

SERVICES AGREEMENT

BETWEEN THE

CITY OF SAN DIEGO



AND

**EMERSON PROCESS MANAGEMENT POWER & WATER
SOLUTIONS, INC.**

**TO PROVIDE AS-NEEDED SUPPLIES AND TECHNICAL
SUPPORT FOR THE COMNET DISTRIBUTED CONTROL
SYSTEM**

SERVICES AGREEMENT

This Services Agreement (Agreement) is entered into by and between the City of San Diego, a municipal corporation (City), and Emerson Process Management Power & Water Solutions, Inc. (Contractor).

RECITALS

City wishes to retain Contractor to provide as-needed supplies and technical support for the COMNET distributed control system as further described in the Scope of Services (Services), attached hereto as Exhibit A.

Contractor has the expertise, experience, and personnel necessary to provide the Services.

City and Contractor (collectively, the "Parties") wish to enter into an agreement whereby City will retain Contractor to provide the Services.

This Agreement is exempt from competitive bidding requirements pursuant to San Diego Municipal Code (SDMC) section 22.3208(e) because the Purchasing Agent has certified that the award of a sole source contract is necessary under SDMC section 22.3016(a).

For good and valuable consideration, the sufficiency of which is acknowledged, City and Contractor agree as follows:

ARTICLE I CONTRACTOR SERVICES

1.1 Scope of Services. Contractor shall provide the Services to City as generally described in Exhibit A, Scope of Services, which is incorporated herein by reference, and as specifically authorized in the applicable Task Order. The desired services will be determined by the City on an as-needed basis. The City will issue a request for a proposal to the Contractor that will outline the services needed. The proposal submitted by the Contractor shall include a scope of work that includes all activities or work reasonably anticipated along with the associated fee to the City as necessary for successful completion of each Task Order in accordance with the general Specifications shown in Exhibits H1 through H7, attached hereto, to the extent applicable and specified on the applicable Task Order. The City will review, and may negotiate elements of the proposal with the Contractor. After reaching mutual agreement, and prior to beginning performance of the services, the City will issue a Task Order. Each Task Order shall include a scope of work, a cost estimate and the time for completion.

1.2 Contract Administrator. The Public Utilities Department (Department) is the Contract Administrator for this Agreement. Contractor shall provide the Services under the direction of a designated representative of the Department as follows:

Cyrus Moaveni, Senior Electrical/Control Systems Engineer
Public Utilities Department
9192 Topaz Way, San Diego, CA 92123
858-654-4224
MCMoaveni@sandiego.gov

1.3 General Contract Terms and Conditions. This Agreement incorporates by reference the General Contract Terms and Conditions, attached hereto as Exhibit B.

1.4 Submittals Required with the Agreement. Contractor is required to submit all forms and information delineated in Exhibit C before the Agreement is executed.

ARTICLE II DURATION OF AGREEMENT

2.1 Term. This Agreement shall be for a period of ten (10) years effective on the date executed by the last Party to sign the Agreement. This Agreement requires City Council approval, by ordinance, prior to award.

2.2 Effective Date. This Agreement shall be effective on the date it is executed by the last Party to sign the Agreement, and approved by the City Attorney in accordance with San Diego Charter Section 40.

ARTICLE III COMPENSATION

3.1 Amount of Compensation. City shall pay Contractor for performance of all Services rendered in accordance with this Agreement in an amount not to exceed \$30 million or the amount referenced in the Purchase Order.

**ARTICLE IV
CONTRACT DOCUMENTS**

4.1 Contract Documents. This Agreement and its exhibits constitute the Contract Documents. The Contract Documents describes the goods and services to be provided. Specific scope of work for a given project will be included in a respective Task Order, execution of which will be governed by the provisions of this Agreement.

4.2 Counterparts. This Agreement may be executed in counterparts, which when taken together shall constitute a single signed original as though all Parties had executed the same page.

IN WITNESS WHEREOF, this Agreement is executed by City and Contractor acting by and through their authorized officers.

EMERSON PROCESS MANAGEMENT POWER CITY OF SAN DIEGO
& WATER SOLUTION, INC.

A Municipal Corporation

BY: _____

Robert Lyger

11/13/19

DATE SIGNED

BY: _____

[Signature]

Print Name

Dolando Charvel

~~Director Purchasing & Contracting~~
~~Department~~

CF

7/22/2020

DATE SIGNED

Approved as to form this 24 day of
July, 2020.

MARA ELLIOTT, City Attorney

BY: _____

[Signature]

Deputy City Attorney

EXHIBIT A
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
SCOPE OF SERVICES

To modernize monitoring and control of its wastewater facilities, the City of San Diego's Public Utilities Department (PUD), through a competitive process, selected Emerson Process Management™ (Emerson) in early 1990's to design and implement a control system, also referred to as COMNET (Cleanwater Operations Management Network). COMNET implementation, using Emerson's Distributed Control System (DCS), started in 1995 and continued for several years thereafter for approximately \$121 million. With additional investments made on new facilities and system expansion and upgrades made since the original implementation, City's investment in COMNET to date is estimated at over \$200 million.

COMNET is currently in need of expansion due to the Pure Water Program (PWP) projects. It is also in need of certain upgrades, as portions of the existing system are obsolete and/or unreliable needing replacement. An example of this is the legacy input/out (I/O) modules that interface with field sensors, such as flowmeters, level and pressure transmitters and analytical instruments, used for monitoring plant conditions. There is currently also a need to upgrade and enhance COMNET's cybersecurity capabilities to help defend against cyber related threats. Both Pure Water Projects, in which Emerson will act as a sub to the general contractor, and the DCS Upgrade Projects, in which Emerson will contract directly with the City under provisions of this Agreement in form of Task Orders, will be priced in accordance with Exhibit F: Pricing, attached hereto.

The facilities included in the system expansion, upgrades and enhancements (Upgrade Projects) include:

- Point Loma Wastewater Plant (PLWTP)
- North City Water Reclamation Plant (NCWRP)
- South Bay Water Reclamation Plant (SBWRP)
- Metropolitan Biosolids Center (MBC)
- Several major sewage pump stations (PS2, PS1, Pensacitos PS, PS64, Grove Ave PS)
- Fill the gaps related to monitoring and control functions that may exist between various PWP projects
- PWP projects (although Emerson will be a sub to a general contractor on these projects, Emerson's cost shall be based on the Discount Pricing Structure included in the Agreement)

The DCS upgrades and enhancements include items such as:

- Input/output and communications modules which are currently over 20 years old
- Network switches and routers
- Main servers and controllers
- Operator workstations
- System software upgrades and services
- Cybersecurity updates and adding Intrusion Detection capability
- Implementing a Disaster Recovery Plan

It is envisaged that the upgrade and enhancement projects that the City plans to award directly to Emerson under the Agreement will commence soon after approval of the final Agreement by the San Diego City Council, and following an agreed upon scope of work and associated cost for each project, as reflected in the applicable, fully-executed Task Order, and shall be executed by Emerson in accordance with the general Technical Specifications shown in Exhibits H1 through H7, attached hereto, as applicable to each Task Order.

**TASK ORDER AUTHORIZATION FOR
PROFESSIONAL SERVICES [TASK ORDER]**

Consultant:	(Name of Consultant) (Address) (Consultant Project Manager) (Email Address)		
Agreement:	(Full Official Title of the Agreement and Contract Number)		
Task Order No.:		Modification No.:	Date:
<p>Pursuant to the Terms and Conditions of the Agreement referenced above and incorporated into this Task Order, Consultant hereby agrees to perform the Professional Services described below. The Consultant shall furnish all necessary facilities, materials, and professional, technical, and supporting personnel required by this Task Order.</p>			
Part A	Scope of Services		
1.1	Professional Services rendered under this Task Order shall be performed in accordance with the Agreement. The Scope of Services shall be as set forth generally in Exhibit A of the Agreement and as specifically and fully set forth below. If necessary, the Scope of Services may be more fully described on one or more separate sheets and attached to this Task Order.		
<p>Ref:</p> <p>Task Title:</p> <p>Scope of Work:</p> <p style="text-align: center;">If there are technical questions please contact _____, Project Manager at (XXX) XXX-XXXX. For contractual matters please contact _____, Senior Contract Specialist at (XXX) XXX-XXXX</p>			
	Fund:	GL:	CC:
Part B			
Task Order Compensation			
	<p>City shall pay Consultant for the Professional Services required by this Task Order in accordance with Article III of the Agreement.</p> <p>The Not-to-Exceed (NTE) cost for the Scope of Services for this Task Order is \$_____.</p>		
Part C	Personnel Commitment		

The Scope of Services shall be performed by Consultant's personnel in the number and classifications required by City.

Part D	Time Sequence
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All Professional Services to be performed under this Task Order shall be completed by Month Day, Year and as set forth in the Task Order Scope of Services.

Signature Approvals		
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City of San Diego Public Utilities Department Budget Analyst: Recommended for Approval:	Approved By:	Date:
	Printed Name & Title	
	Signature	
Consultant: I hereby acknowledge receipt and acceptance of this Task Order:	Approved By:	Date:
	Printed Name & Title	
	Signature	
City of San Diego Public Utilities Department:	Approved By:	Date:
	Printed Name & Title	
	Signature	

cc:

EXHIBIT F PRICING

DEFINITIONS

1. Controller Kit – Ovation Controller with Ovation Software sold together as a kit, and hold one Ovation part-number (I.E. OCC-1100-DC-LL-00); these are identified with Discount Category “AA” in the Ovation List Price Book.
2. Workstation Drop – Standard Ovation workstations that include Workstation hardware and Ovation software, and hold one Ovation part-number (I.E. Ovation Operator Station, OW-OPWS-WIN-000); these are identified with Discount Category “BB” in the Ovation List Price Book.
3. SmartProcess - Ovation Optimization control solution as defined in attached datasheet in paragraph 19 of this exhibit; note: any reference to document Selling Policy Form B does not apply
4. SureService – Customer support program as defined in attached datasheet in paragraph 20 of this exhibit note: any reference to document Selling Policy Form B does not apply

PAYMENT MILESTONES

1. NON SURESERVICE PURCHASES

The following terms of payment are applicable to all contracts (except SureService and SmartProcess) within this agreement and priced per the agreement.

A. Systems/Migrations/Upgrades

Invoices will be issued for each of the following deliverable line items with undisputed electronic email invoice payment made 30 days after receipt of the invoice. The amount of each invoice shall be calculated by applying the percentages (%) shown below against the total Purchase Order price including any changes.

Hardware Only (no application engineering by Emerson)

- 10% Upon Contract Award
- 20% Upon Hardware Released to Manufacturing
- 50% Upon Hardware Complete on Test Floor
- 20% Upon System Shipment (on pro rata basis)

Configured System Projects;

- 10% Upon Contract Award
- 20% Upon Initial Hardware Drawings Submittal
- 45% Upon Hardware Complete on Test Floor
- 20% Upon System Shipment (on pro rata basis)
- 5% Upon Customer Acceptance but no later than ninety (90) days after last major System Shipment

Engineer, Procure, Construct (EPC) Projects (including site construction and trades)

- 10% (less 10% retention) Upon Initial DCS Hardware Drawings Submittal
- 10% (less 10% retention) Upon DCS Hardware Drawings Approval
- 5% (less 10% retention) Upon Software Submittal (Functional Logic, Database, Graphics, etc.) Approval
- 20% (less 10% retention) Upon Successful Completion of Factory Acceptance Tests
- 15% (less 10% retention) Upon System Shipment

10% (less 10% retention)	Upon System Installation (proportional to the progress made in the field)
10% (less 10% retention)	Upon Completion of Loop Testing (proportional to the progress made in the field)
5% (less 10% retention)	Upon Completion of Operational Readiness Tests (proportional to the progress made in the field), but no later than 90 days after shipment or otherwise agreed upon by both parties
10% (less 10% retention)	Upon Satisfactory Completion of 30-Day Acceptance Test, but no later than 120 days after shipment or otherwise agreed upon by both parties
5% (less 10% retention)	Upon Approval of Final Documentation, but no later than 150 days after shipment or otherwise agreed upon by both parties
10%	Retention on all invoices to be released upon Final Acceptance but no later than 180 days after shipment or otherwise agreed upon by both parties

B. Services

When service is provided, invoices will be rendered monthly for the total service provided in that month.

When other services (spare parts and repairs) are provided, invoices will be rendered upon shipment.

When training is provided within a project, invoices will be rendered at the completion of each course. All other training requires payment upon registration.

All invoices are due and payable net 30 days from the date of the invoice date. Contractor will supply invoices via electronic email.

2. SURE SERVICE TERMS OF PAYMENT

Payment for services to be provided under this Contract shall be made on a monthly, quarterly or annual basis as determined by the Contractor offer. Payments shall be invoiced in advance on the first day of each billing period. Payments are due and payable net 30 days from the date of the invoice. In the event of annual payments, the invoice for the first annual payment under this Contract will be issued following receipt of this signed Contract by Purchaser. For subsequent years, the invoices for annual payments will be issued on the Contract renewal date. If payments are made on a monthly or quarterly basis the payments are due the first day of each month or quarter.

3. SMARTPROCESS TERMS OF PAYMENT

Invoices will be issued for each of the following deliverable line items with payment due net 30 days from the date of the invoice. The amount of each invoice shall be calculated by applying the percentages (%) shown below against the total Purchase Order price including any changes.

10%	Upon Contract Award
30%	Upon Shipment of Hardware & software license
50%	Upon completion of installation
10%	Upon Final Commissioning & Customer acceptance, not to exceed ninety (90) days after completion of installation.

PRICING SCHEDULE

1.0 OVERVIEW

This Appendix applies solely to Products and Services supplied by the Emerson Process Management, Power & Water Solution, Inc. (PWS), for its Ovation™ product line for new “system” purchases (see Article 4.0 of this Appendix for qualifications), and Emerson Hardware and software upgrades, migrations and complete system replacements. The pricing structure shown in this Appendix applies to Pure Water Projects, in which PWS will act as a sub to a general contractor as well as Upgrade Projects, in which PWS will contract with the City directly under this Agreement in form of Task Orders.

2.0 PRICE LISTS

2.01 The latest published revision of Emerson's Price Lists on CD for Ovation products and services shall govern all sales under this Agreement (hereinafter collectively referred to as “Price Lists”). In January of each year, Emerson shall supply a copy to City of San Diego the updated Power & Water Solutions, Inc. (PWS) List Price Book via CD or email.

2.02 The Price Lists include pricing for current revision level Ovation products only. The Price Lists will be subject to change once per calendar year (every January) to the then current list price book published by Emerson. Emerson reserves the right to revise any pricing at any time to correct errors and/or to adjust for suppliers' price increases and decreases. Additionally, periodic revisions of the price book may be made throughout each year to add and/or delete products.

2.03 In the event of a list price decline, or should Emerson at any time, during the life of this Agreement, sell the same materials or service, under the same terms and conditions based on similar volume, application, market, quantity and delivery conditions, to any similarly situated private or government entity in the State of California at prices below those stated herein, Emerson will promptly extend such lower prices to the City of San Diego.

2.04 Emerson Power & Water Solutions' Hardware and Software List price changes shall not exceed the lesser of either published Ovation List Price annually or the percentage change plus 1% in BLS PPI 334513334513.

2.05 Emerson Power & Water Solutions' Project Engineering and Field Service Engineering List price changes shall not exceed the lesser of either published Ovation List Price annually or the percentage change in Bureau of Labor Statistics (BLS) Producer Price Index (PPI) 541330541330202.

2.06 Current List Price: The active list price in Ovation Price Book for 2019

2.07 Price Adjustment Dates: Pricing adjustments will be made on an annual basis. [If contract is extended, adjustments will continue to be made in January of each year unless otherwise stipulated].

2.08 Exception to the Rule: On the rare occasion where the List Price change is significantly higher than identified annual adjustment per 2.03 and 2.04, Power & Water Solutions may request relief for select items. In those situations, sufficient explanation must be provided by Power & Water Solutions and agreed to by Owner.

2.09 Prices contained in the Price Lists are applicable only for Purchase Orders with delivery periods of twelve (12) months or less. Prices contained in the Price Lists are based on shipping the equipment F.O.B. point of origin, freight prepaid and added.

2.10 The discounts within this section supersede all other discounts.

3.0 PRICING

3.01 The purchase price of goods and services under the terms of this Agreement is determined by the following: Emerson manufactured hardware and Ovation controller shall be billed with a 55% discount off list price, Emerson workstation with standard Emerson software (i.e. Ovation Operator workstation) shall be billed with a 45% discount off list price, while Original Equipment Manufacturer (OEM) items (manufactured by others) shall be billed at current list price. Emerson software not inclusive to Emerson workstation and controller drops shall be billed at 10% off list price. Emerson project engineering services shall be billed at 15% discount off list price, Emerson field service engineering shall be billed 25% discount off list price. Emerson Evergreen (Ovation-to-Ovation upgrade) Ovation software is a function of current Ovation software level and future Ovation software level and the minimum shall be billed at 70% discount off list price. Emerson training shall be billed at 15% discount off list price. Emerson spare parts shall be billed at 10% discount off list price. Third party services or equipment shall be procured only after approval by City's Project Manager and billed at third party invoice plus 10%.

3.02 In consideration and appreciation for high volume business, a flat 6% discount will be applied to all Emerson products and engineering services; third party services or equipment shall not be discounted nor will traveling living expenses.

3.03 The pricing discounts identified in 3.01 and 3.02 above are provided in table format below in Table 3.03.

Description	Ovation Price Book Discount Symbol	System Discount	Additional 6% Flat Discount	Final Discount off List
Emerson Manufactured hardware: Ovation Controllers Ovation I/O	AA or A	55%	6%	57.7%
Emerson standard workstations with Software Ovation Operator Ovation Engineer client	BB	45%	6%	48.3%
Original Equipment Manufactured (OEM) items	B	0%	6%	6%
Evergreen Software		70%	6%	71.8%
New Specialized Software	D	10%	6%	15.4%

Engineering & Configuration	E	15%	6%	20.1%
Training; > 5 student weeks	G	15%	6%	20.1%
Field Service:	F	25%	6%	29.5%
Ovation Spares - Spare Parts for Emerson-mfg'd items;	C	10%	6%	15.4%
Third party services or equipment procured		Invoice plus 10%	n/a	Invoice plus 10%

4.0 STANDARD OVATION HARDWARE SYSTEM PURCHASES

4.01 All discounts for standard Ovation Hardware are valid only for Purchase Orders for “Current” product support category systems (hereinafter referred to as Systems) with a System being defined as follows:

- a. An order having a minimum of 2 complete drops; 1 controller with 8 I/O cards and 1 HMI workstation, cabinets, connecting cabling and electronics, or large Ovation I/O replacement projects such as North City Water Reclamation Plant Ovation IO Replacement project.
- b. An integrated addition to an ordered but not shipped System (i.e. change notice to a System order) provided the System has not passed the hardware freeze (“cutoff”) dates as applicable, in the agreed to System project schedule.

4.02 The above described “complete drop” consists of cabinets, power supplies, terminations, bases, etc. that are required for a typical, operational EMERSON manufactured drop.

4.03 The hardware can be deleted up until the hardware cutoff date for the project with no additional cost. After the hardware cutoff date but prior to delivery of the hardware to the assembly area, deletions to the hardware scope will be subject to engineering charges to be determined on a case by case basis. Once the hardware is on the shop floor but before shipment, deletions to the hardware scope will be subject to restocking and engineering charges to be determined on a case by case basis. After shipment, no returns will be accepted. Also, all engineering effort used to integrate and configure the deleted hardware in all of the above examples is not recoverable. In every case above, a change notice will be issued for shop labor and re-engineering and the project schedule may be impacted.

4.04 Additions to the hardware scope may utilize the discount multipliers until the startup date, realizing that additional engineering time may be needed to implement the added hardware to the system and the project schedule may be impacted.

4.05 ‘Hardware only’ systems will require project engineering time to account for tracking, ordering, assembly, testing. Spare parts purchases within a System shall use the Spare Parts Discount, Section 9.

5.0 STANDARD OVATION SOFTWARE

5.01 All prices provided for Ovation Software within a System are for single drop licenses only, unless expressly stated differently in the published Price Lists.

5.02 Software discounts are applicable for software purchased as part of a System Order (as defined above) or purchased as an integrated addition (i.e. change notice) to a System Order prior to the software freeze (“cutoff”) date defined in the project schedule.

5.03 The license fee for any Ovation Software which is purchased for installation on hardware which has not been purchased from Emerson, shall be equal to the list price (i.e. no discounts of any type shall be applicable).

5.04 License fees for non-Emerson manufactured software, either contained within an EMERSON product or purchased separately are not discountable.

5.05 Custom application software may be quoted if applicable. The prices quoted to design and implement custom software will be per the Systems Engineering rate. A license fee will be established and quoted for each custom software program so designed.

6.0 ENGINEERING & CONFIGURATION

6.01 Engineering & configuration within a System can be purchased at the engineering rates given in the applicable sections of the Ovation Price List. These rates will apply to all factory system engineering including configuration, control strategy development, graphics development and coding, log coding, database coding, and application specific software development.

6.02 Engineering & configuration will be purchased at the List Price, less the discount for work during regular working hours. Excess of 8 hours per day and all work on Saturdays will be billed at 1.5 times the discounted daily rate and all work on Sunday and Holidays at 1.5 times the discounted daily rate. All scheduled work for Sunday, Holidays will be approved to by both parties.

6.03 In the event that within one Purchase Order a portion of system engineering design can be reused (i.e. if there are duplicate units to be engineered) or if a standard design criterion can be established and implemented to reduce re-engineering efforts, Emerson will offer an additional price reduction to the total system engineering price. This reduction will vary based on the amount of design reuse and/or design standardization and will be determined on a case by case basis.

6.04 Engineering prices are determined by type of expertise based on the following work definition:

Type	Work Definition
Fellow Engineer, Advisor, Manager	Overall project manager, controls consultant
Principal, Supervisory, Advanced Technical Engineer	Project manager/lead project engineer
Senior Engineer	Control design, implementation, testing, FAT
Engineer	Database, hardware, graphics
Technician	Hardware and software assistant
Draftsperson	Drawings

6.05 Purchases of systems (with Emerson configuration engineering) with over three (3) drops require an engineering quotation from Emerson to account for tracking, ordering, assembly, testing.

6.06 See the appropriate Price Book for hourly rates. EMERSON shall determine the type and quantity of engineering expertise required and provide the personnel with the respective job skill. The Sell Price shall be the appropriate List Price times the discount multiplier.

7.0 FIELD SERVICE – Included within a System

7.01 For consecutive man-days of field service time use the applicable discount. The daily rate for field service is the List Price for the applicable field service type less the discount.

7.02 Field Engineering will be purchased at the List Price, less the discount for work during regular working hours. Excess of 8 hours per day and all work on Saturdays will be billed at 1.5 times the discounted daily rate and all work on Sunday and Holidays at 1.5 times the discounted daily rate. All scheduled work for Sunday, Holidays will be approved to by both parties.

7.03 Classifications of Field Engineering

Class A — Class A Field Engineering Services are those provided for current and non-current systems and instrumentation. Specific services provided include system installation assistance, start-up, maintenance, and technical assistance.

Class B — Class B Field Engineering Services are those provided for utility and industrial process control system tuning, consulting and field design work. Class B also covers the services of product application specialists for current and non-current products and systems.

7.04 Billing

Straight Time — The minimum straight time billing will be for one-half days' time. Billing will be made in one-half day increments.

7.05 Overtime — Overtime will be billed on an hourly basis but a minimum of four (4) hours will be billed for Saturdays, Sundays and holidays.

7.06 Service Rate Definitions

Straight Time Rates will apply to all time worked during a normal eight (8) hour work day. The normal

8-hour work day as herein used is defined as the hours between 8:00 a.m. and 5:00 p.m. with one hour for lunch, Monday through Friday, except legal holidays.

Overtime Rates will apply to all hours worked in excess of eight (8) hours on weekdays and all time worked on Saturdays, Sundays and holidays.

7.07 Traveling Expenses

Traveling expenses for engineers will begin when each leaves their headquarters and will terminate when each returns.

Private automobile travel will be priced at the current IRS mileage rate. All traveling and living expenses will be billed at cost.

Field engineers will be allowed an interim trip home every two weeks. Round trip travel expenses will be billed at those times in lieu of local living expenses.

7.08 Other Charges

The following charges will be in addition to the service rates and travel and living expenses outlined above.

- a. Materials and services furnished by other affiliates of Emerson and used on the job will be billed at current list prices.
- b. Services and materials purchased from other vendors or subcontractors required for the job will be billed at cost plus applicable markup.

7.09 Rates apply in the continental U.S.A. but not in the states of Alaska and Hawaii.

7.10 Field engineering offered by Emerson and accepted by Customer that are not used within three (3) months of the delivery of the system will expire and become unavailable. If expired services are prepaid, a pro-rated portion of the fees for such expired services will be refunded.

8.0 TRAINING – Included within a System

8.01 For training of more than 5 student weeks, use the applicable discount. The training discounts are applicable for standard Ovation training courses offered at Emerson's training facilities in Pittsburgh. Travel and living expenses for students are not included.

8.02 Custom courses and courses held off site will be quoted separately from this Agreement. Such a quote will include a firm or not-to-exceed price.

8.03 Training offered by Emerson and accepted by Customer that are not used within three (3) months of the delivery of the system will expire and become unavailable. If expired services are prepaid, a pro-rated portion of the fees for such expired services will be refunded.

9.0 SPARE PARTS AND REPAIRS – Included within a System

For spare parts orders, use the applicable discount. No discounts are available for non-EMERSON manufactured products. Repairs and exchanges are not discountable.

10.0 OPTIONAL MAINTENANCE CONTRACTS

A variety of maintenance contracts are available from Emerson. Upon Customer's request, a maintenance contract designed to address Customer's specific needs can be provided. Maintenance contract offerings include 24-hour support via phone or modem link, software upgrades, spare parts supply and/or inventory control, expedited repair services, preventative maintenance service, etc. The discounts in this Agreement and any other Agreement with EMERSON including Sure Service are not additive in nature.

11.0 DELIVERY >12 MONTHS

For shipment schedules greater than 12 months from the date of the Purchase Order, an adjustment factor to be applied to the discounts stated in this Agreement for such delivery schedules shall be determined on a case-by-case basis.

12.0 CHANGES AFTER FREEZE (“CUTOFF”) DATES

For additions and deletions beyond the hardware, software and engineering cutoff dates given in the agreed System project schedule, the adjustment factor to be applied to the discounts stated in this Agreement for such additions and deletions shall be determined on a case by case basis.

13.0 ALLIANCE

Emerson and Customer agree to meet at least annually to: review Customer’s system plans and future equipment requirements; discuss Emerson’s equipment designs, and in particular how they will benefit and be compatible with Customer’s existing equipment/systems; prepare strategies to affect improvements to Customer’s systems including equipment and inventory requirements, and prepare action plans to address issues, resolve problems, and foster the alliance. Emerson will travel to City of San Diego facilities for annual meeting.

14.0 SURESERVICE MAINTENANCE CONTRACTS

14.01 SureService Maintenance contracts are separate contracts that are signed by both parties to cover the maintenance of individual or multiple plants. The terms and conditions and payment terms of this Agreement are applicable to any such contracts.

14.02 In order to qualify for the SureService discounts noted below, the Customer must purchase packaged modules on a per site basis, all purchased together. Once packaged modules are purchased for a site, spare parts can also be included at the appropriate discount percentage noted in Table 17.1. The Customer will receive the appropriate discount noted in Table 17.1 on both the SureService modules and spare parts for the respective Sure Service site.

**Table 14.1 –
SureService
DISCOUNTS**

Number of Modules*	Discount
1 – 3	5%
4	10%
5 or More	15%

* The Internet Information module of SureService will be offered at No Charge and will count as a module toward packaged discount(s).

14.03 These discounts will be honored on the final qualifying purchase and all future SureService purchases if the number of modules within the contract qualifies for a discount. No other discounts herein are applicable to SureService except those expressed in Section 6.0 of SureService Maintenance Contracts.

