas Piping (Trenched, with Cathodic Protection)	111	LF	$ 275.55	$ 30,585.84
DIVISION 26 ELECTRICAL					
22	(AM200) - Substation A - MV to Substation B AC Power Cable, 15kV rated, (3-250 KCMIL & #2 G)	190	LF	$ 463.09	$ 87,987.58
23	Substation B to Charging Cabinet (A350) Power Cable, 3- 350 KCMIL XHHW-2 & #3G, SUBSTATION B to EV Charging Cabinets	1,122	LF	$ 478.28	$ 536,629.97
24	Cabinet to DC Outlet Box DC Power Cable, 1/C, 2- 300 KCMIL XHHW-2, rated for 1000V, from Charging Cabinets to Pantographs, (Substation B); AC Power Cable, 4/C- #12 AWG, Type TC Control cable, Outdoor Rated for Wet Locations (Substation B); 1/C grounding cable, #12 AWG (Substation B); Category 7 & 4x2x22 AWG (SF/FTP) Ethernet, Shielded and Foiled with Foiled Twisted Pairs, CMX Rated for Outdoor Use; LAPP, Unitronix, CAN BUS, Burial or Equivalent; 7/C 16 AWG, Shielded, 600V, Type TC Control Cable, Outdoor Rated for Wet Locations	1	LS	$ 933,324.16	$ 933,324.16
25	DC Outlet Box to DC Outlet Box AC Power Cable, 4- #12 AWG, in overall Type TC Control cable, Outdoor Rated for Wet Locations (Substation B); 1/C grounding cable, #12 AWG (Substation B); Category 7 & 4x2x22 AWG (SF/FTP) Ethernet, Shielded and Foiled with Foiled Twisted Pairs, CMX Rated for Outdoor Use; LAPP, Unitronix, CAN BUS, Burial or Equivalent; 7/C 16 AWG, Shielded, 600V, Type TC Control Cable, Outdoor Rated for Wet Locations	1	LS	$ 58,337.32	$ 58,337.32

No.	ITEM DESCRIPTION	QTY	UOM	UNIT COST	TOTAL COST
26	DC Outlet Box to Pantograph DC Power Cable, 1/C, 2- 300 KCMIL XHHW-2, rated for 1000V, from Charging Cabinets to Pantographs, (Substation B); 1/C grounding cable, #3 AWG (Substation B); Coax Cable BELDEN TYPE 1694SB OR EQUIVALENT; Coax Cable LMR 240 N-Type F/Reverse Pol SMA M; Category 7 & 4x2x22 AWG (SF/FTP) Ethernet, Shielded and Foiled with Foiled Twisted Pairs, CMX Rated for Outdoor Use	1	LS	$ 99,675.77	$ 99,675.77
27	Communication Optical Fiber Backbone Cabling Fiber optic cable, multimode, in duct bank from Main MV Switchgear to Unit Substation A; Install ModBus copper cable in SWGR-B; Test & Terminate Microgrid Cables	1	LS	$ 68,712.16	$ 68,712.16
28	Microgrid Ductbank 1 x 2" PVC - LV SWBD-A to HH-1; 1 x 2" PVC - Generator to HH-1; 1 x 5" PVC - Substation-A to HH-1; 1 x 5" PVC - HH-1 to LVSB-B	1	LS	$ 113,184.69	$ 113,184.69
29	Microgrid Cable Install 6str MMFO Cable - Microgrid Controller to Generator Control Panel; Install 6str MMFO Cable - Microgrid Controller to SS-A Breaker; Install 6str MMFO Cable - Microgrid Controller to SWBD-A Generator Breaker; Install 6str MMFO Cable - Microgrid Controller to SS-B Breaker; Install Cable in GRC - PV Inverters to Microgrid Controller; Install MODBUS Copper Cable in SWGR-B	1	LS	$ 120,193.53	$ 120,193.53
30	Underground Raceways for Electrical Systems 2 - 5" Sch. 40 PVC Conduit Duct Bank: including spacers from SDGE 4-Way to Property Line; 1 - 5" Sch 40 PVC Conduit Duct Bank including spacers from SDG&E 4-Way 12KV SW to SDG&E Capacitor; 1 - 5" Sch 40 PVC Conduit Duct Bank including spacers from Substation A - MV TO Substation A Transformer (ALT 3); 4 - 5" Sch 40 PVC Conduit Duct Bank including spacers from Substation A - MV to PB-1; 4 - 5" PVC Sch 40, PVC Conduit Duct Bank: including spacers from (PB-1 to Transition); 2 - 5" PVC Sch 40, PVC Conduit Duct Bank: including spacers from (PB-1 to PB-2); 6 - 4" PVC Sch. 40 PVC Conduit Duct Bank: including spacers from Substation A - LV to Generator (ALT 3); 2 - 2" PVC Sch. 40: PVC Conduit Duct Bank: including spacers from Substation A - LV to Generator (ALT 3)	1	LS	$ 379,919.25	$ 379,919.25
31	Raceways and Boxes for Electrical Systems 1 - 5" rigid metal conduit, with fittings, elbows, and attachments: from Transition to Substation B - to Microgrid Controller Compartment; 1 - 5" rigid metal conduit, with fittings, elbows, and attachments: from Transition to Substation B - MV Power; 0.5" rigid metal conduit: Between DC Outlet Boxes (AC Aux Circuit); 2.5" rigid metal conduit: from Substation B to charging cabinet (AC Power Circuit); 2" rigid metal conduit: from charging cabinet to DC outlet box (DC power circuit); 2" rigid metal conduit: from DC outlet box to pantograph (for DC power circuit); 1" rigid metal conduit: from charging cabinet to DC outlet box (for communications circuit); 1" rigid metal conduit: between DC outlet boxes (for communications circuit); 1" rigid metal conduit: from DC outlet box to pantograph (for communications circuit); Cable ladder, 36", with attachments (EV charging cabinets to 30 pantographs); Cable ladder, 18", with attachments (EV charging cabinets to 30 pantographs)	1	LS	$ 1,178,854.30	$ 1,178,854.30
32	Substation A MV Switchgear Medium-voltage switchgear with main fused switch, utility meter section, four distribution fused switches; Installation and Commissioning	1	LS	$ 2,173,022.85	$ 2,173,022.85
33	Unit Substation B Medium-voltage switchgear with single disconnect switch; 12.47kV/480V Transformer - 3750kVA;480V switchboard & breakers; 480V-208/120V AUX transformer - 112.5 kVA; with 208/120V panel & breakers; Installation and Commissioning	1	LS	$ 3,053,788.06	$ 3,053,788.06
34	Lighting Fixture Installation Install Type 1 & L1X Light Fixtures; Install Type L2A Light Fixtures; Install Type L2B & L2C Fixtures	1	LS	$ 277,204.58	$ 277,204.58
35	Lighting Circuits - Conduit & Cabling Install Lighting Conduit & Cabling; Install Lighting Controls	1	LS	$ 163,385.91	$ 163,385.91
36	Other Electrical Ground mat, including ground rods, for MAIN SWITCHGEAR; Steel Grate Grounding Mat, including ground rods, for Substation; MV PB-1; MV PB-2; Handhole HH-1; Vault, pre-cast concrete, 4'X4'X4'6" with cover	1	LS	$ 298,229.41	$ 298,229.41
DIVISION 31 EARTHWORK					
37	Excavation	1,550	CY	$ 492.53	$ 763,414.16
38	Loading, Hauling, and Disposing Clean Export	410	CY	$ 182.44	$ 74,800.00
39	Potholing	1	LS	$ 78,194.42	$ 78,194.42
40	Fixed End Caisson Pile, Open, Machine Drilled, in Stable Ground, No Casings or Ground Water, 36" Diameter	405	LF	$ 563.44	$ 228,195.01
DIVISION 32 EXTERIOR IMPROVEMENTS					
41	Portland Cement Concrete	770	CY	$ 797.60	$ 614,150.94
42	Class 2 Aggregate Base	861	CY	$ 201.23	$ 173,260.49
43	Asphalt Concrete	27	TON	$ 570.19	$ 15,395.13
44	Parking Lot Striping	1	LS	$ 25,056.39	$ 25,056.39
45	Fixed Bollard	4	EA	$ 1,765.38	$ 7,061.52
46	8" Diameter Fixed Bollard	2	EA	$ 2,015.36	$ 4,030.71
47	Double Fixed Bollard	30	EA	$ 3,112.32	$ 93,369.57
48	Removable Bollard	3	EA	$ 2,126.82	$ 6,380.47

No.	ITEM DESCRIPTION	QTY	UOM	UNIT COST	TOTAL COST
ADD. ALTERNATIVE 1					
49	Battery Storage (Battery Storage; AC Power Cable, 2 sets, 2 Parallel Runs - 1/C, 4-500 KCMIL & 1/0G; 2 - 3.5" rigid metal conduit: from Substation B to BESS (AC Power Circuit), and all other work noted on drawings and specifications)	1	LS	$ 1,348,976.50	$ 1,348,976.50
ADD. ALTERNATIVE 2					
50	Photovoltaic System (PV Panel - Provide & Install; DC Optimizer - Provide & Install; PV Wiring - Provide & Install; Bus Canopy PV Inverter Feed - 2 SETS OF [(4) 3/0, #3G IN 2"C]; Tire Shop PV Inverter Feed - 3#4, #6G IN 2"C; Tire Shop PV Inverter Feed - (4) 1/0, #6G IN 2"C; Install cable in GRC conduit - PV Inverters to Microgrid Controller in SS-B; Terminate & Test - Cables and Controls; PV Grounding - Provide & Install; PV Support Rails - Provide & Install; PV Structural Steel Framing - Provide & Install; PV Inverters - 200KW - Provide & Install; PV Inverters - Microinverters - Provide & Install; Microinverter Control System - Provide & Install; Panelboard - 125A, 208/120V 3PH - Provide & Install; Dry Type Transformer - 45KVA, 480V - 208/120V - Provide & Install; Safety Switch - 600V, 100A, 3P - Provide & Install; DC Combiner Cabinet - 400A - Provide & Install; Safety Switch - 600V, 400A, 3P - Provide & Install; PV Signage and Commissioning - Provide & Install, and all other work noted on drawings and specifications)	1	LS	$ 1,255,704.70	$ 1,255,704.70
ADD. ALTERNATIVE 3					
51	Generator (Install and Commission Permanent Generator System (incl SCR); Generator Ground Grid; Substation A additional components (transformer and LV switchboards); (AM100) - Substation A - MV to Substation A Transformer; AC Power Cable, 15kV rated, (3-#4 AWG & #8G 15kV Cable); Substation A LV Switchgear to Generator; (A2000) Power Cable, 5 sets (4 - 600 KCMIL & #250G); (A70) Power Cable, 4- #4 & #4G, from Substation A to Generator AUX Loads; Mobile Generator Quick Connect / Tap box, 3-phase, 4-wire, 480V, 2000 KVA, 2400A continuous rating; Add Installation and Commissioning, Utility Gas Meter Installation and Commissioning, Gas line Trenching, backfill w/ cothodic protection, and resurfacing, CIP Concrete Housekeeping Pad, Fixed Bollards, and all other work noted on drawings and specifications)	1	LS	$ 2,402,020.31	$ 2,402,020.31
ADD. ALTERNATIVE 4					
52	Earthwork - Hazardous Waste Loading, hauling, and disposing hazardous waste (manifest required) to a California hazardous approved site; Imported Borrow	1,550	CY	$ 265.69	$ 411,815.47

Phase 1 Base Bid Total	**$ 19,230,280.76**
Alt 1 Total	**$ 1,348,976.50**
Alt 2 Total	**$ 1,255,704.70**
Alt 3 Total	**$ 2,402,020.31**
Alt 4 Total	**$ 411,815.47**
Grand Total (Basis for Award)	**$ 24,648,797.74**

Metropolitan Transit System

Agenda Item No. 12

MEETING OF THE SAN DIEGO METROPOLITAN TRANSIT SYSTEM
BOARD OF DIRECTORS

January 16, 2025

SUBJECT:

Elect Chair Pro Tem and Committee Appointments (Sharon Cooney)

RECOMMENDATION:

That the San Diego Metropolitan Transit System (MTS) Board of Directors consider the nominating slate (Attachment A) proposed for the election of a Chair Pro Tem and appointment of representatives to MTS committees for 2025 and vote to appoint representatives to those offices and committees.

Budget Impact

None with this action.

DISCUSSION:

MTS Board Policy No. 22, "Rules of Procedure" (Attachment B), provides for the election of a Chair Pro Tem to serve in the absence of the Chair and Vice Chair. In 2024, Board Member Monica Montgomery Steppe served as Chair Pro Tem.

In addition, each year the Board makes appointments to the following committees:

- Accessible Services Advisory Committee (ASAC)[1]
- Airport Authority Advisory Committee
- Audit Oversight Committee
- Budget Development Committee
- Executive Committee

[1] The Ad Hoc Nominating Committee has recommended that former MTS Board Member (Lemon Grove) George Gastil be appointed to continue in his role as a voting member and Chair of the ASAC. Board approval of the Ad Hoc Nominating Committee Slate in Attachment A would implicitly waive the requirement of Section II(A) of the Board's ASAC Guidelines, which includes in the ASAC 15-member committee "a MTS Board of Directors member, appointed on an annual basis who will be approved by the MTS Board of Directors". Section IV(A) of the ASAC Guidelines states that "Committee chairperson will be the MTS Board of Director member representative". Mr. Gastil has been the MTS Board representative on ASAC since 2023. The ASAC Guidelines are attached as Attachment C.

- Los Angeles-San Diego-San Luis Obispo Rail Corridor Agency (LOSSAN)
- Public Security Committee
- San Diego Association of Governments (SANDAG) Board
- SANDAG Regional Planning Committee
- SANDAG Transportation Committee
- San Diego Regional Building Authority
- Taxicab Advisory Committee

Membership of the Executive Committee is dictated by Board Policy No. 22. Similarly, membership on the Audit Oversight Committee is dictated by Board Policy No. 22, which designates all members of the Executive Committee as members of the Audit Oversight Committee, but allows the appointment of other Board members to that Committee at the Board's discretion. A simple majority of the Board present may waive any aspect of Board Policy No. 22 not required by state law.

Process for Appointments

On November 14, 2024 (Agenda Item 23), the Board created an Ad Hoc Nominating Committee to recommend appointments to MTS Committees for 2025. The Ad Hoc Nominating Committee members are Board Members Dillard, Elo-Rivera, Hall, Goble, Montgomery Steppe, Moreno, and Whitburn. The committee met and conferred and created a proposed slate for the Chair Pro Tem, MTS Committees, and outside agency appointments (see Attachment A).

For today's proposed action, the Chair will open the agenda item, introduce the proposed appointments (Attachment A), and request nominations from the floor for any unfilled committee slots (nominations do not require a second). The Chair will then close the nominations and invite any candidates to address the Board and the Board to discuss the proposed slate of appointments. Unless individual votes are requested for Chair Pro Tem or individual committee assignments, the Board may vote for the slate in a single action.