14.04 Corporate SureService Accounts - As an added incentive to the Customer, Emerson is providing an additional corporate discount of 5% if all Customer Ovation system sites are under a SureService contract. “Corporate” is defined as more than one physical plant site with Emerson equipment installed. This additional discount will be honored on the final qualifying purchase and all future SureService purchases if all sites remain under SureService contract(s).

15.0 NUCLEAR APPLICATION

Customer acknowledges that none of the products or services provided hereunder are intended for use in a nuclear application. In the event any such products or services are used in connection with a nuclear power generating facility, all rights of Purchaser under warranty or otherwise shall be void, and Purchaser shall indemnify Contractor from any resulting damage, loss or liability of any kind.

16.0 49-WEEK PRELIMINARY PROJECT SCHEDULED ENGINEER, PROCURE, CONSTRUCT PROJECT; TYPICAL SCHEDULE AND RESPONSIBILITIES EXAMPLE

Emerson provides this 49-week schedule as a recommended basis for the development of your project

In order to maintain the desired eight (8) month delivery time frame, we recommend the listed action items with assigned responsibility be followed within the specific number of weeks after receipt and acceptance of the purchase order (weeks A.R.O.). Changes made after each cut-off point may delay the project schedule and potentially affect price.

Overall, we will rely on customer sourcing information for three key issues: database requirements for system I/O points (including signal types, ranges, engineering units, limits, and alarms per the WDPF™ or Ovation™ record types structure), graphic requirements, and functional design requirements. In turn, we will source back to the customer the updated database, the preliminary graphics with examples and the preliminary functional design.

With careful adherence to the schedule and specific cut-off dates, the project work will progress as planned. We strive for this goal.

Schedule Notes:

At week six, we recommend the customer **approve the graphics design document** and the preferred method of intercommunication with the controls, including: faceplate manual/automatic stations, process graphic displays, trend groups, etc.

At week twelve, we recommend the customer to **approve the partitioned final I/O database**. This means: the final I/O database (information includes tag name, alarm set-points, and cabinets to be terminated) is partitioned, with each point placed on a specific channel of an I/O module within a controller.

At week fifteen, we will **define the hardware freeze**, because the necessary parts need to be ordered to manufacture the system by the required factory test dates. Database changes cannot be accepted after this freeze date without delay of the project schedule.

At week twenty-three, we will **define the design freeze** – the date by which all functional designs have been reviewed and approved. Functional design changes cannot be accepted after this freeze date without delay of the project schedule

49-week Preliminary Project Schedule Example

***Note: For Water projects, it is typical for upgrades to be performed in phases segmented by major control processes within the plant. Each phase will be performed in turn, as each phase is complete a proportionate share of the applicable invoice will be sent. Final documentation and acceptance depend on completion of all phases.**

Item Number	Description	Responsibility	Weeks A.R.O.	Typical Payment Milestone
1.	Project Start			
2.	Contract award	Customer	0	
3.	Project kickoff meeting	Emerson / Customer	2	
4.	I/O Database			
5.	Submit initial I/O database for logic development (point name and drop)	Customer	7	
6.	Submit final I/O database	Customer	7	
7.	Partition final I/O database	Emerson	7-10	
8.	Review & approve partitioned final I/O database	Customer	11-12	
9.	I/O freeze	Customer	12	
10.	Controller & I/O Hardware			
11.	Initial Hardware Drawing Submittal	Emerson	4	10% Upon Initial DCS Hardware Drawing Submittal
12.	Approve hardware drawings	Customer	13	10% Upon DCS Hardware Drawings Approval
13.	Hardware freeze	Customer	15	
14.	Hardware release	Emerson	16	
15.	Hardware manufacture complete	Emerson	28	
16.	Hardware (I/O) test	Emerson	29-31	
17.	Functional Design			
18.	Submit design input (existing control diagrams, P&IDs, operating descriptions)	Customer	4	
19.	Design & implement functional logic	Emerson	5-20	

Item Number	Description	Responsibility	Weeks A.R.O.	Typical Payment Milestone
20.	Functional logic for review	Emerson	21-22	
21.	Functional logic design review	Emerson / Customer	23	
22.	Design freeze	Customer	23	5% Upon Software Submittal Approval
23.	Update functional logic	Emerson	24-25	
24.	Data-links (testing done during HW FAT)			
25.	Submit data-link information	Customer	10	
26.	Configure data-links	Emerson	11-20	
27.	Engineering test / FAT			
28.	Submit FAT plan	Emerson	20	
29.	Approve FAT plan	Customer	21-22	
30.	Engineering test	Emerson	26-31	
31.	FAT	Emerson / Customer	33-34	20% Upon Successful Completion of FAT
32.	Turnover for shipment	Emerson	35	
33.	Clean-up & ship hardware	Emerson	36	15% Upon System Shipment
34.	Deliver system to site	Emerson	37-38	
35.	System Installation	Emerson / Customer	39*	10% Upon system installation (proportional to progress made in field if done in phases by major plant process)
36.	Loop Checking	Emerson / Customer	39*	10% Upon system installation (proportional to progress made in field if done in phases by major plant process)
37.	System Turnover (ORP)	Emerson	40-41*	5% Upon system installation (proportional to progress made in field if done in phases by major plant process)

Item Number	Description	Responsibility	Weeks A.R.O.	Typical Payment Milestone
38.	30-Day Acceptance Test	Customer	41-45*	10% Upon system installation (proportional to progress made in field if done in phases by major plant process)
39.	Final As-Built Documentation	Emerson	45*	5% Upon system installation (proportional to progress made in field if done in phases by major plant process)
40.	Final acceptance	Customer	49*	10% Retention on all invoices upon Final Acceptance

17.0 SMARTPROCESS DATASHEET.

Note: any reference to document Selling Policy Form B does not apply



SmartProcess™ Optimization Technology Overview for the Water/Wastewater Industry Data Sheet

Features

- **Economic Optimization**
- **Global Performance Advisor**
- **LoopMetrics**
- **Optimization Services**



SmartProcess solutions optimize control and monitoring of plant processes utilizing advanced control techniques, ensuring plant efficiency and decreased operating costs are attained within operational and regulatory limits. By building plant-specific models to simulate process variations and changing conditions, SmartProcess identifies the precise control settings for continuous optimal performance.

The customized SmartProcess plant model incorporates self-learning features that enable it to adapt to long-term changes in the plant. Because SmartProcess solutions are platform independent, they can be integrated into any vendor's distributed control system or PLC network. Emerson is committed to helping our customers increase operating efficiency and reliability through advanced control technologies. Introducing these solutions to the water and wastewater industries is part of Emerson's ongoing effort to provide leading-edge technologies that translate into operational and economic benefits for municipalities of all sizes.

SmartProcess™ Solutions

SmartProcess optimization technology incorporates fuzzy logic, analytics, and predictive control to build customized models of

a single plant unit or all plants within a municipality or city. By using these models to simulate process variations and changing load levels, SmartProcess identifies the precise control settings for continuous performance improvement.

Each solution dynamically optimizes its targeted process, sending new setpoints and biases directly to the control system. SmartProcess can also operate in advisory-only mode, alerting operators to changing settings and taking actions to achieve targeted objectives.

SmartProcess is DCS-platform-independent and can be integrated into any supplier's control system or deployed using other technologies, such as PI by OSIsoft™ or the open industry standard OPC protocol.

Key features of SmartProcess include:

- SmartProcess leverages both linear and non-linear modeling technologies to provide the most accurate type of plant model possible for a dynamic, highly interrelated process.
- Dedicated SmartProcess engineers with significant applications engineering expertise implement SmartProcess solutions. Installation is a total package, which includes initial site assessment

18.0 SURESERVICE DATASHEET

Note: any reference to document Selling Policy Form B does not apply

Data Sheet

SureService™ Customer Support Programs

Support Modules

- Telephone Support
- Remote System Diagnostics
- Internet Information Access
- Scheduled On-Site Service
- Emergency On-Site Service
- Component Coverage
- Classic System Component Support
- Training Programs
- Software Updates
- Ovation Guardian Support
- Ovation Security Center Support
- Cybersecurity Assessment
- Software Archiving
- Online Tutoring
- Application Enrichment
- Optimization Services
- Simulation Update Services
- Scheduled Alarm Management Services



Introduction

SureService™ customer support programs by Emerson enable utilities to customize the right maintenance package for the unique needs of the power generation and water/wastewater treatment industries.

SureService Support

Emerson is committed to the quality of SureService. Our customer service is designed to enable customers to reach their maintenance objectives. Emerson works with the customers to ensure top-quality support and customer satisfaction. SureService contracts can control and reduce plant maintenance costs by selecting various support applications individually or bundling them together to take advantage of maximum savings into one fixed contract price.

Superior Engineering Support

Emerson's SureService team is comprised of highly qualified engineers and support personnel. They are selected for their impressive experience in field installation, startup, excitation control systems and upgrades of Emerson's process control systems.

Each member of the SureService team follows approved support guidelines including customer consultation to discuss any potential impact of recommended system adjustments before any adjustments are made to the customer's control system.

SureService engineers bring a wealth of industry experience having implemented control systems for a wide range of processes including power generation and water/wastewater operations. Trained in the latest process control technologies, SureService

Exhibit B



THE CITY OF SAN DIEGO

GENERAL CONTRACT TERMS AND PROVISIONS

APPLICABLE TO GOODS, SERVICES, AND CONSULTANT CONTRACTS

ARTICLE I

SCOPE AND TERM OF CONTRACT

1.1 Scope of Agreement. The scope of contract between the City and a provider of goods and/or services (Contractor) is described in the Agreement Documents. The Agreement Documents are comprised of the successful bid or proposal; the letter awarding the contract to Contractor; and these General Contract Terms and Provisions.

1.2 Effective Date. A contract between the City and Contractor (Agreement) is effective on the last date that the contract is signed by the parties and approved by the City Attorney in accordance with Charter section 40. Unless otherwise terminated, this Agreement is effective until it is completed or as otherwise agreed upon in writing by the parties, whichever is the earliest. An Agreement term cannot exceed ten (10) years unless approved by the City Council by ordinance.

1.3 Contract Extension. The City may, in its sole discretion, unilaterally exercise an option to extend the Contract as described in the Contract Documents. In addition, the City may, in its sole discretion, unilaterally extend the Contract on a month-to-month basis following contract expiration if authorized under Charter section 99 and the Contract Documents.

1.4 Non-Exclusivity. This Agreement is non-exclusive, and nothing herein shall prevent City from providing for itself or obtaining from any third party, at any time during the Term or thereafter, the Services, or any type of work product or services in any way analogous, similar, or comparable to the Services described herein. Furthermore, nothing in this Agreement shall be construed or interpreted as limiting City's right or ability during the Term to increase or decrease its request for Services hereunder.

ARTICLE II

CONTRACT ADMINISTRATOR

2.1 Contract Administrator. The Purchasing Agent or designee is the Contract Administrator for purposes of this Agreement, and has the responsibilities described in this Agreement, in the San Diego Charter, and in Chapter 2, Article 2, Divisions 5, 30, and 32.

2.1.1 Contractor Performance Evaluations. The Contract Administrator will evaluate Contractor's performance as often as the Contract Administrator deems necessary throughout the term of the contract. This evaluation will be based on criteria including the quality of goods or services, the timeliness of performance, and adherence to applicable laws, including prevailing wage and living wage. City will provide Contractors who receive an unsatisfactory rating with a copy of the evaluation and an opportunity to respond. City may consider final evaluations, including Contractor's response, in evaluating future proposals and bids for contract award.

2.2 Notices. Unless otherwise specified, in all cases where written notice is required under this Agreement, service shall be deemed sufficient if the notice is personally delivered or deposited in the United States mail, with first class postage paid, attention to the Purchasing Agent. Proper

notice is effective on the date of personal delivery or five (5) days after deposit in a United States postal mailbox unless provided otherwise in the Agreement. Notices to the City shall be sent to:

Purchasing Agent
City of San Diego, Purchasing and Contracting Division
1200 3rd Avenue, Suite 200
San Diego, CA 92101-4195

2.3 Governance. City and Contractor shall each appoint a qualified staff member to act as project managers (hereinafter the "Project Managers") for the scope of Services undertaken pursuant to each Task Order issued under this Contract. Each such Project Manager shall (a) act as the principal contact for each of City and Contractor, respectively, (b) ensure that City and Contractor personnel coordinate with each other to achieve the objectives of the Agreement, and (c) manage potential disputes which may arise between the Parties hereto. Contractor agrees to submit written reports, or have such reports submitted to City on the progress of the Services performed under each Task Order as may be requested from time to time by City's Project Manager.

2.4 City Modification of Scope of Services. The City may, without invalidating this Agreement, order changes in any Task by altering, adding or deducting from the scope stipulated in a given Task Order issued under this Agreement. All such changes shall be in writing and shall be performed in accordance with the provisions of this Agreement and as mutually agreed upon. If any such changes cause an increase or decrease in the Task Order's cost of, or the time required for, the performance of the scope stipulated in the Task order, the Contractor shall promptly notify the City. If the City deems it appropriate, an equitable adjustment to the Task Order amount may be made, provided that any adjustment must be approved by both Parties in writing in accordance with applicable provisions of this Agreement

ARTICLE III COMPENSATION

3.1 Manner of Payment. Contractor will be paid monthly, in arrears, for goods and/or services provided in accordance with the terms and provisions specified in the Agreement, or as otherwise mutually agreed upon.

3.2 Invoices.

3.2.1 Invoice Detail. Contractor's invoice must be on Contractor's stationary with Contractor's name, address, and remittance address if different. Contractor's invoice must have a date, an invoice number, a purchase order number, a description and quantity of the goods or services provided, and an amount due.

3.2.2 Service Contracts. Invoices must include the address of the location where services were performed and the dates in which services were provided.

3.2.3 Goods Contracts. Invoices must describe the goods provided.

3.2.4 Parts Contracts. Invoices must include the manufacturer of the part, manufacturer's published list price, percentage discount applied in accordance with Pricing Page(s), the net price to City, and an item description, quantity, and extension.

3.2.5 Extraordinary Work. City will not pay Contractor for extraordinary work unless Contractor receives prior written authorization from the Contract Administrator. Failure to do so will result in payment being withheld for services. If approved, Contractor will include an invoice that describes the work performed and the location where the work was performed, and a copy of the Contract Administrator's written authorization.

3.2.6 Reporting Requirements. Contractor must submit the following reports using the City's web-based contract compliance portal. Incomplete and/or delinquent reports may cause payment delays. For questions, please view the City's online tutorials on how to utilize the City's web-based contract compliance portal.

3.2.6.1 Monthly Employment Utilization Reports. Contractor and Contractor's subcontractors and suppliers must submit Monthly Employment Utilization Reports.

3.2.6.2 Monthly Invoicing and Payments. Contractor must submit Monthly Invoicing and Payment Reports.

3.3 Annual Appropriation of Funds. Contractor acknowledges that the Agreement term may extend over multiple City fiscal years, and that work and compensation under this Agreement is contingent on the City Council appropriating funding for and authorizing such work and compensation for those fiscal years. This Agreement may be terminated at the end of the fiscal year for which sufficient funding is not appropriated and authorized. City is not obligated to pay Contractor for any amounts not duly appropriated and authorized by City Council.

3.4 Disputed Amounts. City may withhold payment of fees or any other charges otherwise due to Contractor under this Agreement to the extent that City disputes such charges in good faith, and shall provide a written explanation for the basis of the withholding. If any disputed amounts are later determined to have been improperly withheld (i.e., properly charged by Contractor), then City shall be obligated to pay the withheld amount in accordance with this Agreement, until paid in full. If any paid amounts are later disputed by City and determined to have been improperly paid (i.e., improperly charged by Contractor), then Contractor shall promptly, but no later than seven (7) days, pay City the improperly paid amount. The failure of City to withhold payment shall not waive any other rights City may have under this Agreement with respect to disputed amounts or overpayments.

ARTICLE IV SUSPENSION AND TERMINATION

4.1 City's Right to Suspend for Convenience. City may suspend all or any portion of Contractor's performance under this Agreement at its sole option and for its convenience for a reasonable period of time not to exceed six (6) months. City must first give ten (10) days' written

notice to Contractor of such suspension. City will pay to Contractor a sum equivalent to the price of the goods and/or services satisfactorily provided up to the date of suspension. City may rescind the suspension prior to or at six (6) months by providing Contractor with written notice of the rescission, at which time Contractor would be required to resume performance in compliance with the terms and provisions of this Agreement. Contractor will be entitled to an extension of time to complete performance under the Agreement equal to the length of the suspension unless otherwise agreed to in writing by the Parties.

4.2 City's Right to Terminate for Convenience. City may, at its sole option and for its convenience, terminate all or any portion of this Agreement by giving thirty (30) days' written notice of such termination to Contractor. The termination of the Agreement shall be effective upon receipt of the notice by Contractor. After termination of all or any portion of the Agreement, Contractor shall immediately discontinue all affected performance (unless the notice directs otherwise). By accepting payment for completion, filing, and delivering documents as called for in this section, Contractor discharges City of all of City's payment obligations under this Agreement for the work performed by Contractor.

4.3 City's Right to Terminate for Default. Contractor's failure to satisfactorily perform any material obligation required by this Agreement, when Contractor fails to cure such failure within thirty (30) days after written notice, constitutes a default. Examples of default include a determination by City that Contractor has: (1) failed to deliver goods and/or perform the services of the required quality or within the time specified; (2) failed to perform any of the obligations of this Agreement; and (3) failed to make sufficient progress in performance which may jeopardize full performance.

4.3.1 If Contractor fails to satisfactorily cure a default within thirty (30) calendar days of receiving written notice from City specifying the nature of the default, City may immediately cancel and/or terminate this Agreement.

4.4 Termination for Bankruptcy or Assignment for the Benefit of Creditors. If Contractor files a voluntary petition in bankruptcy, is adjudicated bankrupt, or makes a general assignment for the benefit of creditors, the City may at its option and without further notice to, or demand upon Contractor, terminate this Agreement.

4.5 Contractor's Right to Payment Following Agreement Termination.

4.5.1 Termination for Convenience. If the termination is for the convenience of City, payment shall be made for the services completed and/or goods delivered by Contractor. No amount shall be allowed for anticipated profit on unperformed services.

4.6 Force Majeure Event

With the exception of the other paragraphs in this Article IV, for the duration of a valid Force Majeure Event, each Party shall continue performing its obligations under this Agreement, and neither party may suspend the provision of their responsibilities as a result of a dispute (including, without limitation, a claim of breach) notwithstanding the existence of a dispute.

For the purposes of this Agreement, a “Force Majeure Event” means a cause beyond the reasonable control of a Party that materially prevents or delays such Party’s performance hereunder (or that materially affects such Party’s need for, ability to effectively utilize, or ability to provide, Services hereunder), including acts of God, act of governmental body or military authority, fire, explosion, power failure, flood, epidemic, riot or civil disturbance, war, sabotage, accidents, civil insurrections, blockades, embargoes, storms, labor disputes (except those involving personnel of Provider, its Affiliates or its Subcontractors), earthquakes, elements of nature, terrorism, rebellions or revolutions in the United States, or other similar events.

4.7 Stop Order & Step in Rights.

City may issue a stop order to direct Contractor to cease performing any Services in the event that City determines that the quality or continuity of any portion of the Services have been materially and adversely affected in any way, or that any such material and adverse effect seems reasonably likely to occur (hereinafter a “**Stop Order**”). Contractor shall not re-commence the performance of any Services until City has issued an approval in writing to lift such Stop Order. The issuance of a Stop Order shall not constitute, nor shall be construed as, a breach of this Agreement (or Services) by City or by Contractor, and shall not be attributable to Contractor as a delay or failure to meet the agreed-upon schedule. A Stop Order may be issued based on the following:

- a. An inability of the Contractor to perform the Services as a result of a Force Majeure Event, a material breach, a change in Contractor’s financial condition or as a result of a merger, acquisition or divestiture of a portion or all of Contractor’s business, or
- b. Upon notice to City of Contractor’s inability to meet a performance milestone, commission of a data breach or violation of its information security and confidentiality obligations, City may issue a stop order to direct Contractor to stop and proceed no further with the performance of the affected scope of Services as described and set forth in such stop order notice.

In such event City shall have the right to step in and have performed such affected scope of Services and to utilize third parties to assist in such performance for the purpose of maintaining or achieving continuity of the Services. Contractor shall ensure that the licenses granted to City shall enable City to utilize the applicable Software and affected portions of the Services for the limited purpose of maintaining continuous delivery of the Services until such time as City determines that Contractor can resume the provision of the Services.

- i. Analysis and Plan to Restore Services. Upon the issuance of a Stop Order Contractor shall under take steps, inclusive of (to the extent applicable) a Root Cause Analysis: (i) to analyze the cause of the events leading to the issuance of the Stop Order; and (ii) to develop a reasonable plan for resuming the Services in such a manner as to eliminate or avoid such effect (and any other negative or adverse consequences), subject to City approval.

4.8 Disentanglement/Termination Assistance

In connection with any expiration or termination of the Agreement, including a termination or expiration of any portion of the Services, Contractor agrees to provide reasonable transition

assistance, as mutually agreed upon, to City, or to any third party providers designated by City, as mutually agreed upon between the Contractor and City, and at the then-current market rates existing as of the expiration or termination date of the Agreement.

ARTICLE V ADDITIONAL CONTRACTOR OBLIGATIONS

5.1 Inspection and Acceptance. The City will inspect and accept goods provided under this Agreement at the destination unless specified otherwise. Inspection will be made and acceptance will be determined by the City department shown in the shipping address of the Purchase Order or other duly authorized representative of City. Inspection and acceptance shall not be unreasonably delayed.

5.2 Responsibility for Lost or Damaged Shipments. Contractor bears the risk of loss or damage to goods prior to the time of their receipt and acceptance while in Contractor's care, custody and control. City has no obligation to accept damaged shipments and reserves the right to return damaged goods, at Contractor's sole expense, even if the damage was not apparent or discovered until after receipt. Contractor will replace damaged goods at their expenses and in a reasonable amount of time.

5.3 Responsibility for Damages. Subject to Section 8.1, Limitation of Liability, Contractor is responsible for property damage that occurs to the extent caused by Contractor's fault or negligence or that of its' employees, agents, or representatives in connection with the performance of this Agreement. Contractor shall immediately report any such damage to people and/or property to the Contract Administrator.

5.4 Delivery. Delivery shall be made on the delivery day specified in the Agreement Documents and as mutually agreed upon. The City, in its sole discretion, may extend the time for delivery. The City may order, in writing, the suspension, delay or interruption of delivery of goods and/or services.

5.5 Delay. Unless otherwise specified herein, time is a material condition for each and every provision of the Agreement. Contractor must immediately notify City in writing if there is, or it is anticipated that there will be, a delay in performance. The written notice must explain the cause for the delay and provide a reasonable estimate of the length of the delay. City may terminate this Agreement as provided herein if City, in its sole discretion, determines the delay is material, provided that Contractor shall be afforded a reasonable time period in which to cure any potential delay prior to termination.

5.5.1 If a delay in performance is caused by any unforeseen event(s) beyond the control of the parties, City may allow Contractor to a reasonable extension of time to complete performance, but Contractor will not be entitled to damages or additional compensation. Any such extension of time must be approved in writing by City, which approval shall not be unreasonably withheld. The following conditions may constitute such a delay: war; changes in law or government regulation; labor disputes; strikes; fires, floods, adverse

weather or other similar condition of the elements necessitating cessation of the performance; inability to obtain materials, equipment or labor; or other specific reasons agreed to between City and Contractor. This provision does not apply to a delay to the extent caused by Contractor's acts or omissions. Contractor is not entitled to an extension of time to perform if a delay is caused by Contractor's inability to obtain materials, equipment, or labor unless City has received, in a timely manner, documentary proof satisfactory to City of Contractor's inability to obtain materials, equipment, or labor, in which case City's approval must be in writing.

5.6 Restrictions and Regulations Requiring Agreement Modification. Contractor shall immediately notify City in writing of any regulations or restrictions that may or will require Contractor to alter the material, quality, workmanship, or performance of the goods and/or services to be provided. City reserves the right to accept any such alteration, including any resulting reasonable price adjustments, or to cancel the Agreement at no expense to the City.

5.7 Warranties. Contractor's performance will be covered by the following warranties. These warranties are exclusive and in lieu of all other warranties whether statutory, express or implied (including all warranties of merchantability and fitness for purpose and all warranties arising from course of dealings or usage of trade). The remedies set forth below, for the time and in the manner provided below, shall be the City's exclusive remedies for failure of Contractor to meet its warranty obligations, whether based in contract, in tort (including negligence or strict liability) or otherwise.

Equipment Software and Service Warranty. For equipment, software and services provided under this Contract, Contractor warrants that the equipment will be free of defects in material, workmanship and title; that the software will be free from errors which materially affect its utility; and that the services provided will reflect competent knowledge and judgment. Contractor's representative will notify the City, in writing, when the Work is complete and within thirty (30) days the City will either accept the Work, or reject it in writing. The warranty for equipment and system software provided directly by Contractor shall expire twelve (12) months after the Work is accepted by the City, not to exceed 18 months following delivery. The warranty for services provided directly by Contractor shall expire two (2) years after the Work is accepted by the City. Absent a written rejection from the City, the Work shall be deemed accepted thirty (30) days following Contractor's written notification. Extended warranties may be provided as mutually agreed upon in any Task Order.

Remedies. In the case of a nonconformity in these warranties and if Contractor is notified in writing of such nonconformity during the applicable warranty period, shall be corrected by, 1) in the case of equipment, replacement or repair (at Contractor's discretion) of defective part(s) F.O.B.'s destination point; 2) in the case of title, defense against claims of title defects; 3) in the case of software, correction, in the medium originally supplied or provision of a procedure to correct material errors; or 4) in the case of service, re-performance of the non-conforming portion of the service. If such remedies are impracticable, Contractor may refund the purchase price for the non-conforming equipment, software, or service. Any warranty specified herein is conditioned upon: a) proper handling, installation and maintenance; b) not having been subject to accident, alteration, abuse or misuse; and c) the City providing necessary access and assistance for Contractor to fulfill its warranty obligations.

5.8 Industry Standards. Contractor shall provide goods and/or services acceptable to City in strict conformance with the Agreement. Contractor shall also provide goods and/or services in accordance with the standards customarily adhered to by an experienced and competent provider of the goods and/or services called for under this Agreement using the degree of care and skill ordinarily exercised by reputable providers of such goods and/or services. Where approval by City, the Mayor, or other representative of City is required, it is understood to be general approval only and does not relieve Contractor of responsibility for complying with all applicable laws, codes, policies, regulations, and good business practices.

5.9 Records Retention and Examination. The City's right to review documents shall be limited to work authorized by task authorization, amendment or other work done on a time and material basis. The review of Contractor's records is to permit the City to verify that Contractor invoices are correct with respect to the number of hours worked and equipment and materials provided, loaned to, or purchased for the City. Such review will be conducted at Contractor's Managed Service Center in San Diego during normal working hours and the City agrees to give Contractor seven (7) days advance notice of this intent to perform such a review. During such a review, the City may verify: a) labor hours incurred under this Agreement by individuals including verification of the nature and amount of work performed by the individuals; b) individual expense account expenses which are charged to this Agreement; c) any applicable purchase orders issued by Contractor in performance of its obligations under this Agreement; d) transportation charges; e) equipment rental or use charges; f) units of Contractor manufactured equipment, computer and peripheral resources; and g) any applicable schedules and workforce reports prepared by Contractor. Contractor agrees to allow the City to inspect similar records prepared by or in possession of its named subcontractors performing work under this Agreement; and will include provisions in its subcontracts to accomplish that effect. Contractor shall maintain such project documents for three years after completion of the Work.