/S/ Sharon Cooney
Sharon Cooney
Chief Executive Officer

Key Staff Contact: Mark Olson, 619.557.4588, mark.olson@sdmts.com

Attachments: A. Proposed MTS Nominating Slate for 2025
B. Board Policy No. 22
C. ASAC Guidelines

2025
SLATE OF MTS COMMITTEES AND OUTSIDE AGENCY APPOINTMENTS

Chair Vice Chair Chair Pro Tem	Stephen Whitburn – Chair (Term expires: 12/31/25) Steve Goble – Vice Chair (Term expires: 12/31/25) Monica Montgomery Steppe – Chair Pro Tem
MTS Accessible Services Advisory Committee (ASAC)	George Gastil – Chair*
Airport Authority Advisory Committee	Ronn Hall – Committee Representative Henry Foster – Alternate
MTS Audit Oversight Committee	Stephen Whitburn – Chair Steve Goble – Vice Chair Plus, Executive Committee (listed below)
MTS Joint Executive Committee and Budget Development Committee	Stephen Whitburn – Chair Steve Goble – Vice Chair Monica Montgomery Steppe – County Representative *(County Alternate: Vacant*) Sean Elo-Rivera – City of San Diego Representative *(Alternate:* Stephen Whitburn) Poway Rep. *(EC term: 2024-2025)* – East County Rep. *(Alternate: Ronn Hall)* John McCann *(EC term: 2025-2026)* – South Bay Rep. *(Alternate: Carrie Downey*) Patricia Dillard– SANDAG Transportation Committee Representative *(Alternate: Open)*
Los Angeles - San Diego Rail Corridor Agency (LOSSAN) Board	Open – Board Representative Open – Alternate
MTS Public Security Committee	Monica Montgomery Steppe – Chair Patricia Dillard – Committee Representative Ronn Hall – Committee Representative Steve Goble – Committee Representative Henry Foster – Committee Representative Jose Rodriguez– Committee Representative Cesar Fernandez – Committee Representative
SANDAG Board	Matthew Leyba-Gonzalez – Board Representative Patricia Dillard – Alternate Ronn Hall – 2nd Alternate
SANDAG Regional Planning Committee	Patricia Dillard – Committee Representative Jennifer Mendoza – Alternate
SANDAG Transportation Committee	Patricia Dillard – Committee Representative *Open* – Alternate
San Diego Regional Building Authority	Steve Goble – Committee Representative
MTS Taxicab Advisory Committee	Sean Elo-Rivera – Chair

The ASAC appointment would require waiving the current ASAC guidelines to allow for a non-MTS Board Member to serve in this role.

Metropolitan Transit System

1255 Imperial Avenue, Suite 1000
San Diego, CA 92101-7490
(619) 231-1466 • FAX (619) 234-3407

Policies and Procedures No. 22

Board Approval: 6/13/19

SUBJECT:

RULES OF PROCEDURE FOR THE SAN DIEGO METROPOLITAN TRANSIT SYSTEM (MTS) BOARD OF DIRECTORS

PURPOSE:

To define and clarify Board Rules of Procedure and incorporate them in Board Policy.

BACKGROUND:

In 1977, the Board adopted Rules of Procedure by resolution and from time to time amendments have been adopted. The Rules shall be contained in Board Policy for ease of reference and periodic updating. The Board is established and governed by the Mills-Deddeh Transit Development Act, set forth in the Sections 120000 through 120702 of the California Public Utilities Code ("MTS Enabling Legislation"). Section 120101 requires to the Board to "establish rules for its proceedings." In the event the rules of procedure set forth herein conflict with the MTS Enabling Legislation, or other applicable law, the applicable law shall supersede these rules.

22.1 Membership and Organization

22.1.1 Membership in this Board is established by Sections 120050 through 120051.6 of the MTS Enabling Legislation.

22.1.2 The Board consists of 15 members selected as follows:

a. One member of the County of San Diego Board of Supervisors appointed by the Board of Supervisors.

b. Four members of the City Council of the City of San Diego, one of whom shall be the mayor, appointed by the City Council.

c. One member of each city council appointed individually by the City Councils of the Cities of Coronado, El Cajon, Imperial Beach, La Mesa, Lemon Grove, National City, Poway, and Santee.

d. Two members of the City Council of the City of Chula Vista, one of whom shall be the mayor, appointed by the City Council.

e. The chairperson of the board shall be selected from the board membership by a two-thirds vote of the board, a quorum being present. The chairperson shall serve for a term of two years, except that he or she is subject to removal at any time by a two-thirds vote of the board, a quorum being present.

22.1.3 [RESERVED]

22.1.4 Alternate members of the Board shall be appointed as follows:

a. The County of San Diego Board of Supervisors shall appoint as its alternate member a county supervisor not already appointed as the primary board member under Section 22.1.2(a), who represents one of the two supervisorial districts within MTS's jurisdiction with the greatest percentage of its area within the incorporated area of the County of San Diego.

b. The City Councils of the Cities of Chula Vista, Coronado, El Cajon, Imperial Beach, La Mesa, Lemon Grove, National City, Poway, San Diego and Santee shall each individually appoint a member of their respective city councils not already appointed as a primary board member to serve as an alternate member for each member of the city on the board.

c. At its discretion, a city council or the county board of supervisors may appoint a second alternate member to serve on the board in the event that neither a member nor the alternate member is able to attend a meeting of the board.

22.1.5 This Board shall exercise all powers authorized by the laws of the State of California.

22.1.6 Only the duly selected official representative, or in his or her absence his or her duly selected alternate, shall be entitled to represent a member agency in the deliberations of the Board.

22.1.7 Names of the official representatives and alternates shall be communicated in writing to the Board by each participating member agency and shall thereafter be annually communicated or reaffirmed prior to the February meeting of the Board and at such other times as changes in representation are made by member agencies.

22.1.8 The Board shall have the authority to appoint committees or subcommittees and may provide for the appointment of alternates to these committees or subcommittees.

22.1.9 Standing committees shall be appointed by the Board as may be required to carry out general and continuing functions and shall be abolished only upon specific action by the Board.

22.1.10 Ad hoc specialized subcommittees may be appointed by the Board as the need arises to accomplish specific tasks. Upon completion of its assignment, each ad hoc subcommittee shall disband.

22.1.11 Board members serving on such subcommittees shall be compensated as provided by Board ordinance. The Chief Executive Officer is authorized to enter into agreements to compensate individuals who were Board members at the time of their appointments to such subcommittees and who continue to serve on such subcommittees after their terms of office as Board members, subject to the same limitations as exist for compensation of Board members, and subject to replacement by the Board.

22.2 Meetings

22.2.1 On or before the first regular meeting of the Board in December of each year, the Board shall adopt a schedule of its meetings by date, time, and location for the coming year. The schedule of the meetings shall be published in the local newspaper of general circulation prior to the next regular meeting. The schedule of meetings shall also be published on the MTS website and posted at the MTS Executive Offices.

22.2.2 The Board may, when necessary, change the time and place of regular meetings. Notice of such change shall be posted pursuant to the Ralph M. Brown Act.

22.2.3 The Clerk of the Board shall forward written notice of the annual schedule of regular meetings and any changes thereto stating the dates, times, and locations to each member's agency and to the respective members and alternates of the Board and the standing committees.

22.2.4 Special meetings may be called and noticed under the provisions of the Ralph M. Brown Act as applicable and, specifically, Section 54956 of the California Government Code. The call and notice shall be posted in an area accessible to the public at least 24 hours prior to the meeting.

Special meetings normally shall be called by a majority of the Board or Executive Committee only upon a finding that

extraordinary circumstances require Board action prior to the next scheduled Board meeting, such as to discuss a work stoppage or significant litigation, or that a special meeting is necessary to hold a workshop, a joint meeting with another agency, or for other special purposes at a future date beyond the next Board meeting. The Chair may call such meetings only when such extraordinary circumstances arise after the last Board or Executive Committee meeting and Board action is required prior to the next regularly scheduled Board or Executive Committee meeting.

22.2.5 A majority of the members of the Board shall constitute a quorum for the transaction of business, and all official acts of the Board shall require the affirmative vote of a majority of the members of the Board present.

a. After a vote of the members is taken, a weighted vote may be called by the members of any two jurisdictions in accordance with Section 120102.5 of the MTS Enabling Legislation and MTS Board Policy No. 27 (Weighted Vote).

22.2.6 Parliamentary procedure at all meetings shall be governed by Robert's Rules of Order Newly Revised except as otherwise modified herein.

22.2.7 Prior to each regular meeting, the Clerk of the Board shall forward a copy of the agenda to each member in accordance with the schedule adopted by the Board. The agendas shall also be mailed to each person or entity previously requesting such in writing. The Clerk shall post the agenda in an area accessible to the public at least 72 hours before the meeting in accordance with the Ralph M. Brown Act. Agenda materials shall be available as public record in accordance with the Ralph M. Brown Act and, specifically, Section 54957.5 of the California Government Code.

22.2.8 The Board may take action on items of business not appearing on the posted agenda in accordance with the Ralph M. Brown Act.

22.2.9 Requests for Board action may be initiated by any member of the Board or any staff officer.

22.2.10 Communication requests may be initiated by an individual and submitted to the Clerk by letter or on forms provided by the Clerk and must state the subject matter and the action which the writer wishes the Board to take. The Clerk shall review all communication requests so received and shall list them on the Board's docket under those items which the Clerk deems to be proper areas of discussion or action by the Board. When a Communications item is listed on the docket, it is not debatable and must be referred to an appropriate committee, other public agency, or to staff to prepare a report or response.

22.2.11 Any permanent rule of the Board as set forth herein and unless otherwise established by law may be suspended temporarily by a two-thirds vote of the members present.

22.3 Amendments

22.3.1 The Board shall be responsible for making all amendments to these rules.

22.3.2 Proposed amendments may be originated by the Board, or any member of such, or by the Chief Executive Officer.

22.3.3 Each proposed amendment shall be considered by the Board and a copy thereof forwarded by the Clerk of the Board to the official representative of each member agency.

22.4 Ordinances

22.4.1 Every ordinance shall be signed by the Chairperson of the Board and attested by the Clerk of the Board.

22.4.2 On the passage of all ordinances, the votes of the several members of the Board shall be entered on the minutes.

22.4.3 Ordinances shall not be passed at other than a regular meeting or at an adjourned regular meeting. However, an urgency ordinance may be passed at a special meeting. Except when, after reading the title, further reading is waived by regular motion adopted by unanimous vote of the Board members present, all ordinances shall be read in full either at the time of introduction or passage. When ordinances, other than urgency ordinances, are altered after introduction, they shall be passed only at a regular or at an adjourned regular meeting held at least five days after alteration. Corrections of typographical or clerical errors are not alterations within the meaning of this section.

22.4.4 Consistent with Section 120109 of the MTS Enabling Legislation, the Clerk of the Board shall cause a proposed ordinance or proposed amendment to an ordinance, and any ordinance adopted by the Board, to be published at least once, in a newspaper of general circulation published and circulated in the Board's area of jurisdiction.

22.4.5 The publication of an ordinance, as required by subdivision 22.4.4, may be satisfied by either of the following actions:

a. The Board may publish a summary of a proposed ordinance or proposed amendment to an ordinance. The summary shall be prepared by the Clerk of the Board and General Counsel. The summary shall be published and a certified copy of the full text of the proposed ordinance or proposed amendment shall be posted in the office of the

Clerk of the Board at least five (5) days prior to the Board meeting at which the proposed ordinance or amendment is to be adopted. Within 15 days after adoption of the ordinance or amendment, the Board shall publish a summary of the ordinance or amendment with the names of those Board members voting for and against the ordinance or amendment, and the Clerk of the Board shall post in the office of the clerk a certified copy of the full text of the adopted ordinance or amendment along with the names of those Board members voting for and against the ordinance or amendment.

b. If the person designated by the Board determines that it is not feasible to prepare a fair and adequate summary of the proposed ordinance or amendment, and if the Board so orders, a display advertisement of at lease one-quarter of a page in a newspaper of general circulation in the Board's area of jurisdiction shall be published at least five (5) days prior to the Board meeting at which the proposed ordinance or amendment is to be adopted. Within 15 days after adoption of the ordinance or amendment, a display advertisement of at least one-quarter of a page shall be published. The advertisement shall indicate the general nature of, and prove information regarding, the adopted ordinance or amendment, including information sufficient to enable the public to obtain copy of the complete text of the ordinance or amendment and the name of those Board members voting for and against the ordinance amendment.

22.4.6 Ordinances shall take effect thirty days after their final passage. An ordinance takes effect immediately, if it is an ordinance for the immediate preservation of the public peace, health, or safety, containing a declaration of the facts constituting the urgency and is passed by a four-fifths vote of the Board.

22.5 Public Comment

22.5.1 At a public hearing of the Board, persons wishing to provide comment and testimony shall be permitted to address the Board after submitting a written request to speak to the Clerk identifying the person and the subject agenda item. The Chairperson may limit the time for each presentation and may permit additional time to speakers representing a group of individuals or organizations to avoid duplicative testimony. Ordinarily, each speaker will be allowed no more than three minutes.

22.5.2 Persons wishing to comment on agenda items other than a public hearing must submit a written request to speak in advance to the Clerk identifying the person and the subject agenda item. Comments must be limited to issues relevant to the particular agenda item. The Chairperson may limit the time for each presentation and may permit additional time to speakers

representing a group of individuals or organizations to avoid duplicative testimony. Ordinarily, each speaker will be allowed no more than three minutes.

22.5.3 Public comment on matters not on the agenda will be permitted on items of interest to the public that are within the subject matter jurisdiction of the Board. Persons wishing to comment must submit a written request in advance to the Clerk identifying the person and subject matter. The Chairperson may limit the time for each speaker. Ordinarily, each speaker will be allowed no more than three minutes.

22.6 Chairperson

Prior to the expiration of a Chairperson's term, the Executive Committee shall make a recommendation to the Board on whether to reelect the current Chairpersion. In the event that the Board does not reelect a chairperson, or in the event of a vacancy in the position of Chairperson, the Executive Committee shall create an ad hoc nominating committee that shall, by whatever means it deems appropriate, recommend to the Board a candidate or candidates for the position of Chairperson. The Board shall then vote to elect a Chairperson in accordance with Section 22.1.2(e).

22.7 Election of Board Officers and Appointments to Committees

22.7.1 On or before the Board's first meeting in November, the Board shall appoint less than a quorum of members to an Ad Hoc Nominating Committee. The Ad Hoc Nominating Committee shall review the list of MTS committees and make recommendations to the Board with respect to the appointment of members of the Board or former Board members to serve on each MTS committee.

22.7.2 The Ad Hoc Nominating Committee shall also review the list of outside boards and/or committees and make recommendations to the Board with respect to the appointment of members of the Board to represent MTS on each outside board or committee.

22.7.3 The Ad Hoc Nominating Committee shall also make a recommendation to the Board with respect to the appointment of the Vice Chairperson and the Chair Pro Tem and any other board officers.

22.7.4 The Ad Hoc Nominating Committee shall forward its recommendations for appointments of officers and committee members on or before the first Board meeting in January.

22.7.5 At its first meeting in January, the Board shall elect a Vice Chairperson and a Chair Pro Tem from amongst its members. The Vice Chairperson shall preside in the absence of the Chairperson. In the event of the absence or inability to act by the Chairperson and Vice Chairperson, the Chair Pro Tem shall preside.

22.7.6 The Board shall then vote on the recommendations made by the Ad Hoc Nominating Committee with respect to all other committee appointments.