5.10 Quality Assurance Meetings. Upon City's request, Contractor shall schedule one or more quality assurance meetings with City's Contract Administrator to discuss Contractor's performance. If requested, Contractor shall schedule the first quality assurance meeting no later than eight (8) weeks from the date of commencement of work under the Agreement. At the quality assurance meeting(s), City's Contract Administrator will provide Contractor with feedback, will note any deficiencies in Agreement performance, and provide Contractor with an opportunity to address and correct such deficiencies. The total number of quality assurance meetings that may be required by City will depend upon Contractor's performance.

5.11 Duty to Cooperate with Auditor. The City Auditor may, in his sole discretion, at no cost to the City, and for purposes of performing his responsibilities under Charter section 39.2, review Contractor's records as specified herein. Contractor shall make reasonable efforts to cooperate with Auditor's requests.

5.12 Safety Data Sheets. If specified by City in the solicitation or otherwise required by this Agreement, Contractor must send with each shipment one (1) copy of the Safety Data Sheet (SDS) for each item shipped. Failure to comply with this procedure will be cause for immediate termination of the Agreement for violation of safety procedures.

5.13 Project Personnel. Except as formally approved by the City, the key personnel identified in Contractor's bid or proposal shall be the individuals who will actually complete the work. Changes in staffing must be reported in writing and approved by the City.

5.13.1 Criminal Background Certification. Contractor certifies that all employees working on this Agreement have had a criminal background check and that said employees are clear of any sexual and drug related convictions. Contractor further certifies that all employees hired by Contractor or a subcontractor to perform work on City's site shall be free from any felony convictions.

5.13.2 Photo Identification Badge. Contractor shall provide a company photo identification badge to any individual assigned by Contractor or subcontractor to perform services or deliver goods on City premises. Such badge must be worn at all times while on City premises. City reserves the right to require Contractor to pay fingerprinting fees for personnel assigned to work in sensitive areas. All employees shall turn in their photo identification badges to Contractor upon completion of services and prior to final payment of invoice.

5.14 Standards of Conduct. Contractor is responsible for maintaining standards of employee competence, conduct, courtesy, appearance, honesty, and integrity satisfactory to the City.

5.14.1 Supervision. Contractor shall provide adequate and competent supervision at all times during the Agreement term. Contractor shall be readily available to meet with the City. Contractor shall provide the telephone numbers where its representative(s) can be reached.

5.14.2 City Premises. Contractor's employees and agents shall comply with all City rules and regulations while on City premises.

5.14.3 Removal of Employees. City may request Contractor immediately remove from assignment to the City any employee found unfit to perform duties at the City. Contractor shall comply with all such requests.

5.15 Licenses and Permits. Contractor shall, without additional expense to the City, be responsible for obtaining any necessary licenses, permits, certifications, accreditations, fees and approvals for complying with any federal, state, county, municipal, and other laws, codes, and regulations applicable to and required to be held by Contractor for Contractor's performance hereunder. This includes, but is not limited to, any applicable laws or regulations requiring the use of licensed contractors to perform parts of the work.

5.16 Contractor and Subcontractor Registration Requirements. Prior to the award of the Agreement or Task Order, Contractor and Contractor's subcontractors and suppliers must register with the City's web-based vendor registration and bid management system. The City may not award the Agreement until registration of all subcontractors and suppliers is complete. In the event this requirement is not met within the time frame specified by the City, the City reserves the right to rescind the Agreement award and to make the award to the next responsive and responsible proposer of bidder.

ARTICLE VI INTELLECTUAL PROPERTY RIGHTS

6.1 Proprietary Information. Specifications, drawings, data, software and other information transmitted by Contractor to the City in connection with this Agreement are the property of Contractor. Contractor retains for itself all of its intellectual property rights in and to any Contractor product and supporting documentation furnished hereunder. Information marked proprietary shall be disclosed in confidence on a “need to know” basis on the condition that it is not to be reproduced, copied or used for any other purpose than the purpose for which it is provided and shall not be disclosed to third parties without the prior written permission of Contractor. The provisions of this section shall not apply to information with: 1) becomes generally available to the public through no act or fault of the City; ii) is, prior to disclosure hereunder, already in the possession of the City and was not received from Contractor; iii) is hereafter rightfully received from a third party who did not receive the same from Contractor; or iv) is required by law or governmental agency to be disclosed, after the City notifies Contractor of the disclosure requirements and affords Contractor an opportunity to object to and minimize such disclosure.

6.2 Software and Firmware License. Notwithstanding any other provisions herein to the contrary, Contractor or applicable third party owner shall retain all exclusive rights, interests and title to its respective software and firmware. The City’s use of the software and firmware shall be governed exclusively by Contractor’s and/or third party owner’s applicable license terms. The Contractor’s Software License Agreement is included as Exhibit G.

6.3 Rights in Data. If, in connection with the services performed under this Agreement, Contractor or its employees, agents, or subcontractors, create original artwork, audio recordings, blueprints, designs, diagrams, documentation, photographs, plans, reports, software, source code, specifications, surveys, system designs, video recordings, or any other original works of authorship, whether written or readable by machine, to the extent the same is specifically created for the City or at the City’s direction, and to the extent it includes proprietary information of the City, (“Deliverable Materials”), the rights of Contractor or its subcontractors in the Deliverable Materials, including, but not limited to publication, and registration of copyrights, and trademarks in the Deliverable Materials, are the sole property of City. Contractor, including its employees, agents, and subcontractors, may not use any Deliverable Material for purposes unrelated to Contractor’s work on behalf of the City without prior written consent of City. Contractor may not publish or reproduce any Deliverable Materials, for purposes unrelated to Contractor’s work on behalf of the City, without the prior written consent of the City.

6.4 Patents. Contractor shall defend any action brought against the City to the extent based on a claim that any item furnished by it infringes any U.S. patent or copyright and, if notified promptly in writing and given authority and assistance for the defense of same, Contractor shall pay the damages and cost awarded therein against the City. If the use of the item is enjoined, Contractor shall, at its expense and option, either procure for the City the right to continue using it, replace it with a non-infringing item, modify it so it becomes non-infringing, or remove it and refund the purchase price. These provisions do not apply if (1) the item is furnished in accordance with designs supplied by the City that specified the allegedly infringing article, or (2) to the extent any item furnished hereunder is modified or combined by the City or others with items not furnished hereunder and such modification or combination is the basis of the alleged patent or copyright infringement. If a suit or proceeding is brought against Contractor arising out of such design, modification or combination, then the City shall protect Contractor to the same extent that Contractor has agreed to protect the City herein. This is an exclusive statement relating to intellectual property rights and all the remedies of the parties relating thereto.

6.5 Software Licensing. Contractor represents and warrants that the software, if any, as delivered to City, does not contain any program code, virus, worm, trap door, back door, time or clock that would erase data or programming or otherwise cause the software to become inoperable, inaccessible, or incapable of being used in accordance with its user manuals, either automatically, upon the occurrence of licensor-selected conditions or manually on command. Contractor further represents and warrants that all third party software, delivered to City by Contractor or used by Contractor in the performance of the Agreement, is fully licensed by the appropriate licensor.

Contractor shall use industry best practices regularly to identify, screen, and prevent any Disabling Device in resources utilized by Contractor in connection with the provision of the Services and shall not itself knowingly or intentionally install (and shall prevent its Subcontractors from knowingly and intentionally installing) any Disabling Device in resources utilized by Contractor or any Subcontractor, in connection with the provision or receipt of the Services. A "Disabling Device" is a virus, timer, clock, counter, time lock, time bomb, or other limiting design, instruction, or routine that would purposely and inappropriately erase data or programming or cause any resource to become inoperable or otherwise incapable of being used in the full manner for which such resource was designed to be used. Contractor shall assist City in reducing and mitigating the effects of any Disabling Device discovered in any resource related to the provision or receipt of the Services, especially if such Disabling Device is causing a loss of operating efficiency or data. Timers, clocks, counters, and time locks included as part of any commercial software by the manufacturer of that software shall not be considered Disabling Devices for purposes of this Section.

6.6 Publication. Contractor may not publish or reproduce any City Confidential Information, for purposes unrelated to Contractor's work on behalf of the City without prior written consent from the City.

6.7 Royalties, Licenses, and Patents. Unless otherwise specified, Contractor shall pay all royalties, license, and patent fees included with the goods that are the subject of this solicitation.

ARTICLE VII INDEMNIFICATION AND INSURANCE

7.1 Indemnification. Subject to Section 8.1, Limitation of Liability, Contractor shall defend (with legal counsel reasonably acceptable to City), indemnify, protect, and hold harmless City and its elected officials, officers, and employees, (Indemnified Parties) from and against any and all third party claims, losses, costs, damages, injuries (including, injury to or death of an employee of Contractor or its subcontractors), expense, and liability (including, without limitation, court costs, and litigation expenses and fees of expert consultants or expert witnesses incurred in connection therewith and costs of investigation) to the extent caused by the negligent acts, errors or omissions or willful misconduct of Contractor or its subcontractors. Contractor's duty to defend, indemnify, protect and hold harmless shall not include any claims or liabilities arising from the negligence or willful misconduct of the Indemnified Parties.

7.2 Insurance. Contractor shall procure and maintain for the duration of the contract insurance against claims for injuries to persons or damages to property to the extent caused by Contractor in connection with the performance of the work hereunder and the results of that work by Contractor, his agents, representatives, employees or subcontractors.

Contractor shall provide the following:

7.2.1 Commercial General Liability. Insurance Services Office Form CG 00 01 covering CGL on an "occurrence" basis, including products and completed operations, property damage, bodily injury, and personal and advertising injury with limits of \$5,000,000 per occurrence and in the aggregate.

7.2.2 Excess. Excess insurance in the amount of \$5,000,000 aggregate for commercial general liability.

7.2.2 Commercial Automobile Liability. Insurance Services Office Form Number CA 0001 covering Code 1 (any auto) or, if Contractor has no owned autos, Code 8 (hired) and 9 (non-owned), with limits of \$1,000,000 per accident for bodily injury and property damage.

7.2.3 Workers' Compensation. Insurance as required by the State of California, with Statutory Limits, and Employer's Liability Insurance with limit of \$1,000,000 per accident for bodily injury or disease.

7.2.4 Technology E&O insurance to include coverage for Computer Network Security and Privacy Liability with limits of Five Million Dollars (\$5,000,000) per claim and Six Million Dollars (\$6,000,000) aggregate, to the extent caused by Contractor's negligent acts, errors and omissions. Acceptability of insurers for this coverage to be pursuant to Section 7.3 of the Contract.

7.2.5 Other Insurance Provisions. The insurance policies are to contain, or be endorsed to contain, the following provisions:

7.2.5.1 Additional Insured Status. The City, its officers, officials, employees, and volunteers are to be included as additional insureds on the CGL policy to the extent of Contractor's negligent acts, errors or omissions or willful misconduct. General liability coverage can be provided in the form of a blanket additional insured endorsement to Contractor's insurance.

7.2.5.2 Primary Coverage. For any claims related to this contract, Contractor's insurance coverage shall be primary coverage as respects the City, its officers, officials, employees, and volunteers to the extent of Contractor's negligent acts, errors or omissions or willful misconduct. To the extent of Contractor's negligent acts, errors or omissions or willful misconduct, any insurance or self-insurance maintained by City, its officers, officials, employees, or volunteers shall be excess of Contractor's insurance and shall not contribute with it.

7.2.5.3 Waiver of Subrogation. Contractor hereby grants to City a waiver of any right to subrogation which the Workers' Compensation insurer of said Contractor may acquire against City by virtue of the payment of any loss under such insurance.

7.3 Acceptability of Insurers. Insurance is to be placed with insurers with a current A.M. Best's rating of no less than A-VI, unless otherwise acceptable to City.

City will accept insurance provided by non-admitted, "surplus lines" carriers only if the carrier is authorized to do business in the State of California and is included on the List of Approved Surplus Lines Insurers (LASLI list). All policies of insurance carried by non-admitted carriers are subject to all of the requirements for policies of insurance provided by admitted carriers described herein.

Contractor may meet its insurance obligations by any combination of self-insurance, primary and excess coverage.

7.4 Verification of Coverage. Contractor shall furnish City with original certificates effecting coverage required by this clause. All certificates are to be received and approved by City before work commences. However, failure to obtain the required documents prior to the work beginning shall not waive Contractor's obligation to provide them.

7.5 Subcontractors. Contractor shall require and verify that all subcontractors performing work on behalf of Contractor at City's site maintain insurance meeting all the requirements stated herein.

ARTICLE VIII LIMITATION OF LIABILITY AND BONDS

8.1 Limitation of Liability.

THE REMEDIES OF THE CITY SET FORTH IN THIS AGREEMENT ARE EXCLUSIVE. IN NO EVENT, REGARDLESS OF THE FORM OF THE CLAIM OR CAUSE OF ACTION (WHETHER BASED IN CONTRACT, INFRINGEMENT, NEGLIGENCE, STRICT LIABILITY, OTHER TORT OR OTHERWISE), SHALL CONTRACTOR'S LIABILITY EXTEND TO INCLUDE INCIDENTAL, CONSEQUENTIAL OR PUNITIVE DAMAGES. THE TERM "CONSEQUENTIAL DAMAGES" SHALL INCLUDE, BUT NOT BE LIMITED TO, LOSS OF ANTICIPATED PROFITS, REVENUE OR USE AND COSTS INCURRED INCLUDING, WITHOUT LIMITATION, FOR CAPITAL, FUEL AND POWER, AND CLAIMS OF THE CITY'S CUSTOMERS. EXCEPT FOR CONTRACTOR'S OBLIGATIONS TO INDEMNIFY AND DEFEND THE CITY FOR PERSONAL INJURY, BODILY INJURY OR THIRD-PARTY PROPERTY DAMAGES, WHICH IS CAPPED AT \$2,000,000, CONTRACTORS TOTAL LIABILITY ARISING OUT OF OR IN CONNECTION WITH EACH TASK ORDER SHALL NOT EXCEED 200% OF THE VALUE OF THE TASK ORDER FOR WHICH THE CLAIM ARISES.

8.2 Payment and Performance Bond. Prior to the execution of this Agreement, City may require Contractor to post a payment and performance bond (Bond). The Bond shall guarantee

Contractor's faithful performance of this Agreement and assure payment to contractors, subcontractors, and to persons furnishing goods and/or services under this Agreement.

8.2.1 Bond Amount. The Bond shall be in a sum equal to ten percent (10%) of the Agreement amount, unless otherwise stated in the Specifications. City may file a claim against the Bond if Contractor fails or refuses to fulfill the terms and provisions of the Agreement.

8.2.2 Bond Term. The Bond shall remain in full force and effect at least until complete performance of this Agreement and payment of all claims for materials and labor, at which time it will convert to a ten percent (10%) warranty bond, which shall remain in place until the end of the warranty periods set forth in this Agreement. The Bond shall be renewed annually, at least sixty (60) days in advance of its expiration, and Contractor shall provide timely proof of annual renewal to City.

8.2.3 Bond Surety. The Bond must be furnished by a company authorized by the State of California Department of Insurance to transact surety business in the State of California and which has a current A.M. Best rating of at least "A-, VIII."

8.2.4 Non-Renewal or Cancellation. The Bond must provide that City and Contractor shall be provided with sixty (60) days' advance written notice in the event of non-renewal, cancellation, or material change to its terms. In the event of non-renewal, cancellation, or material change to the Bond terms, Contractor shall provide City with evidence of the new source of surety within twenty-one (21) calendar days after the date of the notice of non-renewal, cancellation, or material change. Failure to maintain the Bond, as required herein, in full force and effect as required under this Contract, will be a material breach of the Agreement subject to termination of the Agreement.

8.2 Alternate Security. City may, at its sole discretion, accept alternate security in the form of an endorsed certificate of deposit, a money order, a certified check drawn on a solvent bank, or other security acceptable to the Purchasing Agent in an amount equal to the required Bond.

ARTICLE IX CITY-MANDATED CLAUSES AND REQUIREMENTS

9.1 Contractor Certification of Compliance. By signing this Agreement, Contractor certifies that Contractor is aware of, and will comply with, these City-mandated clauses throughout the duration of the Agreement.

9.1.1 Drug-Free Workplace Certification. Contractor shall comply with City's Drug-Free Workplace requirements set forth in Council Policy 100-17, which is incorporated into the Agreement by this reference.

9.1.2 Contractor Certification for Americans with Disabilities Act (ADA) and State Access Laws and Regulations: Contractor shall comply with all applicable accessibility requirements under the ADA and under Title 24 of the California Code of Regulations (Title 24). When a conflict exists between the ADA and Title 24, Contractor shall comply with the most restrictive requirement (i.e., that which provides the most access). Contractor also shall comply with the applicable provisions of the City's ADA Compliance/City Contractors requirements as

set forth in Council Policy 100-04, which is incorporated into this Agreement by reference. Contractor warrants and certifies compliance with all applicable federal and state access laws and regulations and further certifies that any subcontract agreement for this contract contains language which indicates the subcontractor's agreement to abide by the provisions of the City's Council Policy and any applicable access laws and regulations.

9.1.3 Non-Discrimination Requirements.

9.1.3.1 Compliance with City's Equal Opportunity Contracting Program (EOCP). Contractor shall comply with City's EOCP Requirements, if applicable. Contractor shall not discriminate against any employee or applicant for employment on any basis prohibited by law. Contractor shall provide equal opportunity in all employment practices. Prime Contractors shall ensure that their subcontractors comply with this program. Nothing in this Section shall be interpreted to hold a Prime Contractor liable for any discriminatory practice of its subcontractors.

9.1.3.2 Non-Discrimination Ordinance. Contractor shall not discriminate on the basis of race, gender, gender expression, gender identity, religion, national origin, ethnicity, sexual orientation, age, or disability in the solicitation, selection, hiring or treatment of subcontractors, vendors or suppliers. Contractor shall provide equal opportunity for subcontractors to participate in subcontracting opportunities. Contractor understands and agrees that violation of this clause shall be considered a material breach of the Agreement and may result in Agreement termination, debarment, or other sanctions. Contractor shall ensure that this language is included in contracts between Contractor and any subcontractors, vendors and suppliers.

9.1.4 Equal Benefits Ordinance Certification. Unless an exception applies, Contractor shall comply with the Equal Benefits Ordinance (EBO) codified in the San Diego Municipal Code (SDMC). Failure to maintain equal benefits is a material breach of the Agreement.

9.1.5 Contractor Standards. Contractor shall comply with Contractor Standards provisions codified in the SDMC. Contractor understands and agrees that violation of Contractor Standards may be considered a material breach of the Agreement and may result in Agreement termination, debarment, and other sanctions.

9.1.6 Noise Abatement. Contractor shall operate, conduct, or construct without violating the City's Noise Abatement Ordinance codified in the SDMC.

9.1.7 Storm Water Pollution Prevention Program. Contractor shall comply with the City's Storm Water Management and Discharge Control provisions codified in Division 3 of Chapter 4 of the SDMC, as may be amended, to the extent applicable, and any and all applicable Best Management Practice guidelines and pollution elimination requirements in performing or delivering services at City owned, leased, or managed property.

Contractor shall comply with the City's Jurisdictional Urban Runoff Management Plan encompassing Citywide programs and activities designed to prevent and reduce storm water pollution within City boundaries as adopted by the City Council on January 22, 2008, via Resolution No. 303351, as may be amended, to the extent applicable.

Contractor shall comply with each City facility or work site's Storm Water Pollution Prevention Plan, as applicable, and institute all applicable controls needed while completing the services to minimize any negative impact to the storm water collection system and environment.

9.1.8 Service Worker Retention Ordinance. If applicable, Contractor shall comply with the Service Worker Retention Ordinance (SWRO) codified in the SDMC.

9.1.9 Product Endorsement. Contractor shall comply with Council Policy 000-41 concerning product endorsement which requires that any advertisement referring to City as a user of a good or service will require the prior written approval of the Mayor.

9.1.10 Business Tax Certificate. Unless the City Treasurer determines in writing that a contractor is exempt from the payment of business tax, any contractor doing business with the City of San Diego is required to obtain a Business Tax Certificate (BTC) and to provide a copy of its BTC to the City before a Agreement is executed.

9.1.11 Equal Pay Ordinance. Unless an exception applies, Contractor shall comply with the Equal Pay Ordinance codified in San Diego Municipal Code sections 22.4801 through 22.4809. Contractor shall certify in writing that it will comply with the requirements of the Equal Pay Ordinance throughout the duration of the Agreement.

9.1.11.1 Contractor and Subcontract Requirement. The Equal Pay Ordinance applies to any subcontractor who performs work on behalf of a Contractor to the same extent as it would apply to that Contractor. Contractor shall require subcontractors performing work for Contractor on the City's site under their contract with the City to certify compliance with the Equal Pay Ordinance in their written subcontracts.

9.1.11.2 Notice Requirement. Contractor must post a notice informing its employees of their rights under the Equal Pay Ordinance in their workplace or job site.

ARTICLE X CONFLICT OF INTEREST AND VIOLATIONS OF LAW

10.1 Conflict of Interest Laws. Contractor is subject to all applicable federal, state and local conflict of interest laws, regulations, and policies applicable to public contracts and procurement practices including, but not limited to, California Government Code sections 1090, *et. seq.* and 81000, *et. seq.*, and the Ethics Ordinance, codified in the SDMC. City may determine that Contractor must complete one or more statements of economic interest disclosing relevant financial interests. Upon City's request, Contractor shall submit the necessary documents to City.

10.2 Contractor's Responsibility for Employees and Agents. Contractor is required to establish and make known to its employees and agents appropriate safeguards to prohibit employees from using their positions for a purpose that is, or that gives the appearance of being, motivated by the desire for private gain for themselves or others, particularly those with whom they have family, business or other relationships.

10.3 Contractor's Financial or Organizational Interests. In connection with any task, Contractor shall not recommend or specify any product, supplier, or contractor with whom Contractor has a direct or indirect financial or organizational interest or relationship that would violate conflict of interest laws, regulations, or policies.

10.4 Certification of Non-Collusion. Contractor certifies that: (1) Contractor's bid or proposal was not made in the interest of or on behalf of any person, firm, or corporation not identified; (2) Contractor did not directly or indirectly induce or solicit any other bidder or proposer to put in a sham bid or proposal; (3) Contractor did not directly or indirectly induce or solicit any other person, firm or corporation to refrain from bidding; and (4) Contractor did not seek by collusion to secure any advantage over the other bidders or proposers.

10.5 Hiring City Employees. This Agreement shall be unilaterally and immediately terminated by City if Contractor knowingly employs an individual who within the twelve (12) months immediately preceding such employment did in his/her capacity as a City officer or employee participate in negotiations with or otherwise have an influence on the selection of Contractor.

ARTICLE XI DISPUTE RESOLUTION

11.1 Mediation. If a dispute arises out of or relates to this Agreement and cannot be settled through normal contract negotiations, Contractor and City shall use mandatory non-binding mediation before having recourse in a court of law.

11.2 Selection of Mediator. A single mediator that is acceptable to both parties shall be used to mediate the dispute. The mediator will be knowledgeable in the subject matter of this Agreement, if possible.

11.3 Expenses. The expenses of witnesses for either side shall be paid by the party producing such witnesses. All other expenses of the mediation, including required traveling and other expenses of the mediator, and the cost of any proofs or expert advice produced at the direct request of the mediator, shall be borne equally by the parties, unless they agree otherwise.

11.4 Conduct of Mediation Sessions. Mediation hearings will be conducted in an informal manner and discovery will not be allowed. The discussions, statements, writings and admissions will be confidential to the proceedings (pursuant to California Evidence Code sections 1115 through 1128) and will not be used for any other purpose unless otherwise agreed by the parties in writing. The parties may agree to exchange any information they deem necessary. Both parties shall have a representative attend the mediation who is authorized to settle the dispute, though City's recommendation of settlement may be subject to the approval of the Mayor and City Council. Either party may have attorneys, witnesses or experts present.

11.5 Mediation Results. Any agreements resulting from mediation shall be memorialized in writing. The results of the mediation shall not be final or binding unless otherwise agreed to in writing by the parties. Mediators shall not be subject to any subpoena or liability, and their actions shall not be subject to discovery.

ARTICLE XII MANDATORY ASSISTANCE

12.1 Mandatory Assistance. If a third party dispute or litigation, or both, arises out of, or relates in any way to the services provided to the City under a Agreement, Contractor , its agents, officers, and employees agree to reasonably assist in resolving the dispute or litigation upon City's request. Contractor's assistance includes, but is not limited to, providing professional consultations, attending mediations, arbitrations, depositions, trials or any event related to the dispute resolution and/or litigation.

12.2 Compensation for Mandatory Assistance. City will compensate Contractor for fees incurred for providing Mandatory Assistance. If, however, the fees incurred for the Mandatory Assistance are determined, through resolution of the third party dispute or litigation, or both, to be attributable to the negligent acts or omissions of Contractor, its agents, officers, and employees, Contractor shall reimburse City for such fees paid to Contractor, its agents, officers, and employees for Mandatory Assistance, to the extent such fees are attributable to Contractor's negligent acts or omissions.

12.3 Attorneys' Fees Related to Mandatory Assistance. In providing City with dispute or litigation assistance, Contractor or its agents, officers, and employees may incur expenses and/or costs. Contractor agrees that any attorney fees it may incur as a result of assistance provided under Section 12.2 are not reimbursable.

ARTICLE XIII MISCELLANEOUS

13.1 Headings. All headings are for convenience only and shall not affect the interpretation of this Agreement.

13.2 Non-Assignment. Neither party shall assign the obligations under this Agreement, whether by express assignment or by sale of the company, nor any monies due or to become due under this Agreement, without the other party's prior written approval. Any assignment in violation of this paragraph shall constitute a default and is grounds for termination of this Agreement. In no event shall any putative assignment create a contractual relationship between City and any putative assignee.

13.3 Independent Contractors. Contractor and any subcontractors employed by Contractor are independent contractors and not agents of City. Any provisions of this Agreement that may appear to give City any right to direct Contractor concerning the details of performing or providing the goods and/or services, or to exercise any control over performance of the Agreement, shall mean only that Contractor shall follow the direction of City concerning the end results of the performance, consistent with the Scope of Work and this Contract.

13.4 Subcontractors. All persons assigned to perform any work on behalf of Contractor under this Agreement, including any subcontractors, are deemed to be representatives of Contractor, and Contractor shall be solely and exclusively responsible for supervising the activities and performance of its Subcontractor and for all acts or omission of such subcontractors to the same extent it is responsible for its own acts and omissions under this Contract.. At all times, the

Contractor shall be liable and responsible as a principal for the performance of all of the duties and obligations that Contractor may elect to subcontract, and for its Subcontractor's compliance with the terms of this Agreement.

Contractor shall not subcontract all or any part of the Services to be performed on the City's site without the prior written consent of City in each instance. City may also request the removal of any Contractor subcontractor whose performance or conduct it deems unsatisfactory, and Contractor shall promptly replace such Subcontractor, and City shall not be subject to an adverse fee increase in the event that a Subcontractor is replaced due to unsatisfactory performance or conduct.

13.5 Covenants and Conditions. All provisions of this Agreement expressed as either covenants or conditions on the part of City or Contractor shall be deemed to be both covenants and conditions.

13.6 Compliance with Controlling Law. Contractor shall comply with all applicable local, state, and federal laws, regulations, and policies. Contractor's act or omission in violation of applicable local, state, and federal laws, regulations, and policies is grounds for contract termination. Subject to Section 8.1 Limitation of Liability, Contractor is liable to City for direct damages to the extent caused by Contractor's violation of applicable law. In addition, Contractor may be subject to suspension, debarment, or both.

13.7 Governing Law. The Agreement shall be deemed to be made under, construed in accordance with, and governed by the laws of the State of California without regard to the conflicts or choice of law provisions thereof.

13.8 Venue. The venue for any suit concerning solicitations or the Agreement, the interpretation of application of any of its terms and conditions, or any related disputes shall be in the County of San Diego, State of California.

13.9 Successors in Interest. This Agreement and all rights and obligations created by this Agreement shall be in force and effect whether or not any parties to the Agreement have been succeeded by another entity, and all rights and obligations created by this Agreement shall be vested and binding on any party's successor in interest.