22.7.7 In the event that a Board member vacates his or her position on the Board, at the next meeting, the Chairperson shall take nominations from the floor to fill any opening in any Committee positions vacated by that Board member.

22.8 Executive Committee

22.8.1 The Executive Committee of the Board shall consist of the Chairperson, the Vice Chairperson (if he or she is not already a voting member), a member from the County of San Diego, a member from the City of San Diego, the Transportation Committee Representative (if he or she is not already a voting member), one member who represents the cities of Chula Vista, National City, Coronado, and Imperial Beach (the "South Bay Cities' representative"), and one member who represents the cities of Lemon Grove, La Mesa, El Cajon, Poway, and Santee (the "East County Cities' representative"). The South Bay Cities' representative and the East County Cities' representative shall serve as members of the Executive Committee for a term of two years each. The terms of these two members shall be staggered so as to avoid replacement of both members at the same time.

22.8.2 The East County and South Bay representatives shall serve in the following order:

East County: El Cajon, La Mesa, Lemon Grove, Santee, Poway—each serving a two-year term.

South Bay: Chula Vista, Coronado, Imperial Beach, National City—each serving a two-year term.

After each member has served as either the East County or South Bay representative, the rotation schedule shall repeat.

22.8.3 The alternates to the Executive Committee members shall be as follows:

22.8.3.1 The alternate for the County of San Diego shall be the alternate appointed by the County of San Diego to serve as the alternate for the Board.

2.8.3.2 The alternate for the City of San Diego shall be selected by the City of San Diego from amongst the three remaining City of San Diego Board members.

2.8.3.3 The alternates for the East County Cities' and the South Bay Cities' representatives shall be the representative from the city that is next in the rotation order set forth in section 22.8.2 above (for example, if the City of El Cajon is currently the primary Executive Committee member, then the City of La Mesa member shall be the alternate Executive Committee member). Alternates shall be appointed for a term of two years or such lesser term as necessary to coincide with the term of the member for whom the alternate is appointed.

22.8.4 The Vice Chairperson shall attend each Executive Committee meeting as a voting member. The Vice Chairperson shall serve as the alternate to the Chairperson in his or her absence and as a second alternate at large for any of the Executive Committee representatives and shall be a voting member when serving in this capacity.

22.8.5 At its first meeting in January, the Board shall vote on the Ad Hoc Nominating Committee's recommendation for the representative and alternate to the San Diego Association of Governments (SANDAG) Transportation Committee to serve for a term of one year. In the event that the Board votes to appoint a member of the Board who does not serve on the Executive Committee , then the appointed SANDAG Transportation Committee representative, or the alternate in his or her absence, shall attend the Executive Committee meetings as a voting member.

22.8.6 The primary purpose of the Executive Committee shall be to review and recommend consent items for the agenda of the next MTS Board of Directors meeting; add or delete items as appropriate; and provide input and direction on emerging policies, plans, and issues, in advance, for Board consideration. The Executive Committee shall have the authority to create ad hoc subcommittees for purposes of carrying out its duties and responsibilities.

22.8.7 Three members shall constitute a quorum of the Executive Committee, and a majority vote of the members present shall be required to approve any item. In the absence of a quorum, the Chairperson may review and recommend consent items for the agenda, establish the order of items, and add or delete items.

22.8.8 The Executive Committee shall adopt operating procedures as are necessary for the conduct of its business.

22.9 Audit Oversight Committee

22.9.1 The Audit Oversight Committee shall be comprised of the same members that make up the Executive Committee and such other

individuals as the Board may appoint at the first MTS Board meeting each calendar year. The Board may also appoint individuals who are not members of the Board to serve as non-voting advisory members to the Audit Oversight Committee

22.9.2 No additional compensation shall be paid to the members of the Audit Oversight Committee unless a meeting takes place on a day other than a regularly scheduled MTS Board meeting or MTS Executive Committee meeting. Compensation shall be paid to any additional voting members who are appointed to serve on the Audit Oversight Committee. No compensation shall be paid to any non-voting advisory member appointed by the MTS Board.

22.9.3 The primary duties and responsibilities of the Audit Oversight Committee shall be to ensure that management is maintaining a comprehensive framework of internal control, to ensure that management's financial reporting practices are assessed objectively, and to determine to its own satisfaction that the financial statements are properly audited and that any problems uncovered in the course of the audit are properly reported and resolved.

22.9.4 The Audit Oversight Committee shall:

a. Review the scope of the annual financial statement audit and any other audits the committee feels are appropriate. The financial statement or CAFR audit should be conducted by an external, independent, public accounting firm experienced in municipal financial audits (external auditor).

b. Review the purpose and scope of any nonaudit services to be performed by the external auditor.

c. Oversee the procurement of the external auditor and any related advisory services with final approval by the Board.

d. Oversee the preparation of annual financial statements, the annual financial reporting process, internal controls, and the external auditor using an appropriate degree of professional skepticism.

e. Assess the performance of the external auditor.

f. Provide a forum for internal auditor(s) to report findings during committee meetings. Internal auditor(s) are MTS employee(s) who report to management and primarily perform operational and compliance audits. In unusual circumstances involving significant fraud, waste, or abuse, the internal auditors must contact the Chairperson of the Audit Oversight Committee.

g. Establish a procedure for receipt, retention, and treatment of complaints regarding accounting, internal controls, or auditing matters.

22.9.5 The Audit Oversight Committee shall perform the following tasks each year and, to the extent possible, adhere to this timetable:

a. Prior to the fiscal year end, review the independent audit engagement letter.

b. Prior to the fiscal year end establish a plan for review of the audits with external auditor.

c. In October or November, review a draft of the Comprehensive Annual Financial Report

d. Prior to the fiscal year end, review the management letter and management's response to the letter from the previous year.

22.9.6 At a minimum, and no later than theMTS Board meeting for the CAFR final adoption, the Audit Oversight Committee shall publically ask the following questions of MTS management and/or the external auditors:

a. What is the name of the audit firm performing the audit, and how long has such firm been under contract to perform such audits?

b. Was the audit performed in accordance with generally accepted auditing standards and generally accepted government auditing standards? If not, why?

c. Has the external auditor prepared an unqualified opinion regarding the financial statements? If not, what type of opinion was issued and why?

d. Did the external auditor issue a management letter?

e. Did the external auditor find any nonmaterial weaknesses or reportable conditions?

f. How did the external audit firm maintain its independence during the course of the audit?

g. Describe, in general, the audit procedures performed.

h. Were any new accounting principles adopted? If so, what was their effect?

i. Does the external auditor recommend any changes in the accounting policies used or their application? Did management apply the best accounting principles or merely permitted ones?

j. Describe any significant accounting adjustments affecting the financial statements (prior year as well as current year).

k. Did the external auditor encounter any difficulties in dealing with management in performing the audit?

l. Were there any disagreements with management regarding any accruals, estimates, reserves, or accounting principles?

m. Did the external auditor have the full cooperation of MTS management and staff?

n. Assess the quality of the accounting, internal controls, and the competency of staff.

o. Were there any accounting issues on which the audit firm sought the advice of other audit firms or regulatory bodies?

p. Are there new pronouncements and/or risks affecting future financial statements which the Audit Oversight Committee should be aware of?

22.9.8 A majority of the members of the Audit Oversight Committee shall constitute a quorum, and a majority vote of the members present shall be required to approve any item.

22.9.9 The Audit Oversight Committee shall adopt operating procedures as are necessary for the conduct of its business.

22.10 Board Member Standards of Conduct

22.10.1 The purpose of this policy is to emphasize that each Board member occupies a position of public trust that demands the highest moral and ethical standard of conduct.

22.10.2 This policy shall be supplemental and in addition to the Conflict of Interest Code of the Board and any applicable laws or regulations (including, but not limited to, the Brown Act, Government Code section 1090 and the Political Reform Act) and is not intended to supersede any provisions thereof.