13.10 No Waiver. No failure of either City or Contractor to insist upon the strict performance by the other of any covenant, term or condition of this Agreement, nor any failure to exercise any right or remedy consequent upon a breach of any covenant, term, or condition of this Agreement, shall constitute a waiver of any such breach of such covenant, term or condition. No waiver of any breach shall affect or alter this Agreement, and each and every covenant, condition, and term hereof shall continue in full force and effect without respect to any existing or subsequent breach.

13.11 Severability. The unenforceability, invalidity, or illegality of any provision of this Agreement shall not render any other provision of this Agreement unenforceable, invalid, or illegal.

13.12 Drafting Ambiguities. The parties acknowledge that they have the right to be advised by legal counsel with respect to the negotiations, terms and conditions of this Agreement, and the decision of whether to seek advice of legal counsel with respect to this Agreement is the sole responsibility of each party. This Agreement shall not be construed in favor of or against either party by reason of the extent to which each party participated in the drafting of the Agreement.

13.13 Amendments. Neither this Agreement nor any provision hereof may be changed, modified, amended or waived except by a written agreement executed by duly authorized representatives of City and Contractor. Any alleged oral amendments have no force or effect. The Purchasing Agent must sign all Agreement amendments.

13.14 Conflicts Between Terms. If this Agreement conflicts with an applicable local, state, or federal law, regulation, or court order, applicable local, state, or federal law, regulation, or court order shall control. Each party shall notify the other immediately upon the identification of any apparent conflict or inconsistency concerning this Agreement.

13.15 Survival of Obligations. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with this Agreement, as well as all continuing obligations indicated in this Agreement, to the extent they are intended to survive, shall survive, completion and acceptance of performance and termination, expiration or completion of the Agreement for the period set forth herein.

13.16 Confidentiality of Services. All services performed by Contractor, and any subcontractor(s) if applicable, including but not limited to all drafts, data, information, correspondence, proposals, reports of any nature, estimates compiled or composed by Contractor, and to the extent it contains City's Confidential Information, are for the sole use of City, its agents, and employees. Neither the documents nor their contents shall be released by Contractor or any subcontractor to any third party without the prior written consent of City. This provision does not apply to information that: (1) was publicly known, or otherwise known to Contractor, at the time it was disclosed to Contractor by City; (2) subsequently becomes publicly known through no act or omission of Contractor; or (3) otherwise becomes known to Contractor other than through disclosure by City.

13.17 Insolvency. If Contractor enters into proceedings relating to bankruptcy, whether voluntary or involuntary, Contractor agrees to furnish, by certified mail or electronic commerce method authorized by the Agreement, written notification of the bankruptcy to the Purchasing Agent and the Contract Administrator responsible for administering the Agreement. This notification shall be furnished within five (5) days of the initiation of the proceedings relating to bankruptcy filing. This notification shall include the date on which the bankruptcy petition was filed, the identity of the court in which the bankruptcy petition was filed, and a listing of City contract numbers and contracting offices for all City contracts against which final payment has not been made. This obligation remains in effect until final payment is made under this Agreement.

13.18 No Third Party Beneficiaries. Except as may be specifically set forth in this Agreement, none of the provisions of this Agreement are intended to benefit any third party not specifically referenced herein. No party other than City and Contractor shall have the right to enforce any of the provisions of this Agreement.

January 14, 2020

VIA EMAIL: Christina.Spangler@Emerson.com

ATTN: Christina A. Spangler
Emerson Process Management Power & Water Solutions, Inc.
200 Beta Drive
Pittsburg, PA 15238

Reference: Equal Employment Opportunity (EEO) Plan Approval

Dear Christina A. Spangler,

This office has reviewed your firm's equal employment opportunity policies and practices and has determined the following:

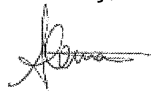
Subject to the commitments detailed in your Equal Employment Opportunity (EEO) Plan, it is the determination of this office that your Plan meets the requirements of the City's Equal Opportunity Contracting Program and **is hereby approved** as of **January 14, 2020**.

Your Plan will be maintained in this office and will be reviewed each time your firm seeks a contract with the City of San Diego. Although under representations were noted within your work force, your Plan is approved because the equal employment policies and practices and outreach efforts described in your Plan are expected to remedy the deficiencies in your work force. Be advised that this office will review and compare this EEO Plan with future work force reports and EEO Plans to determine if progress has been made in correcting those under representations. Please note that any clarifications or revisions made via email in companion with the submitted EEO plan must be incorporated in any future EEO plans submitted to the City of San Diego.

The City of San Diego appreciates your cooperation in our mutual efforts to secure equal employment opportunities to all, including people of color and women.

If you have any questions, please feel free to contact me at (619) 236-6064.

Sincerely,



Maria Aleman
Contract Compliance Officer, Equal Opportunity Contracting

EXHIBIT C
CITY REQUIRED FORMS

1. Contractor Standards Pledge of Compliance
2. Contractors Certification of Pending Actions and Work Force Report

City of San Diego
CONTRACTOR STANDARDS
Pledge of Compliance

The City of San Diego has adopted a Contractor Standards Ordinance (CSO) codified in section 22.3004 of the San Diego Municipal Code (SDMC). The City of San Diego uses the criteria set forth in the CSO to determine whether a contractor (bidder or proposer) has the capacity to fully perform the contract requirements and the business integrity to justify the award of public funds. This completed Pledge of Compliance signed under penalty of perjury must be submitted with each bid and proposal. If an informal solicitation process is used, the bidder must submit this completed Pledge of Compliance to the City prior to execution of the contract. All responses must be typewritten or printed in ink. If an explanation is requested or additional space is required, Contractors must provide responses on Attachment A to the Pledge of Compliance and sign each page. Failure to submit a signed and completed Pledge of Compliance may render a bid or proposal non-responsive. In the case of an informal solicitation or cooperative procurement, the contract will not be awarded unless a signed and completed Pledge of Compliance is submitted. A submitted Pledge of Compliance is a public record and information contained within will be available for public review except to the extent that such information is exempt from disclosure pursuant to applicable law.

By signing and submitting this form, the contractor is certifying, to the best of their knowledge, that the contractor and any of its Principals have not within a five (5) year period – preceding this offer, been convicted of or had a civil judgement rendered against them for commission of a fraud or a criminal offense in connection with obtaining, attempting to obtain or performing a public (Federal, State or local) contract or subcontract.

"Principal" means an officer, director, owner, partner or a person having primary management or supervisory responsibilities within the firm. The Contractor shall provide immediate written notice to the Procurement Contracting Officer handling the solicitation, at any time prior to award should they learn that this Representations and Certifications was inaccurate or incomplete.

This form contains 10 pages, additional information may be submitted as part of *Attachment A*.

A. BID/PROPOSAL/SOLICITATION TITLE:

Master Agreement

B. BIDDER/PROPOSER INFORMATION:

<u>Emerson Process Management Power & Water Solutions, Inc.</u>		<u>N/A</u>	
<u>Legal Name</u>		<u>DBA</u>	
<u>200 Beta Drive</u>	<u>Pittsburgh</u>	<u>PA</u>	<u>15238</u>
<u>Street Address</u>	<u>City</u>	<u>State</u>	<u>Zip</u>
<u>Kyle Lynch, Director, North America Project Proposals</u>	<u>412-963-4003</u>	<u>412-963-4063</u>	
<u>Contact Person, Title</u>	<u>Phone</u>	<u>Fax</u>	

Provide the name, identity, and precise nature of the interest* of all persons who are directly or indirectly involved** in this proposed transaction (SDMC § 21.0103). Use additional pages if necessary.

* The precise nature of the interest includes:

- the percentage ownership interest in a party to the transaction,
- the percentage ownership interest in any firm, corporation, or partnership that will receive funds from the transaction,
- the value of any financial interest in the transaction,
- any contingent interest in the transaction and the value of such interest should the contingency be satisfied, and
- any philanthropic, scientific, artistic, or property interest in the transaction.

** Directly or indirectly involved means pursuing the transaction by:

- communicating or negotiating with City officers or employees,
- submitting or preparing applications, bids, proposals or other documents for purposes of contracting with the City, or
- directing or supervising the actions of persons engaged in the above activity.

Susan Long	Director, Commercial Operations
Name	Title/Position
Pittsburgh, PA	
City and State of Residence	Employer (if different than Bidder/Proposer)
Directing or supervising the actions of persons engaged in the above activity	
Interest in the transaction	

Kyle Lynch	Director, North America Project Proposals
Name	Title/Position
Pittsburgh, PA	
City and State of Residence	Employer (if different than Bidder/Proposer)
Directing or supervising the actions of persons engaged in the above activity	
Interest in the transaction	

Michael Brown	Manager, Lifecycle Proposals
Name	Title/Position
Pittsburgh, PA	
City and State of Residence	Employer (if different than Bidder/Proposer)
Directing or supervising the actions of persons engaged in the above activity	
Interest in the transaction	

Doug Adair	West Region Sales Manager
Name	Title/Position
Riverside, CA	
City and State of Residence	Employer (if different than Bidder/Proposer)
Directing or supervising the actions of persons engaged in the above activity	
Interest in the transaction	

Name	Title/Position
City and State of Residence	Employer (if different than Bidder/Proposer)
Interest in the transaction	

Name	Title/Position
City and State of Residence	Employer (if different than Bidder/Proposer)
Interest in the transaction	

Name	Title/Position
City and State of Residence	Employer (if different than Bidder/Proposer)
Interest in the transaction	

Name	Title/Position
City and State of Residence	Employer (if different than Bidder/Proposer)
Interest in the transaction	

Name	Title/Position
City and State of Residence	Employer (if different than Bidder/Proposer)
Interest in the transaction	

C. OWNERSHIP AND NAME CHANGES:

1. In the past five (5) years, has your firm changed its name?

Yes ☒ **No** To the best of our knowledge.

If **Yes**, use Attachment A to list all prior legal and DBA names, addresses, and dates each firm name was used. Explain the specific reasons for each name change.

2. Is your firm a non-profit?

Yes ☐ **No** ☒

If **Yes**, attach proof of status to this submission.

3. In the past five (5) years, has a firm owner, partner, or officer operated a similar business?

Yes ☒ **No** To the best of our knowledge.

If **Yes**, use Attachment A to list names and addresses of all businesses and the person who operated the business. Include information about a similar business only if an owner, partner, or officer of your firm holds or has held a similar position in another firm.

D. BUSINESS ORGANIZATION/STRUCTURE:

Indicate the organizational structure of your firm. Fill in only one section on this page. Use Attachment A if more space is required.

Corporation Date incorporated: 1998 State of incorporation: Delaware

List corporation's current officers: President: Robert Yeager
 Vice Pres: _____
 Secretary: Dustin Eaton, General Counsel
 Treasurer: _____

Type of corporation: ☒ Subchapter S ☐ _____

Is the corporation authorized to do business in California: ☒ **Yes** ☐ **No**

If **Yes**, after what date: 02/28/2000

Is your firm a publicly traded corporation?

Yes

☒ No We are a wholly-owned subsidiary of a publically traded company

If **Yes**, how and where is the stock traded? _____

If **Yes**, list the name, title and address of those who own ten percent (10 %) or more of the corporation's stocks:

Please see <https://www.emerson.com/en-us/investors/investor-resources/shareholder-information>

Do the President, Vice President, Secretary and/or Treasurer of your corporation have a third party interest or other financial interests in a business/enterprise that performs similar work, services or provides similar goods? **Yes**

☒ No To the best of our knowledge.

If **Yes**, please use Attachment A to disclose.

Please list the following:

Authorized

Issued

Outstanding

- | | | | | |
|----|----------------------------------|-------|--------|----------|
| a. | Number of voting shares: | _____ | | |
| b. | Number of nonvoting shares: | _____ | | |
| c. | Number of shareholders: | _____ | | |
| d. | Value per share of common stock: | | Par | \$ _____ |
| | | | Book | \$ _____ |
| | | | Market | \$ _____ |

Limited Liability Company Date formed: _____ State of formation: _____

List the name, title and address of members who own ten percent (10%) or more of the company:

Partnership Date formed: _____ State of formation: _____

List names of all firm partners:

Sole Proprietorship Date started: _____

List all firms you have been an owner, partner or officer with during the past five (5) years. Do not include ownership of stock in a publicly traded company:

Joint Venture Date formed: _____

List each firm in the joint venture and its percentage of ownership:

Note: To be responsive, each member of a Joint Venture or Partnership must complete a separate *Contractor Standards*

form. **E. FINANCIAL RESOURCES AND RESPONSIBILITY:**

1. Is your firm preparing to be sold, in the process of being sold, or in negotiations to be sold?

Yes ☒ No

If **Yes**, use Attachment A to explain the circumstances, including the buyer's name and principal contact information.

2. In the past five (5) years, has your firm been denied bonding?

Yes ☒ To the best of our knowledge.

If **Yes**, use Attachment A to explain specific circumstances; include bonding company name.

3. In the past five (5) years, has a bonding company made any payments to satisfy claims made against a bond issued on your firm's behalf or a firm where you were the principal?

Yes ☒ To the best of our knowledge.

If **Yes**, use Attachment A to explain specific circumstances.

4. In the past five (5) years, has any insurance carrier, for any form of insurance, refused to renew the insurance policy for your firm?

Yes ☒ To the best of our knowledge.

If **Yes**, use Attachment A to explain specific circumstances.

5. Within the last five years, has your firm filed a voluntary petition in bankruptcy, been adjudicated bankrupt, or made a general assignment for the benefit of creditors?

Yes ☒ To the best of our knowledge.

If **Yes**, use Attachment A to explain specific circumstances.

6. Are there any claims, liens or judgements that are outstanding against your firm?

Yes ☒ Not in the relevant jurisdiction, nor which would adversely impact the relevant transactions.

If **Yes**, please use Attachment A to provide detailed information on the action.

7. Please provide the name of your principal financial institution for financial reference. By submitting a response to this Solicitation Contractor authorizes a release of credit information for verification of financial responsibility.

Name of Bank: JP Morgan Chase

Point of Contact: Robert Bracero

Address: 300 South Riverside Chicago, IL 60606

Phone Number: 312-954-5059

8. By submitting a response to a City solicitation, Contractor certifies that he or she has sufficient operating capital and/or financial reserves to properly fund the requirements identified in the solicitation. At City's request, Contractor will promptly provide to City

a copy of Contractor's most recent balance sheet and/or other necessary financial statements to substantiate financial ability to perform.

9. In order to do business in the City of San Diego, a current Business Tax Certificate is required. Business Tax Certificates are issued by the City Treasurer's Office. If you do not have one at the time of submission, one must be obtained prior to award.

Business Tax Certificate No.: 2004006429 Year Issued: _____

F. PERFORMANCE HISTORY:

1. In the past five (5) years, has your firm been found civilly liable, either in a court of law or pursuant to the terms of a settlement agreement, for defaulting or breaching a contract with a government agency?

Yes ☒ No ☐ To the best of our knowledge.

If **Yes**, use Attachment A to explain specific circumstances.

2. In the past five (5) years, has a public entity terminated your firm's contract for cause prior to contract completion?

Yes ☒ No ☐ To the best of our knowledge.

If **Yes**, use Attachment A to explain specific circumstances and provide principal contact information.

3. In the past five (5) years, has your firm entered into any settlement agreement for any lawsuit that alleged contract default, breach of contract, or fraud with or against a public entity?

Yes ☒ No ☐ To the best of our knowledge.

If **Yes**, use Attachment A to explain specific circumstances.

4. Is your firm currently involved in any lawsuit with a government agency in which it is alleged that your firm has defaulted on a contract, breached a contract, or committed fraud?

Yes ☒ No ☐ To the best of our knowledge.

If **Yes**, use Attachment A to explain specific circumstances.

5. In the past five (5) years, has your firm, or any firm with which any of your firm's owners, partners, or officers is or was associated, been debarred, disqualified, removed, or otherwise prevented from bidding on or completing any government or public agency contract for any reason?

Yes ☒ No ☐ To the best of our knowledge.

If **Yes**, use Attachment A to explain specific circumstances.

6. In the past five (5) years, has your firm received a notice to cure or a notice of default on a contract with any public agency?

Yes ☒ No ☐ To the best of our knowledge.

If **Yes**, use Attachment A to explain specific circumstances and how the matter resolved.

7. Performance References:

Please provide a minimum of three (3) references familiar with work performed by your firm which was of a similar size and nature to the subject solicitation within the last five (5) years.

Please note that any references required as part of your bid/proposal submittal are in addition to those references required as part of this form.

Company Name: Great Lakes Water Authority

Contact Name and Phone Number: Andrae Savage 313-926-8133

Contact Email: andrae.savage@glwater.org

Address: 3GLWA 10100 East Jefferson, Detroit, MI 48214

Contract Date: On-going

Contract Amount: \$175M

GLWA maintains several of Emerson's support modules including telephone support, remote system
Requirements of Contract: diagnostics, PWCS support, and software updates.

Company Name: King County Department of Nature Resources and Parks

Contact Name and Phone Number: Dave Jurgens 206-263-1786

Contact Email: david.jurgens@kingcounty.gov

Address: South Treatment Plant, 1200 Monster Rd. SW Rm 100, Renton, WA 98057

Contract Date: On-going

Contract Amount: \$50M

King County maintains several of Emerson's support modules including telephone support, remote
Requirements of Contract: support, scheduled on-site service, guardian support, and more.

Company Name: MWRDGC

Contact Name and Phone Number: Scott Owen 708-588-3218

Contact Email: scott.owen@mwrdr.org

Address: 6001 W. Pershing Road

Contract Date: On-going

Contract Amount: _____

Requirements of Contract: Recent wastewater treatment control project

G. COMPLIANCE:

1. In the past five (5) years, has your firm or any firm owner, partner, officer, executive, or manager been criminally penalized or found civilly liable, either in a court of law or pursuant to the terms of a settlement agreement, for violating any federal, state, or local law in performance of a contract, including but not limited to, laws regarding health and safety, labor and employment, permitting, and licensing laws?

Yes

☒ No

To the best of our knowledge.

If **Yes**, use Attachment A to explain specific circumstances surrounding each instance. Include the name of the entity involved, the specific infraction(s) or violation(s), dates of instances, and outcome with current status.

2. In the past five (5) years, has your firm been determined to be non-responsible by a public entity?

Yes

☒ No

To the best of our knowledge.

If **Yes**, use Attachment A to explain specific circumstances of each instance. Include the name of the entity involved, the specific infraction, dates, and outcome.

H. BUSINESS INTEGRITY:

1. In the past five (5) years, has your firm been convicted of or found liable in a civil suit for making a false claim or material misrepresentation to a private or public entity?

Yes ☒ **No** To the best of our knowledge.

If **Yes**, use Attachment A to explain specific circumstances of each instance. Include the entity involved, specific violation(s), dates, outcome and current status.

2. In the past five (5) years, has your firm or any of its executives, management personnel, or owners been convicted of a crime, including misdemeanors, or been found liable in a civil suit involving the bidding, awarding, or performance of a government contract?

Yes ☒ **No** To the best of our knowledge.

If **Yes**, use Attachment A to explain specific circumstances of each instance; include the entity involved, specific infraction(s), dates, outcome and current status.

3. In the past five (5) years, has your firm or any of its executives, management personnel, or owners been convicted of a federal, state, or local crime of fraud, theft, or any other act of dishonesty?

Yes ☒ **No** To the best of our knowledge.

If **Yes**, use Attachment A to explain specific circumstances of each instance; include the entity involved, specific infraction(s), dates, outcome and current status.

4. Do any of the Principals of your firm have relatives that are either currently employed by the City or were employed by the City in the past five (5) years?

Yes ☒ **No** To the best of our knowledge.

If **Yes**, please disclose the names of those relatives in Attachment A.

I. BUSINESS REPRESENTATION:

1. Are you a local business with a physical address within the County of San Diego?

☒ **Yes** ☐ **No**

2. Are you a certified Small and Local Business Enterprise certified by the City of San Diego?

Yes ☒ **No**

Certification #

3. Are you certified as any of the following:

a. Disabled Veteran Business Enterprise Certification # N/A

b. Woman or Minority Owned Business Enterprise Certification # N/A

c. Disadvantaged Business Enterprise Certification # N/A

J. WAGE COMPLIANCE:

In the past five (5) years, has your firm been required to pay back wages or penalties for failure to comply with the federal, state or local **prevailing, minimum, or living wage laws**? **Yes** ☒ **No** If **Yes**, use Attachment A to explain the specific circumstances of each instance. Include the entity involved, the specific infraction(s), dates, outcome, and current status.

By signing this Pledge of Compliance, your firm is certifying to the City that you will comply with the requirements of the Equal Pay Ordinance set forth in SDMC sections 22.4801 through 22.4809.

K. STATEMENT OF SUBCONTRACTORS & SUPPLIERS: This form is for a master agreement and not tied to any one project.

Please provide the names and information for all subcontractors and suppliers used in the performance of the proposed contract, and what portion of work will be assigned to each subcontractor. Subcontractors may not be substituted without the written consent of the City. Use Attachment A if additional pages are necessary. If no subcontractors or suppliers will be used, please write "Not Applicable."

Company Name: _____

Address: _____

Contact Name: _____ Phone: _____ Email: _____

Contractor License No.: _____ DIR Registration No.: _____

Sub-Contract Dollar Amount: \$ _____ (per year) \$ _____ (total contract term)

Scope of work subcontractor will perform: _____

Identify whether company is a subcontractor or supplier: _____

Certification type (check all that apply): DBE DVBE ELBE MBE SLBE WBE Not Certified

Contractor must provide valid proof of certification with the response to the bid or proposal to receive participation credit.

Company Name: _____

Address: _____

Contact Name: _____ Phone: _____ Email: _____

Contractor License No.: _____ DIR Registration No.: _____

Sub-Contract Dollar Amount: \$ _____ (per year) \$ _____ (total contract term)

Scope of work subcontractor will perform: _____

Identify whether company is a subcontractor or supplier: _____

Certification type (check all that apply): DBE DVBE ELBE MBE SLBE WBE Not Certified

Contractor must provide valid proof of certification with the response to the bid or proposal to receive participation credit.

L. STATEMENT OF AVAILABLE EQUIPMENT:

A full inventoried list of all necessary equipment to complete the work specified may be a requirement of the bid/proposal submission.

By signing and submitting this form, the Contractor certifies that all required equipment included in this bid or proposal will be made available one week (7 days) before work shall commence. In instances where the required equipment is not owned by the Contractor, Contractor shall explain how the equipment will be made available before the commencement of work. The City of San

Diego reserves the right to reject any response, in its opinion, if the Contractor has not demonstrated he or she will be properly equipped to perform the work in an efficient, effective matter for the duration of the contract period.

M. TYPE OF SUBMISSION: This document is submitted as:

Initial submission of *Contractor Standards Pledge of Compliance*

Initial submission of *Contractor Standards Pledge of Compliance* as part of a Cooperative agreement

Initial submission of *Contractor Standards Pledge of Compliance* as part of a Sole Source agreement

Update of prior *Contractor Standards Pledge of Compliance* dated

Complete all questions and sign below.

Under penalty of perjury under the laws of the State of California, I certify that I have read and understand the questions contained in this Pledge of Compliance, that I am responsible for completeness and accuracy of the responses contained herein, and that all information provided is true, full and complete to the best of my knowledge and belief. I agree to provide written notice to the Purchasing Agent within five (5) business days if, at any time, I learn that any portion of this Pledge of Compliance is inaccurate. Failure to timely provide the Purchasing Agent with written notice is grounds for Contract termination.

I, on behalf of the firm, further certify that I and my firm will comply with the following provisions of SDMC section 22.3004:

- (a) I and my firm will comply with all applicable local, State and Federal laws, including health and safety, labor and employment, and licensing laws that affect the employees, worksite or performance of the contract.
- (b) I and my firm will notify the Purchasing Agent in writing within fifteen (15) calendar days of receiving notice that a government agency has begun an investigation of me or my firm that may result in a finding that I or my firm is or was not in compliance with laws stated in paragraph (a).
- (c) I and my firm will notify the Purchasing Agent in writing within fifteen (15) calendar days of a finding by a government agency or court of competent jurisdiction of a violation by the Contractor of laws stated in paragraph (a).
- (d) I and my firm will notify the Purchasing Agent in writing within fifteen (15) calendar days of becoming aware of an investigation or finding by a government agency or court of competent jurisdiction of a violation by a subcontractor of laws stated in paragraph (a).
- (e) I and my firm will cooperate fully with the City during any investigation and to respond to a request for information within ten (10) working days.

Failure to sign and submit this form with the bid/proposal shall make the bid/proposal non-responsive. In the case of an informal solicitation, the contract will not be awarded unless a signed and completed *Pledge of Compliance* is submitted.

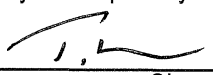
<u>Tim MILLER, VICE</u>	<u>T.L.</u>	<u>12/3/19</u>
Name and Title <u>PRESIDENT</u>	Signature	Date

City of San Diego
CONTRACTOR STANDARDS
Attachment "A"

Provide additional information in space below. Use additional Attachment "A" pages as needed. Each page must be signed. Print in ink or type responses and indicate question being answered.

I have read the matters and statements made in this Contractor Standards Pledge of Compliance and attachments thereto and I know the same to be true of my own knowledge, except as to those matters stated upon information or belief and as to such matters, I believe the same to be true. I certify under penalty of perjury that the foregoing is true and correct.

Print Name, Title



Signature

Date

General Contract Terms and Provisions

City of San Diego
CONTRACTOR STANDARDS
Attachment "A"

Provide additional information in space below. Use additional Attachment "A" pages as needed. Each page must be signed.
Print in ink or type responses and indicate question being answered.

I have read the matters and statements made in this Contractor Standards Pledge of Compliance and attachments thereto and I know the same to be true of my own knowledge, except as to those matters stated upon information or belief and as to such matters, I believe the same to be true. I certify under penalty of perjury that the foregoing is true and correct.

Tim Miller Vice President
Print Name, Title

T.M.
Signature

12/3/19
Date

EQUAL OPPORTUNITY CONTRACTING (EOC)

1200 Third Avenue, Suite 200 • San Diego, CA 92101

Phone: (619) 236-6000 • Fax: (619) 236-5904

BB. WORK FORCE REPORT

The objective of the *Equal Employment Opportunity Outreach Program*, San Diego Municipal Code Sections 22.3501 through 22.3517, is to ensure that contractors doing business with the City, or receiving funds from the City, do not engage in unlawful discriminatory employment practices prohibited by State and Federal law. Such employment practices include, but are not limited to unlawful discrimination in the following: employment, promotion or upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination, rate of pay or other forms of compensation, and selection for training, including apprenticeship. Contractors are required to provide a completed *Work Force Report (WFR)*.

NO OTHER FORMS WILL BE ACCEPTED

CONTRACTOR IDENTIFICATION

Type of Contractor: ☐ Construction ☒ Vendor/Supplier ☐ Financial Institution ☐ Lessee/Lessor
☐ Consultant ☐ Grant Recipient ☐ Insurance Company ☐ Other

Name of Company: EMERSON PROCESS MANAGEMENT POWER & WATER SOLUTIONS, INC.

ADA/DBA: N/A

Address (Corporate Headquarters, where applicable): 200 BETA DRIVE

City: PITTSBURGH County: ALLEGHENY State: PA Zip: 15238

Telephone Number: 412-963-4000 Fax Number: _____

Name of Company CEO: ROBERT YEAGER

Address(es), phone and fax number(s) of company facilities located in San Diego County (if different from above):

Address: 783 PALMYRA AVENUE SUITE D

City: RIVERSIDE County: RIVERSIDE State: CALIFORNIA Zip: 92507

Telephone Number: 951-826-3235 Fax Number: _____ Email: _____

Type of Business: CORPORATION Type of License: _____

The Company has appointed: TIM MILLER

As its Equal Employment Opportunity Officer (EEOO). The EEOO has been given authority to establish, disseminate and enforce equal employment and affirmative action policies of this company. The EEOO may be contacted at:

Address: 200 BETA DRIVE, PITTSBURGH, PA 15238

Telephone Number: 412-963-4484 Fax Number: _____ Email: TIM.MILLER@EMERSON.COM

☒ One San Diego County (or Most Local County) Work Force - Mandatory

☒ Branch Work Force *

☐ Managing Office Work Force

Check the box above that applies to this WFR.