22.10.3 Board members shall not engage in any business or transaction or have a financial or other personal interest, actual, potential, or

apparent, which is incompatible with the proper discharge of his or her official duties or would tend to impair his or her independence of judgment or action in the performance of such duties. Such business, transaction, or interest shall constitute a conflict of interest.

22.10.4 No Board member shall engage in any enterprise or activity that shall result in any of the following:

a. Using the prestige or influence of the Board office for private gain or advantage of the member or another person.

b. Using time, facilities, equipment, or supplies of the Board for the private gain or advantage of the member or another person.

c. Using official information not available to the general public for private gain or advantage of the member or another person.

d. Receiving or accepting money or other consideration from anyone other than the Board for the performance of acts done in the regular course of duty.

e. Receiving or accepting, directly or indirectly, any gift or favor from any one doing business with the Board under circumstances from which it could reasonably be inferred that such was intended to influence such person in such person's duties or as a reward for official action.

f. Soliciting any gift or favor in such person's official capacity, either directly or indirectly, when such solicitation might reasonably be inferred as to have a potential effect on such person's duties or decision, or when the individual's position as a Board member would in any way influence the decision of the person being solicited.

g. Engaging in or accepting private employment or rendering services for private interest, direct or indirect, which may conflict with such person's responsibility or duty, or which, because of that person's position, may influence a decision to the benefit of the organization in which such person has an interest.

22.10.5 If a Board member has an actual, potential, or apparent conflict of interest in the subject of an agenda item, and the Board will make a decision regarding this agenda item during an open session meeting, the Board member must recuse himself or herself or, in the case of uncertainty, request a binding determination from the Board’s General Counsel. If the Board member has a conflict, he

or she may observe, but not participate, in the decision-making process.

22.10.6 If a Board member has an actual, potential, or apparent conflict of interest in the subject of an agenda item to be discussed during a closed session meeting, the Board member shall be disqualified and not present during such discussion so as not to make, participate in making, or in any way attempt to use his or her official position to influence the discussion or decision. In such case, the Board member must recuse himself or herself or, in the case of uncertainty, request a binding determination from the Board's General Counsel. In accordance with the Brown Act, the Board member would be entitled to any information that is publicly reported. The Board member would not, however, be privy to any confidential or privileged information or communications pertaining to the closed session agenda item.

22.10.7 No Board member shall disclose to any person, other than members of the Board and other Board staff designated to handle such confidential matters, the content or substance of any information presented or discussed during a closed session meeting unless the Board authorizes such disclosure by the affirmative vote by a majority of the Board.

22.10.8 No Board member may disclose confidential or privileged information or communications to any person other than a Board member, General Counsel to the Board, or other Board staff designated to handle such matters, unless disclosure is mandated by law or the Board authorizes such disclosure by the affirmative vote of a majority of the Board.

22.10.9 A Board member shall not be privy to confidential or privileged information or communications concerning threatened, anticipated, or actual litigation affecting the Board where the Board member has an actual, potential, or apparent conflict of interest. In the case of uncertainty as to whether a conflict of interest exists, the Board's General Counsel shall issue a binding determination.

22.10.10 No Board member shall represent a position on an issue to be the Board's unless the Board has formally adopted such position at a public meeting.

22.10.11 Any violation of this policy shall constitute official misconduct if determined by an affirmative vote of the majority of the Board in an open and public meeting. The Board may elect to censure the Board member and the violation may be subject to criminal and/or civil penalties as provided for by applicable law.

Original Policy approved on 4/5/84.
Policy revised on 1/12/84.

Policy revised on 7/11/85.
Policy revised on 1/8/87.
Policy revised on 1/11/90.
Policy revised on 8/23/90.
Policy revised on 1/10/91.
Policy revised on 3/24/94.
Policy revised on 1/14/99.
Policy revised on 6/14/01.
Policy revised on 1/10/02.
Policy revised on 1/24/02.
Policy revised on 5/8/03.
Policy revised 2/26/04.
Policy revised 1/12/06.
Policy revised 3/9/06.
Policy revised 3/23/06.
Policy revised 6/14/07.
Policy revised 7/19/07.
Policy revised 2/21/08.
Policy revised 12/11/08.
Policy revised 2/12/15.
Policy revised 11/10/16.
Policy revised 11/9/2017, changes effective 1/1/2018.
Policy revised 6/13/2019.

Metropolitan Transit System

Accessible Services Advisory Committee Guidelines

The San Diego Metropolitan Transit System (MTS) provides fixed route bus service, complementary paratransit service, and light rail service in southern San Diego County. On February 9, 1995, the San Diego Metropolitan Transit System (MTS) Board of Directors established the MTS Accessible Services Advisory Committee (ASAC). The purpose of ASAC is provide feedback to the Chief Executive Officer and designated staff about various MTS services, proposals, and concepts relating to accessibility. This feedback is used to formulate recommended courses of action that the Chief Executive Officer or Board of Directors, whichever applicable, may review for approval.

The minimum guidelines for the ASAC are as follows:

I. The responsibilities of the committee will be:

A. To advise and make recommendations to the MTS Board of Directors on:

1. Funding to implement accessible service;
2. Disabled passenger fare structures;
3. Policies and guidelines for accessible service delivery;
4. Accessible service plans/plan updates; and
5. Accessible service contracts.

B. To advise the MTS staff and MTS operators on:

1. Accessible service operational and performance issues;
2. Disabled passenger transfer procedures between, (a) paratransit/paratransit services, (b) fixed route/fixed route services, and (c) paratransit/fixed route services (fixed route includes all rail);
3. Plans/updates for new or expanded accessible services;
4. Community outreach, interface, and marketing for accessible services;
5. Accessible revenue vehicle purchase or lease, and design for new or updated facilities; and
6. Disabled passenger certification policies and procedures.

II. The committee will not set policy.

III. Membership to the committee will include fifteen (15) voting members, comprised of:

A. a MTS Board of Directors member, appointed on an annual basis who will be approved by the MTS Board of Directors;

B. a San Diego Association of Governments (SANDAG) representative, appointed in writing by the governmental agency;

C. a California Department of Transportation (Caltrans) representative, appointed in writing by the governmental agency;

D. a Facilitating Access to Coordinated Transportation (FACT) representative, appointed in writing by the agency;

E. a San Diego Regional Center representative, appointed in writing by the agency;

F. a San Diego Center for the Blind representative, appointed in writing by the organization;

G. a State Council on Developmental Disabilities representative, appointed in writing by the organization;

H. a County of San Diego Health and Human Services Department, Aging and Independent Services representative, appointed in writing by the agency;

I. a County of San Diego Health and Human Services Department, Behavioral Health Services representative, appointed in writing by the agency;

J. an Access to Independence representative, appointed in writing by the agency;

K. a Deaf Community Service representative, appointed in writing by the organization;

L. two (2) MTS complementary paratransit service patrons (or their representative (e.g. family, guardian, advocate)), appointed by the MTS Chief Executive Officer or designee;

M. two (2) individuals with a disability that use MTS fixed route service (or their representative (e.g. family, guardian, advocate)), appointed by the MTS Chief Executive Officer or designee; and

N. Decisions to add a new governmental agency, social service agency or disability group to the committee shall be approved by the MTS Chief Executive Officer or designee.

IV. Committee officers

A. Committee chairperson will be the MTS Board of Director member representative; and

B. Committee vice-chair will be the MTS Liaison to the committee.

V. Alternates

A. Each governmental agency, social service agency and disability group may designate one (1) alternate member by providing written notification to the MTS Liaison to the committee; and

B. The MTS Chief Executive Officer or designee may designate one (1) alternate MTS complementary paratransit patron and one (1) alternate fixed route patron representative.