*Submit a separate Work Force Report for all participating branches. Combine WFRs if more than one branch per county.

I, the undersigned representative of EMERSON PROCESS MANAGEMENT POWER & WATER SOLUTIONS, INC.

(Firm Name)

ALLEGHENY PENNSYLVANIA hereby certify that information provided
(County) (State)

herein is true and correct. This document was executed on this 18th day of DECEMBER, 2019

Glen Wagner
(Authorized Signature)

GLEN WAGNER, VICE PRESIDENT
(Print Authorized Signature Name)

WORK FORCE REPORT – Page 2

NAME OF FIRM: Emerson Process Management

DATE: 12/16/2019

OFFICE(S) or BRANCH(ES): PWS - Pittsburgh

COUNTY: Allegheny

INSTRUCTIONS: For each occupational category, indicate number of males and females in every ethnic group. Total columns in row provided. Sum of all totals should be equal to your total work force. Include all those employed by your company on either a full or part-time basis. The following groups are to be included in ethnic categories listed in columns below:

- | | |
|--------------------------------------|---|
| (1) Black or African-American | (5) Native Hawaiian or Pacific Islander |
| (2) Hispanic or Latino | (6) White |
| (3) Asian | (7) Other race/ethnicity; not falling into other groups |
| (4) American Indian or Alaska Native | |

Definitions of the race and ethnicity categories can be found on Page 4

ADMINISTRATION OCCUPATIONAL CATEGORY	(1) Black or African- American		(2) Hispanic or Latino		(3) Asian		(4) American Indian/Na- Alaskan		(5) Pacific Islander		(6) White		(7) Other Race/ Ethnicity	
	(M)	(F)	(M)	(F)	(M)	(F)	(M)	(F)	(M)	(F)	(M)	(F)	(M)	(F)
Management & Financial	1	2	1	1	3	2					64	21		
Professional	1	3	1		1	2					33	15		
A&E, Science, Computer	6	3	6		18	2			1		188	15	1	
Technical	1				1						30	3		
Sales	1		1								9	1		
Administrative Support											3	26		
Services														
Crafts	3	1									12	1		
Operative Workers											4			
Transportation														
Laborers*		1									5	1		

*Construction laborers and other field employees are not to be included on this page

Totals Each Column	13	10	9	1	23	6			1		348	83	1	
--------------------	----	----	---	---	----	---	--	--	---	--	-----	----	---	--

Grand Total All Employees

495

Indicate by Gender and Ethnicity the Number of Above Employees Who Are Disabled:

Disabled	1				2						4			
----------	---	--	--	--	---	--	--	--	--	--	---	--	--	--

Non-Profit Organizations Only:

Board of Directors														
Volunteers														
Artists														

WORK FORCE REPORT – Page 2

NAME OF FIRM: Emerson Process Management

DATE: 12/16/2019

OFFICE(S) or BRANCH(ES): PWS - Riverside

COUNTY: RIVERSIDE

INSTRUCTIONS: For each occupational category, indicate number of males and females in every ethnic group. Total columns in row provided. Sum of all totals should be equal to your total work force. Include all those employed by your company on either a full or part-time basis. The following groups are to be included in ethnic categories listed in columns below:

- | | |
|--------------------------------------|---|
| (1) Black or African-American | (5) Native Hawaiian or Pacific Islander |
| (2) Hispanic or Latino | (6) White |
| (3) Asian | (7) Other race/ethnicity; not falling into other groups |
| (4) American Indian or Alaska Native | |

Definitions of the race and ethnicity categories can be found on Page 4

ADMINISTRATION OCCUPATIONAL CATEGORY	(1) Black or African American		(2) Hispanic or Latino		(3) Asian		(4) American Indian/ Nat Alaskan		(5) Pacific Islander		(6) White		(7) Other Race/ Ethnicity	
	(M)	(F)	(M)	(F)	(M)	(F)	(M)	(F)	(M)	(F)	(M)	(F)	(M)	(F)
Management & Financial			1								2			
Professional														
A&E, Science, Computer			4		3						12		1	
Technical														
Sales											4	2		
Administrative Support												1		
Services														
Crafts														
Operative Workers														
Transportation														
Laborers*														

*Construction laborers and other field employees are not to be included on this page

Totals Each Column			5		3						18	3	1	
--------------------	--	--	---	--	---	--	--	--	--	--	----	---	---	--

Grand Total All Employees

30

Indicate by Gender and Ethnicity the Number of Above Employees Who Are Disabled:

Disabled														
----------	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Non-Profit Organizations Only:

Board of Directors														
Volunteers														
Artists														

DATE: 12-2-2019

COUNTY: SAN DIEGO

INSTRUCTIONS: For each occupational category, indicate number of males and females in every ethnic group. Total columns in row provided. Sum of all totals should be equal to your total work force. Include all those employed by your company on either a full or part-time basis. The following groups are to be included in ethnic categories listed in columns below:

- (1) Black or African-American
(2) Hispanic or Latino
(3) Asian
(4) American Indian or Alaska Native
(5) Native Hawaiian or Pacific Islander
(6) White
(7) Other race/ethnicity; not falling into other groups

Definitions of the race and ethnicity categories can be found on Page 4.

[illegible]

*Construction laborers and other field employees are not to be included on this page

[illegible]

Grand Total All Employees

1

Indicate by Gender and Ethnicity the Number of Above Employees Who Are Disabled:

[illegible]

Non-Profit Organizations Only:

[illegible]

WORK FORCE REPORT – Page 2

NAME OF FIRM: _____ DATE: _____

OFFICE(S) or BRANCH(ES): _____ COUNTY: _____

INSTRUCTIONS: For each occupational category, indicate number of males and females in every ethnic group. Total columns in row provided. Sum of all totals should be equal to your total work force. Include all those employed by your company on either a full or part-time basis. The following groups are to be included in ethnic categories listed in columns below:

- | | |
|--------------------------------------|---|
| (1) Black or African-American | (5) Native Hawaiian or Pacific Islander |
| (2) Hispanic or Latino | (6) White |
| (3) Asian | (7) Other race/ethnicity; not falling into other groups |
| (4) American Indian or Alaska Native | |

Definitions of the race and ethnicity categories can be found on Page 4

ADMINISTRATION OCCUPATIONAL CATEGORY	(1) Black or African American		(2) Hispanic or Latino		(3) Asian		(4) American Indian/ Nat. Alaskan		(5) Pacific Islander		(6) White		(7) Other Race/ Ethnicity	
	(M)	(F)	(M)	(F)	(M)	(F)	(M)	(F)	(M)	(F)	(M)	(F)	(M)	(F)
Management & Financial														
Professional														
A&E, Science, Computer														
Technical														
Sales														
Administrative Support														
Services														
Crafts														
Operative Workers														
Transportation														
Laborers*														

*Construction laborers and other field employees are not to be included on this page

Totals Each Column														
--------------------	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Grand Total All Employees

Indicate by Gender and Ethnicity the Number of Above Employees Who Are Disabled:

Disabled														
----------	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Non-Profit Organizations Only:

Board of Directors														
Volunteers														
Artists														

Work Force Report

HISTORY

The Work Force Report (WFR) is the document that allows the City of San Diego to analyze the work forces of all firms wishing to do business with the City. We are able to compare the firm's work force data to County Labor Force Availability (CLFA) data derived from the United States Census. CLFA data is a compilation of lists of occupations and includes the percentage of each ethnicity we track (American Indian or Alaska Native, Asian, Black or African-American, Native Hawaiian or Pacific Islander, White, and Other) for each occupation. Currently, our CLFA data is taken from the 2010 Census. In order to compare one firm to another, it is important that the data we receive from the consultant firm is accurate and organized in the manner that allows for this fair comparison.

WORK FORCE & BRANCH WORK FORCE REPORTS

When submitting a WFR, especially if the WFR is for a specific project or activity, we would like to have information about the firm's work force that is actually participating in the project or activity. That is, if the project is in San Diego and the work force is from San Diego, we want a San Diego County Work Force Report¹. By the same token, if the project is in San Diego, but the work force is from another county, such as Orange or Riverside County, we want a Work Force Report from that county². If participation in a San Diego project is by work forces from San Diego County and, for example, from Los Angeles County and from Sacramento County, we ask for separate Work Force Reports representing your firm from each of the three counties.

MANAGING OFFICE WORK FORCE

Equal Opportunity Contracting may occasionally ask for a Managing Office Work Force (MOWF) Report. This may occur in an instance where the firm involved is a large national or international firm but the San Diego or other local work force is very small. In this case, we may ask for both a local and a MOWF Report^{1,3}. In another case, when work is done only by the Managing Office, only the MOWF Report may be necessary.³

TYPES OF WORK FORCE REPORTS:

Please note, throughout the preceding text of this page, the superscript numbers one ¹, two ² & three ³. These numbers coincide with the types of work force report required in the example. See below:

- ¹ One San Diego County (or Most Local County)
Work Force – Mandatory in most cases
- ² Branch Work Force *
- ³ Managing Office Work Force

**Submit a separate Work Force Report for all participating branches. Combine WFRs if more than one branch per county.*

RACE/ETHNICITY CATEGORIES

American Indian or Alaska Native – A person having origins in any of the peoples of North and South America (including Central America) and who maintains tribal affiliation or community attachment.

Asian – A person having origins in any of the peoples of the Far East, Southeast Asia, or the Indian subcontinent including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam.

Black or African American – A person having origins in any of the Black racial groups of Africa.

Native Hawaiian or Pacific Islander – A person having origins in any of the peoples of Hawaii, Guam, Samoa, or other Pacific Islands.

White – A person having origins in any of the peoples of Europe, the Middle East, or North Africa.

Hispanic or Latino – A person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin.

Exhibit A: Work Force Report Job Categories – Administration

Refer to this table when completing your firm's Work Force Report form(s).

Management & Financial

Advertising, Marketing, Promotions, Public
Relations, and Sales Managers
Business Operations Specialists
Financial Specialists
Operations Specialties Managers
Other Management Occupations
Top Executives

Professional

Art and Design Workers
Counselors, Social Workers, and Other Community
and Social Service Specialists
Entertainers and Performers, Sports and Related
Workers
Health Diagnosing and Treating Practitioners
Lawyers, Judges, and Related Workers
Librarians, Curators, and Archivists
Life Scientists
Media and Communication Workers
Other Teachers and Instructors
Postsecondary Teachers
Primary, Secondary, and Special Education School
Teachers
Religious Workers
Social Scientists and Related Workers

Architecture & Engineering, Science, Computer

Architects, Surveyors, and Cartographers
Computer Specialists
Engineers
Mathematical Science Occupations
Physical Scientists

Technical

Drafters, Engineering, and Mapping Technicians
Health Technologists and Technicians
Life, Physical, and Social Science Technicians
Media and Communication Equipment Workers

Sales

Other Sales and Related Workers
Retail Sales Workers
Sales Representatives, Services
Sales Representatives, Wholesale and
Manufacturing
Supervisors, Sales Workers

Administrative Support

Financial Clerks
Information and Record Clerks
Legal Support Workers

Material Recording, Scheduling, Dispatching,
and Distributing Workers
Other Education, Training, and Library
Occupations
Other Office and Administrative Support
Workers
Secretaries and Administrative Assistants
Supervisors, Office and Administrative Support
Workers

Services

Building Cleaning and Pest Control Workers
Cooks and Food Preparation Workers
Entertainment Attendants and Related
Workers
Fire Fighting and Prevention Workers
First-Line Supervisors/Managers, Protective
Service Workers
Food and Beverage Serving Workers
Funeral Service Workers
Law Enforcement Workers
Nursing, Psychiatric, and Home Health Aides
Occupational and Physical Therapist Assistants
and Aides
Other Food Preparation and Serving Related
Workers
Other Healthcare Support Occupations
Other Personal Care and Service Workers
Other Protective Service Workers
Personal Appearance Workers
Supervisors, Food Preparation and Serving
Workers
Supervisors, Personal Care and Service
Workers
Transportation, Tourism, and Lodging
Attendants

Crafts

Construction Trades Workers
Electrical and Electronic Equipment
Mechanics, Installers, and Repairers
Extraction Workers
Material Moving Workers
Other Construction and Related Workers
Other Installation, Maintenance, and Repair
Occupations
Plant and System Operators
Supervisors of Installation, Maintenance, and
Repair Workers
Supervisors, Construction and Extraction
Workers
Vehicle and Mobile Equipment Mechanics,

Installers, and Repairers
Woodworkers

Operative Workers

Assemblers and Fabricators
Communications Equipment Operators
Food Processing Workers
Metal Workers and Plastic Workers
Motor Vehicle Operators
Other Production Occupations
Printing Workers
Supervisors, Production Workers
Textile, Apparel, and Furnishings Workers

Transportation

Air Transportation Workers
Other Transportation Workers
Rail Transportation Workers
Supervisors, Transportation and Material
Moving Workers
Water Transportation Workers

Laborers

Agricultural Workers
Animal Care and Service Workers
Fishing and Hunting Workers
Forest, Conservation, and Logging Workers
Grounds Maintenance Workers
Helpers, Construction Trades
Supervisors, Building and Grounds Cleaning
and Maintenance Workers
Supervisors, Farming, Fishing, and Forestry
Workers

Exhibit B: Work Force Report Job Categories-Trade

Brick, Block or Stone Masons
Brickmasons and Blockmasons
Stonemasons

Carpenters

Carpet, floor and Tile Installers and Finishers
Carpet Installers
Floor Layers, except Carpet, Wood and Hard
Tiles
Floor Sanders and Finishers
Tile and Marble Setters

Cement Masons, Concrete Finishers
Cement Masons and Concrete Finishers
Terrazzo Workers and Finishers

Construction Laborers

Drywall Installers, Ceiling Tile Inst
Drywall and Ceiling Tile Installers
Tapers

Electricians

Elevator Installers and Repairers

First-Line Supervisors/Managers
First-line Supervisors/Managers of
Construction Trades and Extraction Workers

Glaziers

Helpers, Construction Trade
Brickmasons, Blockmasons, and Tile and
Marble Setters
Carpenters
Electricians
Painters, Paperhangers, Plasterers and Stucco
Pipelayers, Plumbers, Pipefitters and
Steamfitters
Roofers
All other Construction Trades

Millwrights

Heating, Air Conditioning and Refrigeration
Mechanics and Installers
Mechanical Door Repairers

Control and Valve Installers and Repairers

Other Installation, Maintenance and Repair
Occupations

Misc. Const. Equipment Operators

Paving, Surfacing and Tamping Equipment
Operators

Pile-Driver Operators

Operating Engineers and Other Construction
Equipment Operators

Painters, Const. Maintenance

Painters, Construction and Maintenance
Paperhangers

Pipelayers and Plumbers

Pipelayers

Plumbers, Pipefitters and Steamfitters

Plasterers and Stucco Masons**Roofers****Security Guards & Surveillance Officers****Sheet Metal Workers****Structural Iron and Steel Workers****Welding, Soldering and Brazing Workers**

Welders, Cutter, Solderers and Brazers

Welding, Soldering and Brazing Machine
Setter, Operators and Tenders

Workers, Extractive Crafts, Miners

EXHIBIT D

WAGE REQUIREMENTS: SERVICE AND MAINTENANCE CONTRACTS EXECUTED ON OR AFTER JANUARY 1, 2015

By signing this Contract, Bidder certifies that he or she is aware of the wage provisions described herein and shall comply with such provisions, as applicable, before commencing services.

A. PREVAILING WAGES. Pursuant to San Diego Municipal Code section 22.3019, construction, alteration, demolition, repair and maintenance work performed under this Contract is subject to State prevailing wage laws. For construction work performed under this Contract cumulatively exceeding \$25,000 and for alteration, demolition, repair and maintenance work performed under this Contract cumulatively exceeding \$15,000, Bidder and its subcontractors shall comply with State prevailing wage laws including, but not limited to, the requirements listed below. This requirement is in addition to the requirement to pay Living Wage pursuant to San Diego Municipal Code sections 22.4201 through 22.4245. Bidder must determine which per diem rate is highest for each classification of work (i.e. Prevailing Wage Rate or Living Wage Rate), and pay the highest of the two rates to their employees. Living Wage applies to workers who are not subject to Prevailing Wage Rates.

1. Compliance with Prevailing Wage Requirements. Pursuant to sections 1720

through 1861 of the California Labor Code, Bidder and its subcontractors shall ensure that all workers who perform work under this Contract are paid not less than the prevailing rate of per diem wages as determined by the Director of the California Department of Industrial Relations (DIR). This includes work performed during the design and preconstruction phases of construction including, but not limited to, inspection and land surveying work.

1.1. Copies of such prevailing rate of per diem wages are on file at the City of San Diego's Equal Opportunity Contracting Department and are available for inspection to any interested party on request. Copies of the prevailing rate of per diem wages also may be found at <http://www.dir.ca.gov/OPRL/DPreWageDetermination.htm>. Bidder and its subcontractors shall post a copy of the prevailing rate of per diem wages determination at each job site and shall make them available to any interested party upon request.

1.2. The wage rates determined by the DIR refer to expiration dates. If the published wage rate does not refer to a predetermined wage rate to be paid after the expiration date, then the published rate of wage shall be in effect for the life of this Contract. If the published wage rate refers to a predetermined wage rate to become effective upon expiration of the published wage rate and the predetermined wage rate is on file with the DIR, such predetermined wage rate shall become effective on the date following the expiration date and shall apply to this Contract in the same manner as if it had been published in said publication. If the predetermined wage rate refers to one or more additional expiration dates with additional predetermined wage rates, which expiration dates occur during the life of this Contract, each successive predetermined wage rate shall apply to this Contract on the date following the expiration date of the previous wage rate. If the last of such predetermined wage rates expires

EXHIBIT D

during the life of this Contract, such wage rate shall apply to the balance of the Contract.

2. Penalties for Violations. Bidder and its subcontractors shall comply with California Labor Code section 1775 in the event a worker is paid less than the prevailing wage rate for the work or craft in which the worker is employed. This shall be in addition to any other applicable penalties allowed under Labor Code sections 1720 – 1861.

3. Payroll Records. Bidder and its subcontractors shall comply with California Labor Code section 1776, which generally requires keeping accurate payroll records, verifying and certifying payroll records, and making them available for inspection. Bidder shall require its subcontractors to also comply with section 1776. Bidder and its subcontractors shall submit weekly certified payroll records online via the City's web-based Labor Compliance Program. Bidder is responsible for ensuring its subcontractors submit certified payroll records to the City. Bidder and its subcontractors shall also furnish the records specified in Labor Code section 1776 directly to the Labor Commissioner in the manner required in Labor Code section 1771.4.

4. Apprentices. Bidder and its subcontractors shall comply with California Labor Code sections 1777.5, 1777.6 and 1777.7 concerning the employment and wages of apprentices. Bidder shall be held responsible for their compliance as well as the compliance of their subcontractors with sections 1777.5, 1777.6 and 1777.7.

5. Working Hours. Bidder and its subcontractors shall comply with California Labor Code sections 1810 through 1815, including but not limited to: (i) restrict working hours on public works contracts to eight hours a day and forty hours a week, unless all hours worked in excess of 8 hours per day are compensated at not less than 1½ times the basic rate of pay; and (ii) specify penalties to be imposed on design professionals and subcontractors of \$25 per worker per day for each day the worker works more than 8 hours per day and 40 hours per week in violation of California Labor Code sections 1810 through 1815.

6. Required Provisions for Subcontracts. Bidder shall include at a minimum a copy of the following provisions in any contract they enter into with a subcontractor: California Labor Code sections 1771, 1771.1, 1775, 1776, 1777.5, 1810, 1813, 1815, 1860 and 1861.

7. Labor Code Section 1861 Certification. Bidder in accordance with California Labor Code section 3700 is required to secure the payment of compensation of its employees and by signing this Contract, Bidder certifies that "I am aware of the provisions of Section 3700 of the California Labor Code which require every employer to be insured against liability for workers' compensation or to undertake self-insurance in accordance with the provisions of that code, and I will comply with such provisions before commencing the performance of the work of this Contract."

8. Labor Compliance Program. The City has its own Labor Compliance Program authorized in August 2011 by the DIR. The City will withhold contract payments when payroll records are delinquent or deemed inadequate by the City or other governmental entity, or it has been established after an investigation by the City or

EXHIBIT D

other governmental entity that underpayment(s) have occurred. For questions or assistance, please contact the City of San Diego's Equal Opportunity Contracting Department at 619-236-6000.

9. Contractor and Subcontractor Registration Requirements. This project is subject to compliance monitoring and enforcement by the DIR. A Bidder or subcontractor shall not be qualified to bid on, be listed in a bid proposal, subject to the requirements of Section 4104 of the Public Contract Code, or enter into any contract for public work, as defined in this chapter of the Labor Code unless currently registered and qualified to perform the work pursuant to Section 1725.5. In accordance with Labor Code section 1771.1(a), "[i]t is not a violation of this section for an unregistered contractor to submit a bid that is authorized by Section 7029.1 of the Business and Professions Code or by Section 10164 or 20103.5 of the Public Contract Code, provided the contractor is registered to perform public work pursuant to Section 1725.5 at the time the contract is awarded."

9.1. A Bidder's inadvertent error in listing a subcontractor who is not registered pursuant to Labor Code section 1725.5 in a response to a solicitation shall not be grounds for filing a bid protest or grounds for considering the bid non-responsive provided that any of the following apply: (1) the subcontractor is registered prior to bid opening; (2) within twenty-four hours after the bid opening, the subcontractor is registered and has paid the penalty registration fee specified in Labor Code section 1725.5; or (3) the subcontractor is replaced by another registered contractor pursuant to Public Contract Code section 4107.

9.2. A Contract entered into with any Bidder or subcontractor in violation of Labor Code section 1771.1(a) shall be subject to cancellation, provided that a Contract for public work shall not be unlawful, void, or voidable solely due to the failure of the awarding body, Bidder, or any subcontractor to comply with the requirements of section 1725.5 of this section.

9.3. By submitting a bid or proposal to the City, Bidder is certifying that he or she has verified that all subcontractors used on this public works project are registered with the DIR in compliance with Labor Code sections 1771.1 and 1725.5, and Bidder shall provide proof of registration for themselves and all listed subcontractors to the City at the time of bid or proposal due date or upon request.

10. Stop Order. For Bidder or its subcontractor(s) engaging in the performance of any public work contract without having been registered in violation of Labor Code sections 1725.5 or 1771.1, the Labor Commissioner shall issue and serve a stop order prohibiting the use of the unregistered Bidder or unregistered subcontractor(s) on ALL public works until the unregistered Bidder or unregistered subcontractor(s) is registered. Failure to observe a stop order is a misdemeanor.

11. List of all Subcontractors. The City may ask Bidder for the most current list of subcontractors (regardless of tier), along with their DIR registration numbers, utilized on this contract at any time during performance of this contract, and Bidder shall provide the list within ten (10) working days of the City's request. Additionally,

EXHIBIT D

Bidder shall provide the City with a complete list of all subcontractors utilized on this contract (regardless of tier), within ten working days of the completion of the contract, along with their DIR registration numbers. The City shall withhold final payment to Bidder until at least 30 days after this information is provided to the City.

12. Exemptions for Small Projects. There are limited exemptions for installation, alteration, demolition, or repair work done on projects of \$25,000 or less. The Bidder shall still comply with Labor Code sections 1720 et. seq. The only recognized exemptions are listed below:

12.1. Registration. The Bidder will not be required to register with the DIR for small projects. (Labor Code section 1771.1).

12.2. Certified Payroll Records. The records required in Labor Code section 1776 shall be required to be kept and submitted to the City of San Diego, but will not be required to be submitted online with the DIR directly. The Bidder will need to keep those records for at least three years following the completion of the contract. (Labor Code section 1771.4).

12.3. List of all Subcontractors. The Bidder shall not be required to hire only registered subcontractors and is exempt from submitting the list of all subcontractors that is required in section 11 above. (Labor Code section 1773.3).

B. Living Wages. This Contract is subject to the City's Living Wage Ordinance (LWO), codified at SDMC sections 22.4201 through 22.4245. The LWO requires payment of minimum hourly wage rates and other benefits unless an exemption applies. SDMC section 22.4225 requires each Bidder to fill out and file a living wage certification with the City Manager within thirty (30) days of Award of the Contract. LWO wage and health benefit rates are adjusted annually in accordance with SDMC section 22.4220(b) to reflect the Consumer Price Index. Service contracts, financial assistance agreements, and City facilities agreements must include this upward adjustment of wage rates to covered employees on July 1 of each year. In addition, Bidder agrees to require all of its subcontractors, sublessees, and concessionaires subject to the LWO to comply with the LWO and all applicable regulations and rules.

1.1. Exemption from Living Wage Ordinance. Pursuant to SDMC section 22.4215, this Contract may be exempt from the LWO. For a determination on this exemption, Bidder must complete the Living Wage Ordinance Application for Exemption.

C. Highest Wage Rate Applies. Bidder is required to pay the highest applicable wage rate where more than one wage rate applies.

EXHIBIT E

CONFIDENTIALITY AND NON-DISCLOSURE AGREEMENT

During the course of this Contract for [describe services], City and Contractor (collectively, the Parties) may be exposed to important business or technical information which is the property of the other party. The unauthorized use or disclosure of this information could harm the business of the owner of the information. For this reason, and in consideration of the mutual covenants contained in this Agreement and the mutual disclosure of confidential information to each other, the Parties agree as follows:

1. Confidential Information.

(a) Confidential Information is information disclosed by the Disclosing Party (Disclosing Party) to the Receiving Party (Receiving Party) which is non-public, proprietary or confidential in nature, whether provided in writing, orally, visually, electronically or by other means. Confidential Information includes, but is not limited to the following: (i) know-how, trade secrets, tools, methods, methodologies, techniques, designs, specifications, computer source code, customer lists, customer information, marketing plans, personnel information, financial information, business strategies, and information relating to released or unreleased software, hardware or technology; (ii) information received by the Disclosing Party from third parties under confidential conditions which information is identified by the Disclosing Party as being subject to such conditions, (iii) the Disclosing Party's Trade Secrets. Trade Secrets means information which (a) derives economic value, actual or potential, from not being generally known to, or readily ascertainable by proper means by, other persons who can obtain economic value from its disclosure or use, and which is the subject of efforts that are reasonable under the circumstances to maintain its secrecy, or (b) is otherwise a Trade Secret as defined by California law, and (iv) the existence of this Agreement, the fact that the Receiving Party has received any information under this Agreement, and that any investigations, discussions or negotiations are taking, or have taken, place between the parties. Confidential Information disclosed to the Receiving Party by any Disclosing Party subsidiary, affiliate, or agent is covered by this Agreement.

(b) Confidential Information does not include any information that: (i) is or subsequently becomes publicly available without the Receiving Party or its Representative's (as defined below) breach of any obligation owed the Disclosing Party; (ii) became known to the Receiving Party prior to the Disclosing Party's disclosure of such information to the Receiving Party; (iii) became known to the Receiving Party from a source other than the Disclosing Party or its affiliates or advisors other than by the breach of an obligation of confidentiality owed to the Disclosing Party; or (iv) is independently developed by the Receiving Party or its Representatives without violating any of their obligations under this Agreement.

2. Obligations.

(a) The Parties shall each keep in confidence, and shall cause their respective Representatives to keep in confidence, all Confidential Information disclosed to either of them by the other and shall use such Confidential Information only for the mutually agreed upon objectives of the discussions between the Parties.

(b) Receiving Party shall exercise reasonable care to prevent the disclosure of Confidential Information to any third party, and in any event not less than the same precautions used by the Receiving Party to protect its own Confidential Information. Dissemination of Confidential

by these Representatives of their obligation to maintain the confidential status of the information and to restrict the use of the information solely to the use granted under this Agreement. The Receiving Party shall be responsible for any breach of this Agreement by its Representatives.

(c) All Confidential Information, including all tangible embodiments, copies, reproductions and summaries thereof, and any other information and materials provided by the Disclosing Party to the Receiving Party, shall remain the sole and exclusive property of the Disclosing Party.

(d) Receiving Party shall immediately report to the Disclosing Party any attempt by the Receiving Party's Representatives to use or disclose any portion of the Confidential Information without authorization from the Disclosing Party, and shall cooperate with the Disclosing Party in every reasonable way to help the Disclosing Party regain possession of the Confidential Information and prevent its further unauthorized use.

(e) At the Disclosing Party's request, the Receiving Party shall return all originals, copies, reproductions and summaries of Confidential Information in the possession of the Receiving Party or its Representatives.

3. Exception. The obligations of confidentiality imposed by this Agreement do not apply to any Confidential Information which is required to be disclosed pursuant to operation of law or legal process, governmental regulation or court order, provided that the Receiving Party receiving such legal demand or order shall promptly inform the Disclosing Party to allow a reasonable opportunity to obtain a protective order, as appropriate. Nothing in this Agreement shall prohibit City from disclosing information that qualifies as a "public record," as that term is defined in the California Public Records Act, codified in California Government Code section 6250 through 6270.

4. Duration. This Agreement shall survive for a period of three (3) years after the date hereof. For Confidential Information that constitutes a Trade Secret, the restrictions set forth in this Agreement shall continue in effect for so long as such information remains a Trade Secret. This Agreement shall inure to the benefit of and be binding upon the Parties, their successors, and assigns.

Agreed To By:

Signature of Bidder's Authorized
Representative

Signature of the City of San Diego
Purchasing Agent

Approved as to Form
City Attorney

TIM MILLER

Print Name

VICE PRESIDENT

Title

J. ✓

Signature

12/3/19

Date

Print Name

Title

Signature

Date

Print Name

Title

Signature

Date

EXHIBIT G

SOFTWARE LICENSE AGREEMENT

License TO USE: The term LICENSEE includes an authorized user who accepts and agrees to be bound by the terms of this Agreement. Emerson Process Management, Power & Water Solutions, ("EMERSON"), grants LICENSEE a nonexclusive, nontransferable license to utilize one copy of all fully paid up licensed Software provided to LICENSEE (unless multiple copies or concurrent or simultaneous use rights are elsewhere authorized) for the intended purpose and LICENSEE's internal use in the equipment in which it is initially installed.

"Software" as used herein shall mean any software program, firmware, or flash ROM licensed by EMERSON including, but not limited to, the EMERSON operating system software, application software, machine readable media on which the Software is contained, documentation, and/or written materials accompanying the Software. IF LICENSEE TRANSFERS POSSESSION OF ANY COPY OR MODIFICATION OF THE SOFTWARE OR RELATED MATERIALS TO ANOTHER PARTY, EXCEPT AS EXPRESSLY PROVIDED FOR IN THIS LICENSE, THIS LICENSE IS AUTOMATICALLY TERMINATED.

The license fee for the EMERSON Software is included in the contract price. If concurrent or simultaneous usage licenses are furnished, LICENSEE may not at any one time exceed the maximum number of licenses purchased under this

Agreement. LICENSEE shall not alone or with assistance of others reverse compile, reverse engineer or in any other manner attempt to decipher in whole

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LICENSEE recognizes that third party software furnished by EMERSON may be subject to a separate license agreement and/or registration requirements and limitations on copying and use and LICENSEE agrees to be bound by the terms of any third party license agreement(s) accompanying such software.

TITLE: All title and ownership of the Software and any derivative works including, without limitation, the copyright to such Software, shall remain exclusively with EMERSON or its licensors. LICENSEE'S right to use the same is at all times subject to the terms and conditions of this Agreement. EMERSON may, from time to time, revise or update the Software and/or related materials and, in so doing, incurs no obligation to furnish such revisions or updates to LICENSEE.

TERMINATION: LICENSEE may terminate this license at any time by destroying the Software and the related materials together with all copies and modifications in any form. It will also terminate upon conditions set forth elsewhere in this Agreement or if LICENSEE fails to comply with any term or condition of this Agreement. LICENSEE agrees upon such termination to destroy the Software and the related materials together with all copies and modifications in any form.

WARRANTY: a) Software provided directly to End User: Unless otherwise agreed in writing by the parties, EMERSON warrants that the Software provided hereunder will be free from errors which materially affect its utility. The warranty period shall expire 12 months from the date of completion of installation or 18 months from the date of delivery, whichever occurs first. Unless stated otherwise herein, third party software shall be warranted and remedied on a pass through basis in the same manner and for the same period and extent provided by the

original software manufacturer. This Software warranty does not apply to any application software or set of instructions composed by LICENSEE; provided however, that this warranty will extend to any application software composed by EMERSON in accordance with LICENSEE's instructions, but only to the extent of such instructions.

b) Software provided through Intermediate Parties: Unless otherwise agreed in writing by the parties, EMERSON warrants that the Software provided hereunder will be free from errors which materially affect its utility. The warranty period shall expire 12 months from the date of completion of installation or 18 months from the date of delivery to the Intermediate Party, whichever occurs first. Unless stated otherwise herein, third party software shall be warranted and remedied on a pass through basis in the same manner and for the same period and extent

provided by the original software manufacturer. This Software warranty does not apply to any application software or set of instructions composed by LICENSEE; provided however, that this warranty will extend to any application software composed by EMERSON in accordance with LICENSEE's instructions, but only to the extent of such instructions.

YEAR 2000 WARRANTY: EMERSON warrants that the Software provided hereunder will be Year 2000 Compliant. "Year 2000 Compliant" shall mean the Software will be capable of managing and manipulating data involving dates, including single century formulas and multi-century formulas, and not generate incorrect values or invalid results involving such dates. LICENSEE acknowledges that this Year 2000 warranty shall not apply: i) to any software

that is not date sensitive; ii) to any software not furnished under this Agreement; iii) to software provided by LICENSEE or others which may interface or operate in conjunction with EMERSON furnished Software/equipment, regardless of whether such other software/equipment is itself Year 2000 compliant; and iv) to the EMERSON furnished Software in the event any software/equipment not

furnished by EMERSON under this Agreement prevents the EMERSON furnished Software from performing any function specified in the above definition of "Year 2000 Compliant".

Remedies: In the case of a nonconformity in this warranty and if EMERSON is notified in writing of such nonconformity during the applicable warranty period, it shall be remedied, upon return to EMERSON, by correction in the medium originally supplied, or provision of a procedure to correct material errors. If such remedies are impracticable, EMERSON may refund the purchase price for the nonconforming Software. Any warranty specified herein is conditioned upon: a) proper handling, installation and maintenance; b) not having been subjected to accident, alteration, abuse or misuse; and c) LICENSEE providing necessary access and assistance for EMERSON to fulfill its warranty obligations.

LIMITATIONS OF REMEDIES: The warranties set forth above are exclusive and in lieu of all other warranties whether statutory, express or implied (including all warranties of merchantability and fitness for purpose and all warranties arising from course of dealing or usage of trade). The remedies set forth, for the time and in the manner provided above, shall be LICENSEE's exclusive remedies for failure of EMERSON to meet its warranty obligations, whether based in contract, in tort (including negligence or strict liability), or otherwise. IN NO EVENT WILL EMERSON BE LIABLE TO LICENSEE FOR ANY DAMAGES ARISING OUT OF ANY CAUSES WHATSOEVER (WHETHER SUCH CAUSES BE BASED IN CONTRACT, NEGLIGENCE, STRICT LIABILITY, OTHER TORT, PATENT INFRINGEMENT, OR OTHERWISE), INCLUDING ANY damage to or loss of property or equipment; loss of profits or revenue; loss of use of LICENSEE's property, equipment or power system; increased costs of any kind, including but not limited to cost of operation and maintenance, capital cost, fuel cost and cost of purchased or replacement power; or claims of customers of licensee, OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE SUCH SOFTWARE EVEN IF EMERSON HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, OR OF ANY CLAIM BY ANY OTHER PARTY.

GOVERNING LAW: This Agreement shall be governed by the laws of the Commonwealth of Pennsylvania, U.S.A., excluding both its rules or laws regarding choice or conflict of laws and the United Nations Convention on Contracts for the International Sale of Goods.

EXPORT RESTRICTIONS: Licensee shall comply fully with all laws, regulations, decrees and orders of the United States of America that restrict or prohibit the exportation (or reexportation) of technical data and/or the direct product of it to other countries, including, without limitation, the U.S. Export Administration Regulations.

U.S. GOVERNMENT RIGHTS: The Software and related materials are provided with "RESTRICTED RIGHTS." Use, duplication or disclosure by the

U.S. Government is subject to restrictions set forth in the Federal Acquisition Regulations and its Supplements.

GENERAL: LICENSEE may not sublicense, assign, or transfer the license or the Software and related materials without the prior written consent of EMERSON. Any attempt otherwise to sublicense, assign or transfer any of the rights, duties, or obligations hereunder without such consent is void.

EMERSON's licensors shall be a third party beneficiary to this Agreement to the extent permitted by applicable law.

UNLESS OTHERWISE AGREED, THE SOFTWARE IS NOT FOR USE IN ANY NUCLEAR AND RELATED APPLICATIONS. LICENSEE accepts the Software with the foregoing understanding and agrees to indemnify and hold harmless EMERSON and its licensors from any claims, losses, suits, judgments and damages, including incidental damages, arising from such use, whether the cause of action be based in tort, contract or otherwise, including allegations based on negligence or strict liability.

Should LICENSEE have any question concerning this Agreement, please contact LICENSEE'S EMERSON representative or sales office.

LICENSEE ACKNOWLEDGES THAT LICENSEE HAS READ THIS AGREEMENT, UNDERSTANDS IT, AND AGREES TO BE BOUND BY ITS TERMS. LICENSEE FURTHER AGREES THAT IT IS THE COMPLETE AND EXCLUSIVE STATEMENT OF THE AGREEMENT BETWEEN EMERSON AND LICENSEE AND LICENSEE AGREES THAT EMERSON MAY AUDIT LICENSEE'S FACILITY TO CONFIRM COMPLIANCE WITH THE FOREGOING PROVISIONS.

**EMERSON PROCESS MANAGEMENT,
POWER & WATER SOLUTIONS
SOFTWARE LICENSE AGREEMENT**

200 Beta Drive
Pittsburgh, PA 15238

www.ovationusers.com

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Revision 6 02/06/07

EXHIBIT H-1
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 REQUIREMENT

A. **GENERAL:** The DISTRIBUTED CONTROL SYSTEM PROVIDER (DCSP or Contractor) shall furnish all equipment and provide all applicable engineering for a fully functional distributed control system, that complies with the technical requirements stipulated in the Scope of Services included as a part of the Task Order for a specific project, including, but not limited to, project management, design assistance, coordinate with on-site area contractors, detailed system design and integration, conducting graphic design workshops, equipment supply and shipment, storage, job site delivery, programming and configuration, installation oversight, testing, commissioning and start up, integration with the existing City-wide Operation and Management Network (COMNET), and staff training, as per specific project requirements defined in the aforementioned Scope of Services.

1. The Work covered by this specification and all of its sub parts shall include, but not limited to, engineering and design of system and components, manufacture and/or procurement of all necessary equipment, components, material, transportation, labor, special tools, factory testing, application programming, shipment, storage, and jobsite delivery, operational readiness testing, installation of equipment, DCS installation oversight, system integration, startup operation, site testing, training and documentation, support, maintenance/warranty of a complete, integrated and operational DCS project per the Statement of services within the Task Order
2. The requirements contained herein are necessarily general in nature and should not be construed as an all-inclusive list of devices, equipment, software, and services necessary for successful completion of the Work.
3. It shall be the responsibilities of the DCSP to coordinate and project manage the Work, as set forth in this section of the Specifications, with work that may be underway by other contractors at the facility, to provide a complete and satisfactory installation.
4. It shall be the responsibilities of the DCSP to ensure that the distributed control system shall be a standard system of Emerson Process Management, Ovation family with a complete repertoire of pre-existing software modules running in a familiar hardware environment and free from hardware/software incompatibilities.
5. The DCSP shall be responsible for coordination, installation, and testing of DCS.
6. The DCSP shall be responsible for providing all equipment, installation supervision, engineering, programming, configuration,

EXHIBIT H-1
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
GENERAL REQUIREMENTS

management, and services associated with integrating all instrumentation and control devices, and special systems, including Foreign Device Interfaces (FDI), into the DCS in a transparent and seamless manner. The use of a third party, system house, or system integrators for the above service is not acceptable.

7. DCSP shall be fully responsible for the implementation, installation, and integration of the DCS project as outlined in this specification.
8. DCSP shall be responsible for interfacing to all existing instrumentation and all other Input/Output (I/O) devices as per the specific DCS project requirements stipulated in the Scope of Services.
9. During field functional testing the DCSP shall verify the operation of all instruments and field devices and associated wiring (from instrument/device to DCS) and notify the City's representative of any deficiencies that exist.

B. Scope of Work:

1. The Work generally consists of the supply of all labor, tools, services, and provision of all products required, for a complete, integrated, operational DCS control system in accordance with Scope of Services.
2. Identify other on-going projects/systems developments that are not part of this contract. Ensure other ongoing activities, in close proximity or otherwise, do not disturb or interrupt the operation of the existing systems or the work already commissioned or placed into operation. Should any such activity pose a risk to this Work or to the system operation, advise the City immediately.
3. The following is a summary of the major works:
 - a. Engineer to provide a high-level description of the project specific work including provision of all instruments, hardware, software, network, cabling, and services such as testing, commissioning, training, and documentation.
 - b. Following the instructions in D, Provide, test and commission all field instrumentation including field wiring, instrument control panels, and control system hardware including all lightning & surge protection, and all peripheral devices necessary.
 - c. Conduits and Wires:
 - 1) All conduits, including those for the district information network (DIN), plant information network (PIN) and facility information network (FIN), will be furnished and installed by the Contractor. All conductors, including power and grounding for DCSP furnished equipment will be furnished and installed by the Contractor. DCS grounding will use a

EXHIBIT H-1
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
GENERAL REQUIREMENTS

special triad grounding system; specifications for this system are provided in the contract documents in accordance with the DCSP requirements. All signal conductors will be provided, and installed by the General Contractor.

- 2) The PIN and FIN fiber optic cables will be furnished, installed, and terminated by the General Contractor. DIN fiber optic cable will be furnished by the General Contractor and installed by the Contractor up to the first termination point within a facility. All wire termination except for PIN, FIN, and DIN cables will be performed by the General Contractor.
 - 3) Cables and conduits for non-DCS communications systems, such as the telephone system, will be furnished and installed by the General Contractor.
- d. Provide all programming and microprocessor-based instrument configuration.
 - e. Provide all required testing, commissioning and start up services. Allow in the Contract Price, for any additional time deemed necessary to meet the testing and commission requirements.
 - f. Provide Factory Acceptance Testing (FAT) to demonstrate the operational functionality of hardware and communications per specifications.
 - g. Provide Operational Readiness Testing (ORT) to demonstrate the correct operation of the control system with both hardware and software in place per specifications.
 - h. Provide Performance Acceptance Test to ensure entire system functions properly per specifications.
 - i. Provide all required training per specifications.
 - j. Provide warranty services in accordance with the requirements specified in this and other related sections included in these Specifications.

1.2 RELATED SECTIONS

- A. The Work described in the following sections also applies to the Work in this section. Other sections of the specifications not referenced below shall also apply to the extent required for proper performance of this Work.
 1. Division 00, General Conditions.
 2. Division 01, General Requirements.
 3. Section 01 33 00, Submittal Procedures.
 4. Division 26, Electrical.
 5. Division 40, Process Integration.
- B. COMNET Standards: The Work shall comply with the current standards, as in graphics, documentation, etc., adopted by COMNET.

EXHIBIT H-1
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
GENERAL REQUIREMENTS

1.3 SUBMITTALS

- A. The DCSP shall develop and submit within the first 30 days after NTP, a detailed list of submittals required by all Contract Documents for review and approval. The list shall contain the title of each submittal, detailed description of its contents and the applicable reference Sections. Submittal shall be grouped, organized, and sequenced logically such that it facilitates the City's representative's review process. This requirement extends to all Work required by all other Divisions.
- B. The DCSP shall conduct a pre-submittal conference. At a minimum, the following shall be presented at the conference:
 - 1. A list of equipment and materials required for the applicable submittal content
 - 2. An exact one-to-one sample of each type of document to be submitted
 - 3. Any implementation and construction documentation associated with the submittal
 - 4. A project completion schedule or schedule fragment that applies to the submittal.
- C. The DCSP shall prepare and submit complete and organized shop drawings, as specified herein. Incomplete or partial submittals are not acceptable. All Shop Drawings and Record Drawings shall be submitted in accordance with the requirements of this Section.
 - 1. Loop drawing submittal (LDS) to verify the DCS interfaces with all instrumentation and devices being provided or installed under the project are to be developed by the DCSP or its subcontractor. The Loop Drawings shall define all interfaces with equipment provided by the DCSP on a timely basis. The Loop Drawings shall be developed in accordance with existing City Loop Drawing standards, as follows:
 - a. The loop drawing shall be composed of three sections:
 - b. Page 1: A device schedule with a table showing the following:
 - 1) Device tag number, with Prefix, Unit Process, ISA Tag Prefix, Tag No, Tag suffix.
 - 2) Equipment Service.
 - 3) Device Type.
 - 4) Location.
 - 5) Device Manufacturer.
 - 6) Model No.
 - 7) Spec. No.
 - 8) Area Contractor (if applicable).
 - 9) Submittal No.
 - 10) Remarks.
 - 11) Data Sheet No.

EXHIBIT H-1
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
GENERAL REQUIREMENTS

- 12) I/O Signal (AI, AO, DI, or DO).
 - 13) Signal Level.
 - 14) Device Range.
 - 15) Engineering Units.
 - 16) Process Set Point.
 - 17) Loop Diagram No.
 - 18) Loop Drawing File Name.
 - 19) Interconnect Drawing File Name.
 - 20) For third-party devices, should also include: IP (if applicable), module addresses, data registers, IO Tag Names (AB), protocols etc.
 - c. Page 2: Loop drawing meeting the Requirements of ANSI/ISA S5.4, except that intermediate terminal junction boxes may omitted and be shown on Page 3 for clarity.
 - d. Page 3: Abbreviated diagram showing instrument, wire and cable numbers, intermediate terminal junction boxes, and PCM terminations.
 2. The DCSP shall augment the content of the Loop Drawings by providing all of the requisite data relating to the DCS. For each DCS input/output, the DCSP shall note on the PLDS the following information:
 - a. PCM number, and physical location.
 - b. Controller Number.
 - c. Type of input.
 - d. I/O card location and address.
 - e. All DCS-dependent displayed functions using ISA symbology.
 - f. Drawing reference for DCS software content.
 3. In these Contract Documents all systems, all meters, all instruments, and all other elements are represented schematically, and are designated by symbology as derived from International Society of Automation ISA S5.1 (latest revision). The nomenclature and numbers designated herein and on the Drawings, shall be employed exclusively throughout shop drawings, and similar materials. Any other symbols, designations, and nomenclature unique to any manufacturer's standard methods shall not replace those prescribed above, used herein, and on the Drawings.
 4. All shop drawings shall include a City-approved title block. The title block shall include, as a minimum, business name and address, project name, drawing name, revision level, and personnel responsible for the content of Drawing. Loop Drawing Submittals shall be submitted in accordance with Section 01 33 00, Submittal Procedures.
- D. The DCS hardware submittal (DCSHS) shall be singular and all inclusive,

EXHIBIT H-1
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
GENERAL REQUIREMENTS

submitted in accordance with Section 01 33 00, Submittal Procedures. The DCS Hardware Submittal shall include, but not be limited to:

1. A complete set of system diagrams which depict:
 - a. All Process Control Modules (PCMs), Workstations (WSs), video devices, printers, Foreign Device Interfaces (Data Link) telemetry devices, communication devices, and communication links.
 - b. A one-line showing the designed conduit and wire required to support the power, ground, Input/Output, and communication requirements of the system.
 - c. A complete I/O Database showing all I/Os, annotated in ISA format, which depicts all designed I/O, both external and internal hard-wired and data-linked, inclusive of DCS termination locations.
 - d. A Complete one-line diagram showing all power wiring and ground wiring, including UPS power, Utility (non-UPS) power and any other external D.C. or A.C. sources for each PCM.
2. A complete set of Factory Data sheets for every DCS component. This shall include layout drawings that show enclosure details, including seismic mounting, as well as the location of each component within the DCS PCM enclosure. Drawings shall contain a scaled representation of the placement of all DCS equipment being provided under this contract and its spatial relationship to all other equipment (both new and existing) located in the abutting and adjoining areas. All acquired access and clearances associated with the DCS equipment and other equipment must be shown with a statement of compliance to DCSP requirements, NEC, NFPS and other applicable codes.
3. Detailed installation, mounting, and anchoring details for all components and assemblies to be field mounted, including access requirements, conduit connections, or entry details shall be provided.
4. DCSP shall provide Seismic calculations for each DCS PCM enclosure, or other anchored apparatus, based on the proposed mounting arrangement. Installation/Mounting/Anchoring drawings shall be stamped by a Structural Engineer, registered with the State of California. Each individual anchoring drawing, as well as the seismic calculations drawings, shall be stamped by the structural engineer.
5. A complete, and detailed, bill of material (BOM) shall be

EXHIBIT H-1
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
GENERAL REQUIREMENTS

provided. The BOM shall show the factory model number for each component within the DCS.

- E. The DCS Network submittal (DCSNS) shall be singular and all inclusive, submitted in accordance with the requirements of this Section. The DCS Network Submittal shall include, but not be limited to:
1. A complete set of network diagrams which depict:
 - a. All Process Control Modules (PCMs), Workstations (WSs), video devices, printers, Foreign Device Interfaces (Data Link) telemetry devices, communication devices, and communication links.
 - b. A one-line showing the designed conduit and wire required to support the power, ground, Input/Output, and communication requirements of the system.
 - c. A complete network design report including IP scheme, traffic planning, and control, QoS, configuration of every network equipment including routers, switches and firewalls.
 - d. A Complete fiber connection diagrams including fiber routing plans, fiber details, link budget calculations etc.
 - e. A complete, and detailed, bill of material (BOM) shall be provided. The BOM shall show the factory model number for each component within the DCS.
 2. A complete set of Factory Data sheets for every network component.
- F. The DCS Software Submittal (DCSSS) shall be singular and all inclusive, submitted in accordance with Section 01 33 00, Submittal Procedures. The DCS Software Submittal shall include, but not be limited to:
1. A complete set of all available software algorithms.
 2. An English narrative of each data acquisition or control loop mission and anticipated action. Narratives shall enumerate the signal point name, signal descriptor, associated PCM number, associated system template displays, system functions activated by signal (i.e., interlocks, alarms, logs, etc.).
 3. A complete set of PCM configuration sheets depicting each loop linkage. Each loop shall be on its own 8 1/2-inch by 11-inch sheet.
 4. A complete listing of the DCS data base listing for each data point's relevant parameters such as range, contact orientation, limits, incremental limits, I/O card type, I/O hardware address and assignment, including ALL Macros used/created for the Software.

EXHIBIT H-1
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
GENERAL REQUIREMENTS

5. A complete set of Designer control strategies, with annotations provided by the DCSP depicting engineering details to show how all monitoring and control functions, on a loop by loop basis, will be accomplished. So operators can understand how the process will respond to his action through DCS interfaces.
- J. The DCS Graphic Submittal (DCSGS) shall be singular and all inclusive, submitted in accordance with the requirements of this Section. The DCS Graphics Submittal shall include, but not be limited to:
1. One complete set of all WS-accessible displays which are unique to this project (i.e., process global, system global, process regional, systems regional, process group, process loop, process component, integrated tutorials, integrated process tutorials, integrated documentation, user assistance).
 2. The DCSP shall ensure that all graphics development, and graphics submittal, conform to the existing graphics layouts, linkages and formats used throughout the COMNET Enterprise.
 3. The Graphics Submittals shall contain displays in full size color graphic format and replicate the proposed screen contents. All background colors shall be identical to that of the screen content. All displays shall be arranged in a hierarchical order with references to associated WSs.
 4. A system display linkage diagram which defines the hierarchical order and the linkages via page, down, left, right commands.
 5. A definition of each displays data fields by tag numbers, utilizing the existing DCS COMNET standard.
 6. A definition of each displays dynamic elements which shall blink, change color, rotate or change shape in response to process changes, and conforms to the existing COMNET standard.
 7. A listing of all "help" text associated with each display screen, arranges in conformance to the COMNET standard.
- K. The DCSP shall prepare and submit a Plan for the Operation Readiness Tests (ORT). The ORT plan shall be submitted in accordance with the requirements of this Section. The ORT Plan shall be a single-source document which shall encompasses means and methods for testing the complete DCS for this Project segment.
1. The ORT Plan shall provide testing of all DCS hardware, software, graphics, alarms and network communications.
 2. The ORT Plan shall elaborate on the simulator to be utilized to provide proof of performance testing for the I&C and DCS functions of the project.
 3. The ORT Plan shall provide sample sheets depicting all I/O, hardware, Data Links, communication Networking and internally generated alarms and I/O

EXHIBIT H-1
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
GENERAL REQUIREMENTS

points. Once approved conceptually by the City, these forms will be populated and utilized by the DCSP in the submission of each PCM individual ORT submittal.

- L. The DCSP shall prepare a complete Training Plan. The Training Plan shall be submitted in accordance with the requirements of this Section. The DCS Training Plan will provide the structure and syllabus for training sessions as follows:
1. Operator Training: Shall provide instruction to Operators already familiar with the operation of the Enterprise DCS, and shall be tailored to the new I/O, process controls, P&ID schemes and specialty consideration for the controls for this Project.
 2. Maintenance Training; Shall provide training to City DCS Staff on all enhancements to the DCS, new-generation components and all other hardware, software or graphics maintenance requirements, not currently covered in the City's existing Enterprise DCS.
 3. The DCSP shall allow for a minimum of four (4) sessions of each class outlined in the Training Plan to ensure staff availability and shift-differential considerations are facilitated.
 4. Resumes of all Training Instructors to be utilized in DCS training shall be included in the Training Plan submittal.
 5. After approval of the Training Plan, the DCSP is responsible for coordinating with City DCS Staff, or the City's project representative, to schedule training classes at appropriate times in advance of cut-over and start-up.

PART 2 PRODUCTS

2.1 CURRENT TECHNOLOGY

- A. All hardware and software shall be the product of Emerson Process Management (EPM) and shall be of the Ovation family of DCS.
- B. The DCS should utilize state-of-the-art products in the DCSP's product line. However, the DCSP must ensure that all products used for this Project are compatible, and will fully integrate into the City's existing enterprise wide COMNET DCS.
- C. Successful operation and calculation shall be demonstrated during Factory Acceptance Testing (FAT), Operational Readiness Testing (ORT), and Functional Testing phases.

2.2 HARDWARE AND SOFTWARE COMMONALITY

EXHIBIT H-1
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
GENERAL REQUIREMENTS

- A. Where there is more than one item of similar equipment being furnished, all such similar equipment shall be the of the same Ovation family series.
- B. The DCSP shall submit a plan in case of a discontinued or upgraded product, or other cases where changing technology requires changes in equipment, the DCSP shall submit a Substitute Item Request Form.
- C. All equipment shall be of modular design to facilitate interchangeability of parts and to assure ease of servicing. This interchangeability shall apply to the following components, as a minimum, of the DCS.
 - 1. Processor Modules.
 - 2. Bulk Memory Modules.
 - 3. Communication Interface Modules.
 - 4. Analog and Discrete Signal Modules.
 - 5. Power Supply Modules.
 - 6. Workstations and operator interface devices.
 - 7. Software licenses.