VI. Committee membership terms

A. Except for the chairperson of the committee, the term of membership of each committee member shall be three (3) years. Members may be re-appointed for successive terms.

VII. Removal and Resignation

A. Any member who misses four (4) consecutive meetings may be subject to removal. For any member who has missed three (3) consecutive meetings, a documented warning shall be provided to the member; and

B. A member may resign from the committee by a letter of resignation.

VIII. Committee voting will be accomplished, as follows:

A. Committee will determine the number of its membership of purposes of a quorum;

B. 51 percent attendance will be a quorum to hold a meeting;

C. Each membership representative, as described within Section III, will have an equal vote;

D. 51 percent of the vote of those in attendance will approve an item; and

E. A roster of the members who voted will be provided to the MTS Board of Directors along with any agenda item proposed for MTS Board of Directors Action.

IX. Subcommittees

A. ASAC may establish subcommittees as necessary.

1. MTS Board of Directors approval is required to establish a standing subcommittee.

2. MTS Chief Executive Officer or designee approval is required to establish an ad hoc subcommittee.

X. MTS Liaison – Staff Support

A. MTS Chief Executive Officer or designee will designate a staff person(s) to act as the MTS Liaison to the committee to prepare meeting notices, agendas and minutes as required. MTS Chief Executive Officer may also designate MTS staff or

MTS contractors to attend ASAC meetings in order to facilitate ASAC Meeting discussions (e.g. representatives from Trolley, Fixed Route Bus, Complementary Paratransit, Complementary Paratransit Eligibility, Customer Service or Security).

XI. MTS Board of Directors approval is required to revise the ASAC Guidelines.

XII. The committee is subject to the Brown Act.

Originally adopted by the MTS Board of Directors on 2/3/1995
Revisions Approved by ASAC on 3/3/2016
Revisions Approved by MTS Board of Directors on 3/17/2016
Revisions Approved by ASAC on 9/21/2017
Revisions Approved by ASAC on 12/14/2017
Revisions Approved by MTS Board of Directors on 1/18/2018
Revisions Approved by ASAC on 6/15/2023
Revisions Approved by MTS Board of Directors on 7/27/2023

Metropolitan Transit System

Agenda Item No. 13

MEETING OF THE SAN DIEGO METROPOLITAN TRANSIT SYSTEM
BOARD OF DIRECTORS

January 16, 2025

SUBJECT:

SANDAG Report on Airport Transit Connection (ATC) (Marisa Mangan, SANDAG)

INFORMATIONAL ONLY

Budget Impact

None.

DISCUSSION:

SANDAG is currently studying a variety of options to improve transit access to San Diego International Airport. These options include:

- An automated people mover (APM), extending from the airport to downtown San Diego and/or the Consolidated Rental Car Facility (CONRAC)
- An extension of the Trolley network to the airport, from downtown San Diego.
- Expanded bus service

This presentation was given to the SANDAG Board of Directors on December 6, 2024. Direction was given to provide similar presentations to the MTS Board of Directors – as well as other public agencies – to gather feedback on the options and on next steps.

SANDAG will consider input then conduct analysis and use public feedback to identify the ATC concepts that will advance to environmental review in Fall 2025. SANDAG will continue collaborating with MTS and other peer agency stakeholders as well as state and federal funding partners to ensure the proposed project best meets the needs of the San Diego region and is highly competitive for state and federal funding

In addition to the long-term ATC analysis, near-term strategies for enhancing bus and shuttle connections are being developed with MTS staff.

/S/ Sharon Cooney
Sharon Cooney
Chief Executive Officer

Key Staff Contact: Mark Olson, 619.557.4588, mark.olson@sdmts.com

Metropolitan Transit System

Agenda Item No. 14

MEETING OF THE SAN DIEGO METROPOLITAN TRANSIT SYSTEM
BOARD OF DIRECTORS

January 16, 2025

SUBJECT:

Orange Line Improvement Project Update (Heather Furey; Sharon Humphreys and David Holman of T.Y. Lin)

INFORMATIONAL ONLY

Budget Impact

None.

DISCUSSION:

The San Diego Metropolitan Transit System (MTS) staff and external consultants, T.Y. Lin, will present an update on the Orange Line Improvement Project.

The Orange Line Improvement Project includes Transit and Intercity Rail Capital Program (TIRCP) grant funded projects to improve the Trolley system infrastructure at various locations along the 17.6-mile Orange Line. The Project will benefit the riding public and the cities of San Diego, Lemon Grove, La Mesa, and El Cajon. The projects include track, signal, and grade crossing improvements along the Orange Line and has been divided into two phases. Phase 1 is the work between 32nd/Commercial Station and Massachusetts Avenue Station. Phase 2 is the work between Massachusetts Avenue Station and El Cajon Transit Center. Once completed, the Project will allow Trolleys to safely operate at higher speeds and allow reverse-run on certain sections of the line, improving transit times and operational flexibility.

The Project funding currently includes two discretionary TIRCP grant awards of $14,560,000 (2022 grant for Phase 1) and $48,315,712 (2023 grant for Phase 2). On December 14, 2023 (Agenda Item (AI) 29), the Board approved the SB 125 Allocation Package, which allocated $26,000,000 in state funds for the Phase 1 project. The remaining Project funding consists of MTS local matching funds. The estimated cost of the combined Orange Line Improvement Project is $136,000,000.

The design process for Phase 1 began in January 2023 after a work order to Pacific Railway Enterprises, Inc. (PRE), a Disadvantaged Business Enterprise (DBE), was awarded on December 8, 2022 (AI 13). PRE used the standard signal design implemented on the Mid-Coast Project as a basis for the Orange Line Improvement work. While the design has progressed,

MTS Capital Projects staff and the design team have been working on a project implementation schedule to meet the TIRCP grant's required completion date of June 30, 2027. The scheduling effort identified required start dates for construction. When compared with known lead times for specialty equipment to be installed by the contractor, staff identified that equipment lead times could put the construction schedule at risk. To limit the schedule risk associated with long lead equipment, the MTS Capital Projects team proposed that MTS directly purchase the signaling equipment so that it can be provided as "owner-furnished equipment" to the construction contractor for installation.

MTS staff has worked diligently to procure long lead materials and services contracts to support the construction of the project, executing the following contracts over the last 24 months:

Owner Furnished Equipment

Signal instrument components	April 25,2024 (AI 5)	$427,222.03
Vital signals, switch machines and crossing gate equipment	April 25,2024 (AI 6)	$757,712.32
Impedance bonds and plug-in relay socket assembly	May 16, 2024 (AI 13)	$323,833.14
Special trackwork materials	June 20, 2024 (AI 12)	$1,077,473.06
Signal houses	July 18, 2024 (AI 9)	$6,691,924.99
OCS assembly kits	October 17, 2024 (AI 22)	$377,731.63
OCS poles	November 14, 2024 (AI 16)	$319,200.06
Train control wire and cable	December 19, 2024 (AI 7)	$394,629.29
	Total	**$10,369,726.52**

Other Contracts

Design Services	December 8, 2022 (AI 13)	$1,411,503.63
Construction Management	May 16, 2024 (AI 17)	$4,473,793.39
Design Support during Construction	July 18, 2024 (AI 10)	$1,517,309.03
Program Management Consultant Services *	July 18, 2024 (AI 8)	$2,438,778.80
	Total	**$9,841,384.85**

* Contract scope and dollar value cover both Phase 1 and Phase 2

The presentation will highlight the program management support services being provided by the TY Lin team.

/S/ Sharon Cooney
Sharon Cooney
Chief Executive Officer

Key Staff Contact: Mark Olson, 619.557.4588, mark.olson@sdmts.com

Metropolitan Transit System

Agenda Item No. 15

MEETING OF THE SAN DIEGO METROPOLITAN TRANSIT SYSTEM
BOARD OF DIRECTORS

January 16, 2025

SUBJECT:

Budget Overview (Mike Thompson)

INFORMATIONAL ONLY

Budget Impact

None.