2.3 DCS PRIMARY ARCHITECTURAL COMPONENTS

- A. The DCS supplied by EPM shall consist of, but not be limited to, the following primary architectural components:
 - 1. Operator, engineering, instructor, and field workstations
 - 2. Copper and fiber optic communications network (at DCS PCMs, etc).
 - 3. DCS OS Software for alarms, events, monitoring and control and configuration tools.
 - 4. Security.
 - 5. Historian/Historical data recording and reporting.
 - 6. System Configuration (Application Software) of I/O database, displays, control loops, and human machine interfaces (HMI) graphics.
 - 7. Process Control Modules (PCM).
 - 8. Input/output (I/O) cards and devices, I/O racks, I/O units, remote IO, and Termination Cabinets.
 - 9. PLC's, RTUs, Foreign Device Interface (FDI) modules for PCMs.
- B. In addition, components associated with the DCS are:
 - 1. Control room furniture as shown on drawings and contained in these Specification, peripherals such as large screen displays, alarm printers, etc.
 - 2. Services related to DCS (including system maintenance, upgrading, and third party and enterprise integration).
 - 3. Enclosures, termination panels, power, UPS, and ground termination busses, etc.

EXHIBIT H-1
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
GENERAL REQUIREMENTS

2.4 INTEGRATION COMPONENTS

- A. The Integration components shall consist of the following:
 - 1. Integration Server (where shown on design drawings and specified herein).
 - 2. Integration Adapters.
 - 3. Software Integration Services.
 - 4. Web Services (when required by specifications).

2.5 SUPPORTING COMPONENTS

- A. The supporting components and associated application software shall consist of the following:
 - 1. DCS LAN Switches.
 - 2. DCS LAN/DCS WAN Routers.
 - 3. Patch Management Server (when specified herein).
 - 4. Security hardware and software, including Antivirus software and malware detection.

PART 3 EXECUTION

3.1 PROJECT EXECUTION AND PROJECT MANAGEMENT SERVICES

- A. The DCSP shall prosecute all Work in strict accordance with the sequence and schedule of the Contract's Master Baseline Schedule.
- B. Not Used.
- C. The DCSP shall provide all project management services required to complete the Work of these documents. At a minimum project management services shall include:
 - 1. Progress Review Meetings.
 - 2. Meeting and workshops to develop project requirements and design details.
 - 3. Regular meetings on scheduling and invoicing.
 - 4. All required meetings for design and submittal reviews.
 - 5. Coordination of support and warranty.
 - 6. Coordination of training.
 - 7. Development and delivery of DCS project controls and document management that coordinates with that of the Prime Contractor.
 - 8. Attend coordination meetings with Prime Contractor, City's representative, plant staff and other City entities as they relate to

EXHIBIT H-1
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
GENERAL REQUIREMENTS

- the delivery of DCS Work.
- 9. Respond to City representative's requests for information and project documentation.
- 10. Respond to RFI reviews, as requested by the Design Engineer through the City's representative.
- D. The DCSP shall provide all labor, equipment, materials, and furniture for the tenant improvements required for the approved staging site at the sole expense of the DCSP.

3.2 ENGINEERING & DESIGN PHASE

- A. The DCSP shall provide all engineering, resources, equipment, and labor required to successfully:
 - 1. Produce all submittals, in accordance with Section 01 33 00, Submittal Procedures, and Division 40 requirements.
 - 2. Program, configure, and test of all hardware and software as required by these specifications.
 - 3. Design and specify the enterprise inter-site WAN interface at Project site for communications interface with the existing COMNET DCS.
 - 4. Develop the classroom and computer-based-training for all system elements.
 - 5. Execute field verification and documentation of all conditions, and develop installation drawings and accurate as-constructed documents to successfully complete the Work.
 - 6. Setup, stage, and test the Work of each process segment and perform ORT, witnessed by the City's representative at the approved Staging Area prior to any installation.
 - 7. Put into service all system elements by detailed I/O tests, loop checks, and commissioning. Develop and perform functional and performance testing.
 - 8. Develop and submit PCM-by-PCM cutover plans for approval by the City's representative.
 - 9. Document all system elements, software and custom applications
 - 10. Maintain, upgrade and warrant all Work required by the Prime Contract.
 - 11. Design, develop, program, test, and commission Integration of DCS with other systems.
 - 12. The DCSP shall develop and submit a uniform and standardized IO tag name convention, and follow the ISA tagging scheme standardly used by the COMNET DCS.

3.3 PROCUREMENT, STAGING, PROGRAMMING, AND TESTING PHASE:

EXHIBIT H-1
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
GENERAL REQUIREMENTS

- A. The DCSP shall provide all engineering, resources, equipment, and labor required to:
 - 1. Procure all goods and services required to conform to these specifications.
 - 2. Perform all shipments required by the Work.
 - 3. Ship all equipment and software to the approved staging facility, including deliveries from approved Staging Site to Project site
- B. Assemble, stage and program each Segment of Work at the approved Staging area and perform ORT prior to delivery for installation. All tests shall be performed in accordance with Division 40 specifications and approved test procedures.
- C. The system elements (i.e. WS, PCM, FHS, etc.) may be assembled at the DCSPS facility and shipped to the approved Staging area for staging, programming, and testing. However, the CITY reserves the right to inspect these system elements prior to shipment, and again prior to delivery from the Staging site to the Project site.

3.4 FIELD CONSTRUCTION/ COMMISSIONING PHASE

- A. Provide all engineering, resources, equipment, and labor required to:
 - 1. Oversee the physical install, by others, of all Process Control Modules (PCM) and Remote IO (RIO) enclosures and electronics.
 - 2. Oversee termination, by others, of all field wiring in 'B' or PCM Cabinets.
 - 3. Where more than one PCM is provided, run new wires from Cabinet to DCS IO where required.
 - 4. Design, install, and test foreign devices including serial or networked I/O.
 - 5. Oversee Supply and termination of power and grounding of all devices, by others.
 - 6. Test all signal grounding and certify proper installation and function.
 - 7. Deliver Uninterruptible Power Supplies, for installation by others under Division 26.
 - 8. Obtain and manage all required Intra-Plant permits.
 - 9. Install and test all DCS-related networking hardware and cabling.
 - 10. Test all workstations, hardened workstations, PCM and RIO cabinetry, and enclosures.
 - 11. Manage and deliver as-built documentation including DCS loop diagram information and P&IDs information. As

EXHIBIT H-1
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
GENERAL REQUIREMENTS

specified.

12. Conduct a functional test, and site acceptance test to verify DCS performance.
13. Update and submit all specified documentation to reflect “as-built” or record conditions.

3.5 MAINTENANCE AND UPGRADE SERVICES PHASE

- A. The DCSP shall Warrant all parts and services for a period as specified for the Prim Contract, after Final DCS Acceptance.

3.6 ENVIRONMENTAL SUITABILITY

- A. All DCS devices provided under this contract shall be provided with enclosures which are suitable for use in a treatment facility environment where there are typically high energy AC fields, DC control pulses, and varying ground potentials between the transducers or process instrument locations and those occupied by DCS components.
- B. The system design shall be adequate to provide proper protection against interferences from all such possible situations.
- C. As a minimum, all DCS equipment shall be resistive to airborne contaminants commonly found in wastewater treatment facilities, and be suitable for installation in an environment which conforms to a G2 classification as defined by ISA-S71.04.
- D. Field-Situated Equipment:
 1. DCS equipment being furnished under this contract shall be suitable for use in wastewater treatment facilities, some of which are in an environment of air with traces of methane and hydrogen sulfide.
 2. The system design shall be adequate to provide proper protection against such an environment.
 3. All field-situated components including PCMs shall be UL-listed or approved LABOS by an independent certification agency acceptable to the City of San Diego.
 4. All DCS devices shall be housed in an enclosure suitable for its intended service and installation location.
 5. All DCS devices to be installed in MCC or other protected areas shall be furnished in NEMA 12 rated enclosure.
 6. All DCS devices to be installed in indoor protected areas shall be furnished in NEMA 12 rated enclosures.
 7. All DCS devices to be installed in indoor unprotected or areas subject to hose-down conditions, or outdoor areas, shall be furnished in

EXHIBIT H-1
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
GENERAL REQUIREMENTS

- 316SS NEMA 4X rated enclosures.
8. At a minimum, the DCS shall be designed and constructed for satisfactory, long, and low maintenance operation under the following environmental conditions:
 - a. Temperature Range: 0 degree C through 50 degrees Celsius (32 degrees Fahrenheit through 122 degrees Fahrenheit).
 - b. Thermal Shock: 0.55 degrees Celsius (1 degree Fahrenheit per minute maximum).
 - c. Relative Humidity: 5 through 95 percent (non-condensing).
 9. The mounting of all enclosures shall meet the requirements as specified in Division 26, and shall be seismically braced as required by code for this seismic zone.

END OF SECTION

EXHIBIT H-2
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.1 RELATED SECTIONS

- A. Requirements specified within this section apply to all Electrical Work.

1.2 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
 - 1. National Electrical Contractors Association (NECA):
National Electrical Installation Standards.
 - 2. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - b. Z535.4, Product Safety Signs and Labels.
 - 3. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
 - 4. UL.

1.3 DESIGN REQUIREMENTS

- A. Design and submit conduit layout design, as required in Raceway and Boxes Exhibit.

1.4 SUBMITTALS

- A. Action Submittals:
 - 1. Provide manufacturers' data for the following:
 - a. Nameplates, signs, and labels.
 - 2. Provide Incident Energy and Arc Flash Boundary calculations.

1.5 QUALITY ASSURANCE

- A. Provide the Work in accordance with NFPA 70. Where required by Authority Having Jurisdiction (AHJ), material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ, in order to provide a basis for approval under the NEC.

EXHIBIT H-2
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
BASIC ELECTRICAL REQUIREMENTS

- B. Materials and equipment manufactured within the scope of standards published by UL shall conform to those standards and shall have an applied UL listing mark or label.

1.6 ENVIRONMENTAL CONDITIONS

- A. Perform Incident Energy and Arc Flash Protection Boundary calculations per NFPA 70E, Table D.4.7, Version 2018, and show information on Arc Flash Protection Warning Signs.

PART 2 PRODUCTS

2.1 GENERAL

- A. Where two or more units of the same class of material or equipment are required, provide products of a single manufacturer. Component parts of materials or equipment need not be products of the same manufacturer.
- B. Material and equipment installed in heated and ventilated areas shall be capable of continuous operation at their specified ratings within an ambient temperature range of 40 degrees F to 104 degrees F.
- C. Materials and equipment installed outdoors shall be capable of continuous operation at their specified rating within the ambient temperature range stated in Section 01 61 00, Common Product Requirements.

2.2 EQUIPMENT FINISH

- A. Manufacturer's standard finish color, except where specific color is indicated. If manufacturer has no standard color, finish equipment in accordance with light gray color finish as approved by Engineer.

2.3 NAMEPLATES

- A. Material: Laminated plastic.
- B. Attachment Screws: Stainless steel.
- C. Color: Black, engraved to a white core.
- D. Letter Height:
 - 1. Pushbuttons/Selector Switches: 1/8 inch.
 - 2. Other Electrical Equipment: 3/8 inch.

2.4 SIGNS AND LABELS

- A. Sign size, lettering, and color shall be in accordance with NEMA Z535.4.
- B. Provide the information shown for all new Arc Flash Protection Warning Signs located as a supplement to end of section.

PART 3 EXECUTION

3.1 GENERAL

- A. Electrical Drawings show general locations of equipment, devices, and raceway, unless specifically dimensioned. Contractor shall be responsible for actual location of equipment and devices and for proper routing and support of raceways, subject to approval of Engineer.
- B. Check approximate locations of light fixtures, switches, electrical outlets, equipment, and other electrical system components shown on Drawings for conflicts with openings, structural members, and components of other systems and equipment having fixed locations. In the event of conflicts, notify Engineer in writing.
- C. Install work in accordance with NECA Standard of Installation, unless otherwise specified.
- D. Keep openings in boxes and equipment closed during construction.
- E. Lay out work carefully in advance. Do not cut or notch any structural member or building surface without specific approval of Engineer. Carefully perform cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, paving, or other surfaces required for the installation, support, or anchorage of conduit, raceways, or other electrical materials and equipment. Following such work, restore surfaces to original condition.

3.2 ANCHORING AND MOUNTING

- A. Equipment anchoring and mounting shall be in accordance with manufacturer's requirements for seismic zone criteria given in Section 01 61 00, Common Product Requirements.

3.3 COMBINING CIRCUITS INTO COMMON RACEWAY

- A. Circuits shown on Drawings indicate functional wiring requirements for power and control circuits. Circuits may be combined into common raceways in accordance with the following requirements:
 - 1. Analog control circuits from devices in same general area to same destination.
 - a. No power or AC discrete control circuits shall be combined in same conduit with analog circuits.
 - b. No Class 2 or Class 3 circuits including, but not limited to, HVAC

EXHIBIT H-2
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
BASIC ELECTRICAL REQUIREMENTS

- control circuits, fire alarm circuits, paging system circuits shall be combined with power or Class 1 circuits.
- c. Analog circuits shall be continuous from source to destination. Do not add TJB, splice, or combine into a multi-pair cable without authorization of Engineer.
 - d. Raceways shall be sized per General Circuit and Raceway Schedule and do not exceed 40 percent fill.
 - e. Changes shall be documented on record drawings.
2. Discrete control circuits from devices in the same general area to the same destination.
- a. No power or analog control circuits shall be combined in same conduit with discrete circuits.
 - b. No Class 2 or Class 3 circuits including, but not limited to, HVAC control circuits, fire alarm circuits, and paging system circuits shall be combined with power or Class 1 circuits.
 - c. Raceways shall be sized per the General Circuit and Raceway Schedule and do not exceed 40 percent fill.
 - d. Changes shall be documented on record drawings.
3. Power circuits from loads in same general area to same source location (such as panelboard, switchboard, low voltage motor control center).
- a. Lighting Circuits: Combine no more than three circuits to a single raceway. Provide a separate neutral conductor for each circuit. Contractor shall be responsible for increasing conduit and conductor size if derating is required by NEC.
 - b. Receptacle Circuits, 120-Volt Only: Combine no more than three circuits to a single raceway. Provide a separate neutral conductor for each circuit. Contractor shall be responsible for increasing conduit and conductor size if derating is required by NEC.
 - c. All Other Power Circuits: Do not combine power circuits without authorization of Engineer.

3.4 NAMEPLATES, SIGNS, AND LABELS

- A. Arc Flash Protection Warning Signs: Field mark all new or updated equipment as specified in this section to warn qualified persons of potential arc-flash hazards. Locate marking so to be clearly visible to persons before working on energized equipment.
- B. Multiple Power Supply Sign: Install permanent plaque or directory at each service disconnect location denoting other services, feeders, and branch circuits supplying the building and the area served by each.
- C. Equipment Nameplates:
 - 1. Provide a nameplate to label electrical equipment including

EXHIBIT H-2
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
BASIC ELECTRICAL REQUIREMENTS

switchgear, switchboards, motor control centers, panelboards, motor starters, transformers, terminal junction boxes, disconnect switches, switches and control stations.

2. Switchgear, motor control center, transformer, and terminal junction box nameplates shall include equipment designation.
3. Disconnect switch, starter, and control station nameplates shall include name and number of equipment powered or controlled by that device.
4. Switchboard and panelboard nameplates shall include equipment designation, service voltage, and phases.

3.5 LOAD BALANCE

- A. Drawings and Specifications indicate circuiting to electrical loads and distribution equipment.
- B. Balance electrical load between phases as nearly as possible on switchboards, panelboards, motor control centers, and other equipment where balancing is required.
- C. When loads must be reconnected to different circuits to balance phase loads, maintain accurate record of changes made, and provide circuit directory that lists final circuit arrangement.

3.6 CLEANING AND TOUCHUP PAINTING

- A. Cleaning: Throughout the Work, clean interior and exterior of devices and equipment by removing debris and vacuuming.
- B. Touchup Paint:
 1. Touchup scratches, scrapes and chips on exterior and interior surfaces of devices and equipment with finish matching type, color, and consistency and type of surface of original finish.
 2. If extensive damage is done to equipment paint surfaces, refinish entire equipment in a manner that provides a finish equal to or better than factory finish, that meets requirements of Specification, and is acceptable to Engineer.

3.7 PROTECTION FOLLOWING INSTALLATION

- A. Protect materials and equipment from corrosion, physical damage, and effects of moisture on insulation and contact surfaces.
- B. When equipment intended for indoor installation is installed at Contractor's convenience in areas where subject to dampness, moisture, dirt or other adverse atmosphere until completion of construction, ensure adequate protection from these atmospheres is provided and acceptable to Engineer.

EXHIBIT H-2
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
BASIC ELECTRICAL REQUIREMENTS

3.8 SUPPLEMENTS

A. The supplement listed below, following “End of Section,” is part of this Specification.

1. Figure 1: Example Arc Flash Label.

END OF SECTION

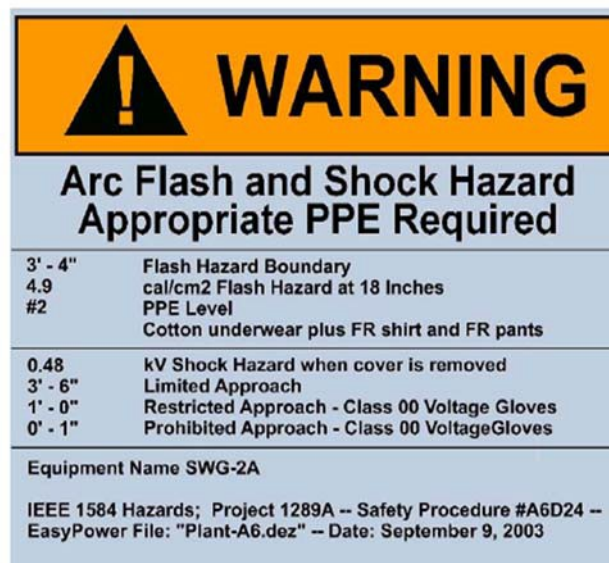


Figure 1
Example Arc Flash Label

EXHIBIT H-3
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
BASIC ELECTRICAL MATERIALS & METHODS

PART 1 GENERAL

1.1 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
 - a. A1011/A1011M, Standard Specification for Steel, Sheet, and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low Alloy and High-Strength Low Alloy Formability.
 - b. E814, Method of Fire Tests of Through-Penetration Fire Stops.
2. Canadian Standards Association (CSA).
3. Institute of Electrical and Electronics Engineers, Inc. (IEEE): 18, Standard for Shunt Power Capacitors.
4. International Society of Automation (ISA): RP12.06.01, Wiring Practices for Hazardous (Classified) Locations Instrumentation—Part 1: Intrinsic Safety.
5. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
 - b. C12.1, Code for Electricity Metering.
 - c. C12.6, Phase-Shifting Devices Used in Metering, Marking and Arrangement of Terminals.
 - d. ICS 2, Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated 600 Volts.
 - e. ICS 5, Industrial Control and Systems: Control Circuit and Pilot Devices.
 - f. KS 1, Enclosed and Miscellaneous Distribution Switches (600 Volts Maximum).
6. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
7. UL:
 - a. 98, Standard for Enclosed and Dead-Front Switches.
 - b. 248, Standard for Low Voltage Fuses.
 - c. 486E, Standard for Equipment Wiring Terminals for use with Aluminum and/or Copper Conductors.
 - d. 489, Standard for Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures.
 - e. 508, Standard for Industrial Control Equipment.
 - f. 810, Standard for Capacitors.
 - g. 943, Standard for Ground-Fault Circuit-Interrupters.
 - h. 1059, Standard for Terminal Blocks.

EXHIBIT H-3
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
BASIC ELECTRICAL MATERIALS & METHODS

- i. 1479, Fire Tests of Through-Penetration Fire Stops.

1.2 SUBMITTALS

A. Action Submittals:

- 1. Provide manufacturers' data for the following:
 - a. Control devices.
 - b. Control relays.
 - c. Circuit breakers.
 - d. Fused switches.
 - e. Nonfused switches.
 - f. Timers.
 - g. Fuses.
 - h. Magnetic contactors.
 - i. Intrinsic safety barriers.
 - j. Enclosures: Include enclosure data for products having enclosures.
- 2. Seismic anchorage and bracing drawings and cut sheets, as required by Section 01 88 15, Anchorage and Bracing.

- B. Informational Submittals:** Seismic anchorage and bracing calculations as required by Section 01 88 15, Anchorage and Bracing.

PART 2 PRODUCTS

2.1 MOLDED CASE CIRCUIT BREAKER THERMAL MAGNETIC, LOW VOLTAGE

A. General:

- 1. Type: Molded case.
- 2. Trip Ratings: 15 amps to 100 amps.
- 3. Voltage Ratings: 120, 208, 240, 277V ac.
- 4. Suitable for mounting and operating in any position.
- 5. UL 489.

B. Operating Mechanism:

- 1. Overcenter, trip-free, toggle type handle.
- 2. Quick-make, quick-break action.
- 3. Locking provisions for padlocking breaker in OPEN position.
- 4. ON/OFF and TRIPPED indicating positions of operating handle.
- 5. Operating handle to assume a CENTER position when tripped.

EXHIBIT H-3
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
BASIC ELECTRICAL MATERIALS & METHODS

- C. Trip Mechanism:
 - 1. Individual permanent thermal and magnetic trip elements in each pole.
 - 2. Two and three pole, common trip.
 - 3. Automatically opens all poles when overcurrent occurs on one pole.
 - 4. Calibrated for 40 degrees C ambient, unless shown otherwise.
 - 5. Do not provide single-pole circuit breakers with handle ties where multi-pole circuit breakers are shown.
- D. Short Circuit Interrupting Ratings: Equal to rating of existing equipment.
- E. Accessories: Shunt trip, auxiliary switches, handle lock ON devices, mechanical interlocks, key interlocks, unit mounting bases, double lugs as shown or otherwise required. Shunt trip operators shall be continuous duty rated or have coil-clearing contacts.
- F. Connections:
 - 1. Supply (line side) at either end.
 - 2. Mechanical wire lugs, except crimp compression lugs where shown.
 - 3. Suitable for 75 degrees C rated conductors without derating breaker or conductor ampacity.

2.2 FUSED SWITCH, INDIVIDUAL, LOW VOLTAGE

- A. UL 98 listed for use and location of installation.
- B. NEMA KS 1.
- C. Short Circuit Rating: 200,000 amps rms symmetrical with Class R, Class J, or Class L fuses installed.
- D. Quick-make, quick-break, motor rated, load-break, heavy-duty (HD) type with external markings clearly indicating ON/OFF positions.
- E. Connections:
 - 1. Mechanical lugs, except crimp compression lugs where shown.
 - 2. Lugs removable/replaceable.
 - 3. Suitable for 75 degrees C rated conductors at NEC 75 degrees C ampacity.
- F. Fuse Provisions:
 - 1. 30-amp to 600-amp rated shall incorporate rejection feature to reject all

EXHIBIT H-3
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
BASIC ELECTRICAL MATERIALS & METHODS

fuses except Class R.

2. 601-amp rated and greater shall accept Class L fuses, unless otherwise shown.

G. Enclosures: See Article Enclosures.

H. Interlock: Enclosure and switch to prevent opening cover with switch in ON position. Provide bypass feature for use by qualified personnel.

2.3 NONFUSED SWITCH, INDIVIDUAL, LOW VOLTAGE

A. NEMA KS 1.

B. Quick-make, quick-break, motor rated, load-break, heavy-duty (HD) type with external markings clearly indicating ON/OFF positions.

C. Lugs: Suitable for use with 75 degrees C wire at NEC 75 degrees C ampacity.

D. Enclosures: See Article Enclosures.

E. Interlock: Enclosure and switch to prevent opening cover with switch in ON position. Provide bypass feature for use by qualified personnel.

2.4 FUSE, 250-VOLT AND 600-VOLT

A. Power Distribution, General:

1. Current-limiting, with 200,000 ampere rms interrupting rating.
2. Provide to fit mountings specified with switches.
3. UL 248.

B. Power Distribution, Ampere Ratings 1 Amp to 600 Amps:

1. Class: RK-1.
2. Type: Dual element, with time delay.
3. Manufacturers and Products:
 - a. Bussmann; Types LPS-RK (600 volts) and LPN-RK (250 volts).
 - b. Littelfuse; Types LLS-RK (600 volts) and LLN-RK (250 volts).
 - c. Or approved equal.

C. Power Distribution, Ampere Ratings 601 Amps to 6,000 Amps:

1. Class: L.
2. Double O-rings and silver links.
3. Manufacturers and Products:

EXHIBIT H-3
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
BASIC ELECTRICAL MATERIALS & METHODS

- a. Bussmann; Type KRP-C.
- b. Littelfuse, Inc.; Type KLPC.
- c. Or approved equal.

D. Cable Limiters:

- 1. 600V or less; crimp to copper cable, bolt to bus or terminal pad.
- 2. Manufacturers and Products:
 - a. Bussmann; K Series.
 - b. Or approved equal.

E. Ferrule:

- 1. 600V or less, rated for applied voltage, small dimension.
- 2. Ampere Ratings: 1/10 amp to 30 amps.
- 3. Dual-element time-delay, time-delay, or nontime-delay as required.
- 4. Provide with blocks or holders as indicated and suitable for location and use.
- 5. Manufacturers:
 - a. Bussmann.
 - b. Littlefuse, Inc.
 - c. Or approved equal.

2.5 PUSHBUTTON, INDICATING LIGHT, AND SELECTOR SWITCH

- A. Contact Rating: 7,200VA make, 720VA break, at 600V, NEMA ICS 5 Designation A600.
- B. Selector Switch Operating Lever: Standard.
- C. Indicating Light: Push-to-test.
- D. Pushbutton Color: As shown on Control Diagrams.
- E. Pushbutton and selector switch lockable in OFF position where indicated.
- F. Legend Plate:
 - 1. Material: Aluminum.
 - 2. Engraving: Enamel filled in high contrasting color.
 - 3. Text Arrangement: 11-character/spaces on one line, 14-character/spaces on each of two lines, as required, indicating specific function.
 - 4. Letter Height: 7/64 inch.
- G. Manufacturers and Products:

EXHIBIT H-3
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
BASIC ELECTRICAL MATERIALS & METHODS

1. Heavy-Duty, Oil-Tight Type:
 - a. General Electric Co.; Type CR 104P.
 - b. Square D Co.; Type T.
 - c. Eaton/Cutler-Hammer; Type 10250T.
 - d. Or approved equal.
2. Heavy-Duty, Watertight, and Corrosion-Resistant Type:
 - a. Square D Co.; Type SK.
 - b. General Electric Co.; Type CR 104P.
 - c. Eaton/Cutler-Hammer; Type E34.
 - d. Crouse-Hinds; Type NCS.
 - e. Or approved equal.

2.6 TERMINAL BLOCK, 600 VOLTS

- A. UL 486E and UL 1059.
 - B. Size components to allow insertion of necessary wire sizes.
 - C. Capable of termination of control circuits entering or leaving equipment, panels, or boxes.
 - D. Screw clamp compression, dead front barrier type, with current bar providing direct contact with wire between compression screw and yoke.
 - E. Yoke, current bar, and clamping screw of high strength and high conductivity metal.
 - F. Yoke shall guide all strands of wire into terminal.
 - G. Current bar shall ensure vibration-proof connection.
 - H. Terminals:
 1. Capable of wire connections without special preparation other than stripping.
 2. Capable of jumper installation with no loss of terminal or rail space.
 3. Individual, rail mounted.
 - I. Marking system, allowing use of preprinted or field-marked tags.
 - J. Manufacturers:
 1. Weidmuller, Inc.
 2. Ideal.
-

EXHIBIT H-3
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
BASIC ELECTRICAL MATERIALS & METHODS

3. Electrovert USA Corp.
4. Or approved equal.

2.7 SUPPORT AND FRAMING CHANNELS

A. Carbon Steel Framing Channel:

1. Material: Rolled, mild strip steel, 12-gauge minimum, ASTM A1011/A1011M, Grade 33.
2. Finish: Hot-dip galvanized after fabrication.