DISCUSSION:

Staff will provide a presentation of the financial budgets of the San Diego Metropolitan Transit System (MTS). This will include the major revenue streams that MTS receives on a recurring basis to fund its operating and capital budgets, as well as what is funded by each separate budget. It will also include an overview of annual budget development processes for the operating and capital budgets. Lastly, it will include the financial position at MTS and the challenges facing the agency in the coming years.

/S/ Sharon Cooney
Sharon Cooney
Chief Executive Officer

Key Staff Contact: Mark Olson, 619.557.4588, mark.olson@sdmts.com

Metropolitan Transit System

Agenda Item No. 16

MEETING OF THE SAN DIEGO METROPOLITAN TRANSIT SYSTEM
BOARD OF DIRECTORS

January 16, 2025

SUBJECT:

University of California, San Diego (UCSD) Universal Pass (U-Pass) Renewal Agreement (Brent Boyd)

INFORMATIONAL ONLY

Budget impact

The UCSD U-Pass program is an important source of reliable fare revenue for MTS. This proposed agreement is estimated to bring $61,030,334, or approximately $6 million annually, in fare revenues to MTS over the ten-year period, pending a successful student referendum.

As compared to the estimated revenue received from UCSD for similar transit access and supplemental service in Fiscal Year 2025 ($7,013,246.66), the annual estimated revenue received in Fiscal Year 2026 will be reduced by $1,677,641.96.

DISCUSSION:

UCSD students passed two consecutive referenda, in 2014 and 2018, to implement a U-Pass program for undergraduate and graduate students. The program implements a transit-specific fee that every eligible student pays with their quarterly registration fees. The transit fee funds unlimited rides for eligible UCSD students on most MTS and NCTD services. The current referendum expires after summer session 2025, so UCSD is working with their student council to hold a vote on a new Student Transportation Fee Referendum between January 27-31, 2025 to extend the U-Pass program and fund other UCSD transportation initiatives.[1]

The referendum is the mechanism by which UCSD adds the U-Pass to students' quarterly fees. An updated U-Pass agreement between MTS and UCSD is being finalized. By its terms, the U-Pass program will be renewed if the UCSD student vote approves the program. If the vote is not successful, then the UCSD U-Pass program would expire before the UCSD Fall 2025 academic quarter.

[1] Details on the UCSD Student Transportation Fee Referendum can be found here: https://as.ucsd.edu/upass2025/index.html

The updated referendum will offer similar benefits to students in terms of MTS services, but there would be some notable changes in the UCSD U-Pass program, including:

- The UCSD Student Transportation Fee Referendum does not have a specific sunset date. Students may cancel the program if desired by a subsequent referendum. The draft UCSD U-Pass agreement between UCSD and MTS is for a ten-year period, rather than the expiring agreement's six-year term. The reason for the shorter duration of the 2018 Agreement was that the Mid-Coast trolley extension that includes two UCSD campus stations had not opened (it opened in November 2021) and student trolley ridership was a major uncertainty.

- UCSD will include other transportation-related services in this referendum. In addition to the U-Pass, the fee would also pay for UCSD micromobility options and other campus transportation services. Additionally, the fee would fund added MTS SuperLoop frequency and span that UCSD currently reimburses MTS for.

- The quarterly fee for Fall, Winter, and Spring quarters will include a summer transit pass at no extra charge for students. This resolves the transportation issues of students who either take classes during one or both summer sessions, and/or remain in San Diego over the summer break for work or other purposes. In past years, summer has been negotiated individually every year, with an inconsistent solution over the years and unreliable costs for UCSD and revenues for MTS.

- Under the existing UCSD U-Pass program, only North County Transit District's (NCTD) BREEZE (fixed route bus) and SPRINTER (hybrid rail operating between Oceanside and Escondido) transit services are included. For the new U-Pass Agreement, the Coaster and NCTD+ microtransit (Flex) service will also be included.

The UCSD Student Transportation Fee Referendum will charge students a $75.00 fee each academic quarter (Fall, Winter, Summer), and will be adjusted annually by the Consumer Price Index (CPI) for the San Diego Region. Of that fee, the following will be paid to MTS and NCTD:

Academic Year	MTS U-Pass Fee	MTS Rapid 201/202 Supplemental Service Fee	NCTD U-Pass Fee	Total Fee per Quarter
2025/2026	$37.65	$5.70	$4.00	$47.35
2026/2027	$38.40	$5.73	$4.06	$48.19
2027/2028	$38.71	$5.90	$4.12	$48.73
2028/2029	$38.28	$6.28	$4.18	$48.75
2029/2030	$38.20	$6.57	$4.25	$49.02
2030/2031	$37.71	$6.99	$4.31	$49.01
2031/2032	$37.57	$7.30	$4.37	$49.24
2032/2033	$36.94	$7.77	$4.44	$49.15
2033/2034	$37.21	$7.97	$4.51	$49.68
2034/2035	$37.47	$8.18	$4.57	$50.22

The U-Pass program is structured under the Universal Pass provisions of the San Diego Association of Governments (SANDAG) Comprehensive Fare Ordinance. Under Section 2.41 of the Comprehensive Fare Ordinance, the Universal Pass is defined as a pass that "[p]rovides unlimited rides on select transit services for an agreed upon period of time to individuals associated with a sponsoring entity, where the sponsoring entity guarantees universal participation/purchase by its employees, students, or other membership." Under this program, 100% of the eligible population (in this case UCSD students) pay for a transit pass, even though 100% of that group is not expected to use the transit pass or use it enough to earn a monthly pass. MTS and NCTD establish the U-Pass fee based on an analysis and estimates of UCSD ridership, the size of the UCSD student population, and MTS average fares.

This agreement will result in a lower per student rate for the MTS U-Pass as compared to the 2018 U-Pass Agreement. This results from several factors. At the time the 2018 U-Pass Agreement was negotiated, systemwide ridership and average fares were rising and the anticipated opening of the Mid-Coast trolley extension on campus was expected to increase ridership even more. Therefore, the per student/per quarter rate significantly increased between the 2014 agreement and the 2018 agreement:

2014 Agreement		**2018 Agreement**	
Academic Year	**MTS Fee**	**Academic Year**	**MTS Fee**
2014/2015	$34.00	2019/2020	$43.99
2015/2016	$34.00	2020/2021	$44.65
2016/2017	$35.00	2021/2022	$45.32
2017/2018	$35.00	2022/2023	$46.00
2018/2019	$35.00	2023/2024	$46.69
		2024/2025	$47.39

Ridership did not increase at the scale anticipated in 2018. The overall system ridership declines that resulted from the COVID-19 pandemic also impacted MTS average fare per trip, causing it to decline.

Projecting forward in time, UCSD student transit trips are also expected to decrease over the life of this new 10-year U-Pass Agreement because of the significant investments in on-campus housing that UCSD is making. Several new housing developments are under construction or planned for the 2024 to 2033 time period. These projects will add 17,275 student beds to the campus. Students living on campus are expected to make fewer transit trips as many of their day-to-day needs will be provided on campus. By 2032, UCSD expects to have on-campus housing available for 38,275 students.[2]

Overall, the new U-Pass Agreement, if approved by the Student Referendum vote, will provide reliable annual funding of approximately $6 million to MTS, while also introducing over 40,000 students to transit each year.

[2] Projected 2033 UCSD Enrollment is 50,400.

At the conclusion of the 10-year agreement term in 2035, the ridership data and estimates will be reviewed and analyzed before pricing for a subsequent U-Pass agreement is established.

Sharon Cooney
Chief Executive Officer

Key Staff Contact: Mark Olson, 619.557.4588, mark.olson@sdmts.com