B. Paint Coated Framing Channel: Carbon steel framing channel with electro-deposited rust inhibiting acrylic or epoxy paint.

C. PVC-Coated Framing Channel: Carbon steel framing channel with 40-mil polyvinyl chloride coating.

D. Stainless Steel Framing Channel: Rolled, Type 316 stainless steel, 12-gauge minimum.

E. Extruded Aluminum Framing Channel:

1. Material: Extruded from Type 6063-T6 aluminum alloy.
2. Fittings fabricated from Alloy 5052-H32.

F. Nonmetallic Framing Channel:

1. Material: Fire retardant, fiber reinforced vinyl ester resin.
2. Channel fitting of same material as channel.
3. Nuts and bolts of long glass fiber reinforced polyurethane.

G. Manufacturers:

1. B-Line Systems, Inc.
2. Unistrut Corp.
3. Aickinstrut.
4. Or approved equal.

2.8 INTRINSIC SAFETY BARRIER

A. Provides a safe energy level for exposed wiring in a Class I, Division 1 or Division 2 hazardous area when circuit is connected to power source in nonhazardous area.

B. Rating: Power source shall be rated 24 volts dc, nominal, with not more than

EXHIBIT H-3
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
BASIC ELECTRICAL MATERIALS & METHODS

250 volts available under fault conditions.

- C. Contact Rating: 5 amps, 250 volts ac.
- D. Mounting: Rail or surface.
- E. Manufacturers and Products:
 - 1. MTL, Inc.; Series 2000 or Series 3000.
 - 2. R. Stahl, Inc.
 - 3. Or approved equal.

2.9 FIRESTOPS

- A. General:
 - 1. Provide UL 1479 classified hourly fire rating equal to, or greater than, the assembly penetrated.
 - 2. Prevent the passage of cold smoke, toxic fumes, and water before and after exposure to flame.
 - 3. Sealants and accessories shall have fire-resistance ratings as established by testing identical assemblies in accordance with ASTM E814, by UL, or other testing and inspection agency acceptable to authorities having jurisdiction.
- B. Firestop System:
 - 1. Formulated for use in through-penetration firestopping around cables, conduit, pipes, and duct penetrations through fire-rated walls and floors.
 - 2. Fill, Void, or Cavity Material: 3M Brand Fire Barrier Caulk CP25, Putty 303, Wrap/Strip FS195, Composite Sheet CS195 and Penetration Sealing Systems 7902 and 7904 Series.
 - 3. Two-Part, Foamed-In-Place, Silicone Sealant: Dow Corning Corp. Fire Stop Foam, General Electric Co. Pensil 851.
 - 4. Fire Stop Devices: See Section 26 05 33, Raceway and Boxes, for raceway and cable fittings.

2.10 ENCLOSURES

- A. Finish: Sheet metal structural and enclosure parts shall be completely painted using an electrodeposition process so interior and exterior surfaces as well as bolted structural joints have a complete finish coat on and between them.
- B. Color: Manufacturer's standard color (gray) baked-on enamel,

EXHIBIT H-3
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
BASIC ELECTRICAL MATERIALS & METHODS

unless otherwise shown.

- C. Barriers: Provide metal barriers within enclosures to separate wiring of different systems and voltage.
- D. Enclosure Selections:
 - 1. Except as shown otherwise, provide electrical enclosures according to the following table:

Enclosures			
Location	Finish	Environment	NEMA 250 Type
Indoor	Finished	Dry	1
Indoor	Unfinished	Dry	1
Indoor	Unfinished	Industrial Use	12
Indoor and Outdoor	Any	Wet	4
Indoor and Outdoor	Any	Denoted "WP"	3R
Indoor and Outdoor	Any	Wet and Corrosive	4X 316 Stainless Steel
Indoor and Outdoor	Any	Wet, Dust or Oil	13
Indoor and Outdoor	Any	Hazardous Gas	7
Indoor and Outdoor	Any	Hazardous Dust	9

PART 3 EXECUTION

3.1 GENERAL

- A. Install equipment in accordance with manufacturer's recommendations.

3.2 PUSHBUTTON, INDICATING LIGHT, AND SELECTOR SWITCH

- A. Install heavy-duty, oil-tight type in nonhazardous, indoor, dry locations, including motor control centers, control panels, and individual stations, unless otherwise shown.
- B. Install heavy-duty, watertight and corrosion-resistant type in nonhazardous, outdoor, or normally wet areas, unless otherwise shown.

3.3 SUPPORT AND FRAMING CHANNEL

EXHIBIT H-3
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
BASIC ELECTRICAL MATERIALS & METHODS

- A. Install where required for mounting and supporting electrical equipment, raceway, and cable tray systems.
- B. Channel Type:
 - 1. Interior, Wet or Dry (Noncorrosive) Locations:
 - a. Aluminum Raceway: Extruded aluminum or carbon steel with neoprene material isolators.
 - b. PVC-Coated Conduit: PVC coated.
 - c. Steel Raceway and Other Systems Not Covered: Carbon steel or paint coated.
 - 2. Interior, Corrosive (Wet or Dry) Locations:
 - a. Aluminum Raceway: Extruded aluminum.
 - b. PVC Conduit: Type 316 stainless steel or nonmetallic.
 - c. PVC-Coated Steel Conduit and Other Systems Not Covered: Type 316 stainless steel, nonmetallic, or PVC-coated steel.
 - 3. Outdoor, Noncorrosive Locations:
 - a. Steel Raceway: Carbon steel or paint coated framing channel, except where mounted on aluminum handrail, then use aluminum framing channel.
 - b. Aluminum Raceway and Other Systems Not Covered: Aluminum framing channel or carbon steel with neoprene material isolators.
 - 4. Outdoor Corrosive Locations:
 - a. PVC Conduit: Type 316 stainless steel or nonmetallic.
 - b. Aluminum Raceway: Aluminum or carbon steel with neoprene material isolators.
 - c. PVC-Coated Steel Conduit and Other Systems Not Covered: Type 316 stainless steel, nonmetallic, or PVC-coated steel.
 - 5. Aluminum Railings: Devices mounted on aluminum railing shall use aluminum framing channel.
- C. Paint cut ends prior to installation with the following:
 - 1. Carbon Steel Channel: Zinc-rich primer.
 - 2. Painted Channel: Rust-inhibiting epoxy or acrylic paint.
 - 3. Nonmetallic Channel: Epoxy resin sealer.
 - 4. PVC-Coated Channel: PVC patch.

3.4 INTRINSIC SAFETY BARRIERS

- A. Install in compliance with ISA RP12.06.01.
- B. Arrange conductors such that wiring from hazardous areas cannot short to wiring from nonhazardous area.

EXHIBIT H-3
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
BASIC ELECTRICAL MATERIALS & METHODS

- C. Stencil “INTRINSICALLY SAFE CIRCUIT” on all boxes enclosing barriers.

3.5 FIRESTOPS

- A. Install in strict conformance with manufacturer’s instructions. Comply with installation requirements established by testing and inspecting agency.
- B. Sealant: Install sealant including forming, packing, and other accessory materials, to fill openings around electrical services penetrating floors and walls, to provide firestops with fire-resistance ratings indicated for floor or wall assembly in which penetration occurs.

END OF SECTION

EXHIBIT H-4
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
ELECTRICAL CONDUCTORS

PART 1 GENERAL

1.1 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
 - a. A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - b. B3, Standard Specification for Soft or Annealed Copper Wire.
 - c. B8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
 - d. B496, Standard Specification for Compact Round Concentric-Lay-Stranded Copper Conductors.
2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - a. 386, Standard for Separable Insulated Connector Systems for Power Distribution Systems Above 600V.
3. Insulated Cable Engineer's Association, Inc. (ICEA):
 - a. S-58-679, Standard for Control Cable Conductor Identification.
 - b. S-73-532, Standard for Control Thermocouple Extensions and Instrumentation Cables.
 - c. T-29-520, Conducting Vertical Cable Tray Flame Tests with Theoretical Heat Input of 210,000 Btu/hour.
4. National Electrical Manufacturers' Association (NEMA):
 - a. CC 1, Electric Power Connectors for Substations.
 - b. WC 57, Standard for Control, Thermocouple Extension, and Instrumentation Cables.
 - c. WC 70, Standard for Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.
5. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 - b. 262, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.
6. Telecommunications Industry Association (TIA): TIA-568-C, Commercial Building Telecommunications Cabling Standard.
7. UL:
 - a. 13, Standard for Safety for Power-Limited Circuit Cables.
 - b. 44, Standard for Safety for Thermoset-Insulated Wires and Cables.
 - c. 62, Standard for Safety for Flexible Cord and Cables.
 - d. 486A-486B, Standard for Safety for Wire Connectors.

EXHIBIT H-4
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
ELECTRICAL CONDUCTORS

- e. 486C, Standard for Safety for Splicing Wire Connectors.
- f. 510, Standard for Safety for Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape.
- g. 854, Standard for Safety for Service-Entrance Cables.
- h. 1277, Standard for Safety for Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.
- i. 1569, Standard for Safety for Metal-Clad Cables.
- j. 1581, Standard for Safety for Reference Standard for Electrical Wires, Cables, and Flexible Cords.

1.2 SUBMITTALS

A. Action Submittals:

- 1. Product Data:
 - a. Wire and cable.
 - b. Wire and cable accessories.

1.3 QUALITY ASSURANCE

A. Authority Having Jurisdiction (AHJ):

- 1. Provide the Work in accordance with NFPA 70. Where required by the AHJ, material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ in order to provide a basis for approval under NEC.
- 2. Materials and equipment manufactured within the scope of standards published by UL shall conform to those standards and shall have an applied UL listing mark.

PART 2 PRODUCTS

2.1 CONDUCTORS 600 VOLTS AND BELOW

A. Conform to applicable requirements of NEMA WC 70.

B. Conductor Type:

- 1. 120-Volt and 277-Volt Lighting, 10 AWG and Smaller: Solid copper.
- 2. 120-Volt Receptacle Circuits, 10 AWG and Smaller: Solid copper.
- 3. All Other Circuits: Stranded copper.

C. Insulation: Type THHN/THWN-2, except for sizes No. 6 and larger, with XHHW-2 insulation.

EXHIBIT H-4
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
ELECTRICAL CONDUCTORS

D. Direct Burial and Aerial Conductors and Cables:

1. Type USE/RHH/RHW insulation, UL 854 listed, or Type RHW-2/USE-2.
2. Conform to physical and minimum thickness requirements of NEMA WC 70.

E. Flexible Cords and Cables:

1. Type SOW-A/50 with ethylene propylene rubber insulation in accordance with UL 62.
2. Conform to physical and minimum thickness requirements of NEMA WC 70.

2.2 600-VOLT RATED CABLE

A. General:

1. Type TC, meeting requirements of UL 1277, including Vertical Tray Flame Test at 70,000 Btu per hour, and NFPA 70, Article 340, or UL 13 meeting requirements of NFPA 70, Article 725.
2. Permanently and legibly marked with manufacturer's name, maximum working voltage for which cable was tested, type of cable, and UL listing mark.
3. Suitable for installation in open air, in cable trays, or conduit.
4. Minimum Temperature Rating: 90 degrees C dry locations, 75 degrees C wet locations.
5. Overall Outer Jacket: PVC, flame-retardant, sunlight- and oil-resistant.

B. Type 1, Multiconductor Control Cable:

1. Conductors:
 - a. 14 AWG, seven-strand copper.
 - b. Insulation: 15-mil PVC with 4-mil nylon.
 - c. UL 1581 listed as Type THHN/THWN rated VW-1.
 - d. Conductor group bound with spiral wrap of barrier tape.
 - e. Color Code: In accordance with ICEA S-58-679, Method 1, Table 2.
2. Cable: Passes the ICEA T-29-520, 210,000 Btu per hour Vertical Tray Flame Test.
3. Manufacturers:
 - a. Okonite Co.
 - b. Southwire.
 - c. Or approved equal.

EXHIBIT H-4
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
ELECTRICAL CONDUCTORS

- C. Type 2, Multiconductor Power Cable:
1. General:
 - a. Meet or exceed UL 1581 for cable tray use.
 - b. Meet or exceed UL 1277 for direct burial and sunlight-resistance.
 - c. Overall Jacket: PVC.
 2. Conductors:
 - a. Class B stranded, coated copper.
 - b. Insulation: Chemically cross-linked ethylene-propylene or cross-linked polyethylene.
 - c. UL rated VW-1 or listed Type XHHW-2.
 - d. Color Code:
 - 1) Conductors, size 8 AWG and smaller, colored conductors, ICEA S-58-679, Method 1, Table 1.
 - 2) Conductors, size 6 AWG and larger, ICEA S-73-532, Method 4.
 3. Cable shall pass ICEA T-29-520, 210,000 Btu per hour Vertical Tray Flame Test.
 4. Manufacturers:
 - a. Okonite Co.
 - b. Southwire.
 - c. Or approved equal.
- D. Type 3, 16 AWG, Twisted, Shielded Pair, Instrumentation Cable: Single pair, designed for noise rejection for process control, computer, or data log applications meeting NEMA WC 57 requirements.
1. Outer Jacket: 45-mil nominal thickness.
 2. Individual Pair Shield: 1.35-mil, double-faced aluminum/synthetic polymer overlapped to provide 100 percent coverage.
 3. Dimension: 0.31-inch nominal OD.
 4. Conductors:
 - a. Bare soft annealed copper, Class B, seven-strand concentric, meeting requirements of ASTM B8.
 - b. 20 AWG, seven-strand tinned copper drain wire.
 - c. Insulation: 15-mil nominal PVC.
 - d. Jacket: 4-mil nominal nylon.
 - e. Color Code: Pair conductors, black and red.
 5. Manufacturers:
 - a. Okonite Co.
 - b. Alpha Wire Corp.
 - c. Belden.
 - d. Or approved equal.
-

EXHIBIT H-4
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
ELECTRICAL CONDUCTORS

- E. Type 4, 16 AWG, Twisted, Shielded Triad Instrumentation Cable: Single triad, designed for noise rejection for process control, computer, or data log applications meeting NEMA WC 57 requirements.
1. Outer Jacket: 45-mil nominal.
 2. Individual Pair Shield: 1.35-mil, double-faced aluminum/synthetic polymer, overlapped to provide 100 percent coverage.
 3. Dimension: 0.32-inch nominal OD.
 4. Conductors:
 - a. Bare soft annealed copper, Class B, seven-strand concentric, meeting requirements of ASTM B8.
 - b. 20 AWG, seven-strand, tinned copper drain wire.
 - c. Insulation: 15-mil nominal PVC.
 - d. Jacket: 4-mil nylon.
 - e. Color Code: Triad conductors black, red, and blue.
 5. Manufacturers:
 - a. Okonite Co.
 - b. Alpha Wire Corp.
 - c. Belden.
 - d. Or approved equal.
- F. Type 5, 18 AWG, Multi-twisted Shielded Pairs, with a Common Overall Shield, Instrumentation Cable: Designed for use as instrumentation, process control, and computer cable, meeting NEMA WC 57 requirements.
1. Conductors:
 - a. Bare soft annealed copper, Class B, seven-strand concentric, in accordance with ASTM B8.
 - b. Tinned copper drain wires.
 - c. Pair drain wire size AWG 20, group drain wire size AWG 18.
 - d. Insulation: 15-mil PVC.
 - e. Jacket: 4-mil nylon.
 - f. Color Code: Pair conductors, black and red with red conductor numerically printed for group identification.
 - g. Individual Pair Shield: 1.35-mil, double-faced aluminum/synthetic polymer.
 2. Cable Shield: 2.35-mil, double-faced aluminum/synthetic polymer, overlapped for 100 percent coverage.
 3. Manufacturers:
 - a. Okonite Co.
 - b. Alpha Wire Corp.
 - c. Belden.
 - d. Or approved equal.
-

EXHIBIT H-4
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
ELECTRICAL CONDUCTORS

G. Type 8, Multiconductor Adjustable Frequency Drive Power Cable:

1. Conductors:
 - a. Class B, stranded coated copper.
 - b. Insulation: 600-volt cross-linked polyethylene, UL Type XHHW-2.
 - c. Grounding Conductors: Insulated stranded copper.
2. Sheath:
 - a. UL 1277 Type TC, 90 degrees C.
 - b. Continuous shield, Al/polyester foil, drain wires, overall copper braid.
3. Outer Jacket: Polyvinyl chloride (PVC) per UL 1569.
4. Manufacturers and Products:
 - a. Alpha Wire; Series V.
 - b. Belden; Series 29500.
 - c. LAPP USA; OLFLEX VFD Slim.
 - d. Or approved equal.

2.3 300-VOLT RATED CABLE

A. General:

1. Type PLTC, meeting requirements of UL 13 and NFPA 70, Article 725.
2. Permanently and legibly marked with manufacturer's name, maximum working voltage for which cable was tested, type of cable, and UL listing mark.
3. Suitable for installation in open air, in cable trays, or conduit.
4. Minimum Temperature Rating: 105 degrees C.
5. Passes Vertical Tray Flame Test.
6. Outer Jacket: PVC, flame-retardant, sunlight- and oil-resistant.

2.4 SPECIAL CABLES

A. Type 30, Unshielded Twisted Pair (UTP) Telephone and Data Cable, 600V:

1. Category 6 UTP, UL listed, and third party verified to comply with TIA/EIA 568-C Category 6 requirements.
2. Suitable for high speed network applications including gigabit Ethernet and video. Cable shall be interoperable with other standards compliant products and shall be backward compatible with Category 5 and Category 5e.
3. Provide four each individually twisted pair, 23 AWG conductors, with FEP insulation and blue PVC jacket.
4. NFPA 70 Plenum (CMP) rated; comply with flammability plenum requirements of NFPA 70 and NFPA 262.

EXHIBIT H-4
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
ELECTRICAL CONDUCTORS

5. Cable shall withstand a bend radius of 2.5-inch minimum at a temperature of minus 20 degrees C maximum without jacket or insulation cracking.
6. Manufacturers:
 - a. Belden.
 - b. Or approved equal.

2.5 GROUNDING CONDUCTORS

- A. Equipment: Stranded copper with green, Type USE/RHH/RHW-XLPE or THHN/THWN, insulation.
- B. Direct Buried: Bare stranded copper.

2.6 ACCESSORIES FOR CONDUCTORS 600 VOLTS AND BELOW

- A. Tape:
 1. General Purpose, Flame Retardant: 7-mil, vinyl plastic, Scotch Brand 33+, rated for 90 degrees C minimum, meeting requirements of UL 510.
 2. Flame Retardant, Cold and Weather Resistant: 8.5-mil, vinyl plastic, Scotch Brand 88.
 3. Arc and Fireproofing:
 - a. 30-mil, elastomer.
 - b. Manufacturers and Products:
 - 1) 3M; Scotch Brand 77, with Scotch Brand 69 glass cloth tapebinder.
 - 2) Plymouth; 53 Plyarc, with 77 Plyglas glass cloth tapebinder.
 - 3) Or approved equal.
- B. Identification Devices:
 1. Sleeve:
 - a. Permanent, PVC, yellow or white, with legible machine-printed black markings.
 - b. Manufacturers and Products:
 - 1) Raychem; Type D-SCE or ZH-SCE.
 - 2) Brady, Type 3PS.
 - 3) Or approved equal.
 2. Heat Bond Marker:
 - a. Transparent thermoplastic heat bonding film with acrylic pressure sensitive adhesive.

EXHIBIT H-4
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
ELECTRICAL CONDUCTORS

- b. Self-laminating protective shield over text.
 - c. Machine printed black text.
 - d. Manufacturers and Products:
 - 1) 3M Co.; Type SCS-HB.
 - 2) Or approved equal.
 - 3. Marker Plate: Nylon, with legible designations permanently hot stamped on plate.
 - 4. Tie-On Cable Marker Tags:
 - a. Chemical-resistant white tag.
 - b. Size: 1/2 inch by 2 inches.
 - c. Manufacturers and Products:
 - 1) Raychem; Type CM-SCE.
 - 2) Or approved equal.
 - 5. Grounding Conductor: Permanent green heat-shrink sleeve, 2-inch minimum.
- C. Connectors and Terminations:
 - 1. Nylon, Self-Insulated Crimp Connectors:
 - a. Manufacturers and Products:
 - 1) Thomas & Betts; Sta-Kon.
 - 2) Burndy; Insulug.
 - 3) ILSCO.
 - 4) Or approved equal.
 - 2. Nylon, Self-Insulated, Crimp Locking-Fork, Torque-Type Terminator:
 - a. Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.
 - b. Seamless.
 - c. Manufacturers and Products:
 - 1) Thomas & Betts; Sta-Kon.
 - 2) Burndy; Insulink.
 - 3) ILSCO; ILSCONS.
 - 4) Or approved equal.
 - 3. Self-Insulated, Freespring Wire Connector (Wire Nuts):
 - a. UL 486C.
 - b. Plated steel, square wire springs.
 - c. Manufacturers and Products:
 - 1) Thomas & Betts.
 - 2) Ideal; Twister.
 - 3) Or approved equal.
 - 4. Self-Insulated, Set Screw Wire Connector:
 - a. Two piece compression type with set screw in brass barrel.
 - b. Insulated by insulator cap screwed over brass barrel.
 - c. Manufacturers:
 - 1) 3M Co.
 - 2) Thomas & Betts.

EXHIBIT H-4
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
ELECTRICAL CONDUCTORS

- 3) Marrette.
- 4) Or approved equal.

D. Cable Lugs:

- 1. In accordance with NEMA CC 1.
- 2. Rated 600 volts of same material as conductor metal.
- 3. Uninsulated Crimp Connectors and Terminators:
 - a. Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.
 - b. Manufacturers and Products:
 - 1) Thomas & Betts; Color-Keyed.
 - 2) Burndy; Hydent.
 - 3) ILSCO.
 - 4) Or approved equal.
- 4. Uninsulated, Bolted, Two-Way Connectors and Terminators:
 - a. Manufacturers and Products:
 - 1) Thomas & Betts; Locktite.
 - 2) Burndy; Quiklug.
 - 3) ILSCO.
 - 4) Or approved equal.

E. Cable Ties:

- 1. Nylon, adjustable, self-locking, and reusable.
- 2. Manufacturers and Products:
 - a. Thomas & Betts; TY-RAP.
 - b. Or approved equal.

F. Heat Shrinkable Insulation:

- 1. Thermally stabilized cross-linked polyolefin.
- 2. Single wall for insulation and strain relief.
- 3. Dual Wall, adhesive sealant lined, for sealing and corrosion resistance.
- 4. Manufacturers and Products:
 - a. Thomas & Betts; SHRINK-KON.
 - b. Raychem; RNF-100 and ES-2000.
 - c. Or approved equal.

2.7 PULLING COMPOUND

- A. Nontoxic, noncorrosive, noncombustible, nonflammable, water-based lubricant; UL listed.

EXHIBIT H-4
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
ELECTRICAL CONDUCTORS

- B. Suitable for rubber, neoprene, PVC, polyethylene, hypalon, CPE, and lead-covered wire and cable.
- C. Approved for intended use by cable manufacturer.
- D. Suitable for zinc-coated steel, aluminum, PVC, bituminized fiber, and fiberglass raceways.
- E. Manufacturers:
 - 1. Ideal Co.
 - 2. Polywater, Inc.
 - 3. Cable Grip Co.
 - 4. Or approved equal.

2.8 WARNING TAPE

- A. As specified in Section 26 05 33, Raceway and Boxes.

2.9 SOURCE QUALITY CONTROL

- A. Conductors 600 Volts and Below: Test in accordance with UL 44 and UL 854.
- B. Conductors Above 600 Volts: Test in accordance with NEMA WC 71 and AEIC CS 8 partial discharge level test for EPR insulated cable.

PART 3 EXECUTION

3.1 GENERAL

- A. Conductor installation shall be in accordance with manufacturer's recommendations.
- B. Conductor and cable sizing shown is based on copper conductors for 600V circuits.
- C. Do not exceed cable manufacturer's recommendations for maximum pulling tensions and minimum bending radii.
- D. Terminate conductors and cables, unless otherwise indicated.
- E. Tighten screws and terminal bolts in accordance with UL 486A-486B for copper conductors.

EXHIBIT H-4
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
ELECTRICAL CONDUCTORS

- F. Cable Lugs: Provide with correct number of holes, bolt size, and center-to-center spacing as required by equipment terminals.
- G. Bundling: Where single conductors and cables in manholes, handholes, vaults, cable trays, and other indicated locations are not wrapped together by some other means, bundle conductors from each conduit throughout their exposed length with cable ties placed at intervals not exceeding 12 inches on center.
- H. Ream, remove burrs, and clear interior of installed conduit before pulling wires or cables.
- I. Concrete-Encased Raceway Installation: Prior to installation of conductors, pull through each raceway a mandrel approximately 1/4 inch smaller than raceway inside diameter.
- J. Cable Tray Installation:
 - 1. Install wire and cable parallel and straight in tray.
 - 2. Bundle, in groups, wire and cable of same voltage having a common routing and destination; use cable ties, at maximum intervals of 8 feet.
 - 3. Clamp cable bundles prior to making end termination connections.
 - 4. Separate cables of different voltage rating in same cable tray with barriers.
 - 5. Fasten wires, cables, and bundles to tray with nylon cable straps at the following maximum intervals:
 - a. Horizontal Runs: 20 feet.
 - b. Vertical Runs: 5 feet.

3.2 POWER CONDUCTOR COLOR CODING

- A. Conductors 600 Volts and Below:
 - 1. 6 AWG and Larger: Apply general purpose, flame retardant tape at each end, and at accessible locations wrapped at least six full overlapping turns, covering area 1-1/2 inches to 2 inches wide.
 - 2. 8 AWG and Smaller: Provide colored conductors.
 - 3. Colors:

System	Conductor	Color
All Systems	Equipment Grounding	Green

EXHIBIT H-4
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
ELECTRICAL CONDUCTORS

System	Conductor	Color
240/120 Volts, Single-Phase, Three-Wire	Grounded Neutral One Hot Leg Other Hot Leg	White Black Red
08Y/120 Volts, Three-Phase, Four-Wire	Grounded Neutral Phase A Phase B Phase C	White Black Red Blue
480Y/277 Volts, Three-Phase, Four-Wire	Grounded Neutral Phase A Phase B Phase C	White Brown Orange Yellow
Note: Phase A, B, C implies direction of positive phase rotation.		

4. Tracer: Outer covering of white with identifiable colored strip, other than green, in accordance with NFPA 70.

3.3 CIRCUIT IDENTIFICATION

- A. Identify power, instrumentation, and control conductor circuits at each termination, and in accessible locations such as manholes, handholes, panels, switchboards, motor control centers, pull boxes, and terminal boxes.
- B. Circuits Appearing in Circuit Schedules: Identify using circuit schedule designations.
- C. Circuits Not Appearing in Circuit Schedules:
 1. Assign circuit name based on device or equipment at load end of circuit.
 2. Where this would result in same name being assigned to more than one circuit, add number or letter to each otherwise identical circuit name to make it unique.
- D. Method:
 1. Conductors 3 AWG and Smaller: Identify with sleeves or heat bond markers.
 2. Cables and Conductors 2 AWG and Larger:
 - a. Identify with marker plates or tie-on cable marker tags.
 - b. Attach with nylon tie cord.
 3. Taped-on markers or tags relying on adhesives not permitted.

3.4 CONDUCTORS 600 VOLTS AND BELOW

EXHIBIT H-4
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
ELECTRICAL CONDUCTORS

- A. Install 10 AWG or 12 AWG conductors for branch circuit power wiring in lighting and receptacle circuits.
- B. Do not splice incoming service conductors and branch power distribution conductors 6 AWG and larger, unless specifically indicated or approved by Engineer.
- C. Connections and Terminations:
 - 1. Install wire nuts only on solid conductors. Wire nuts are not allowed on stranded conductors.
 - 2. Install nylon self-insulated crimp connectors and terminators for instrumentation and control, circuit conductors.
 - 3. Install self-insulated, set screw wire connectors for two-way connection of power circuit conductors 12 AWG and smaller.
 - 4. Install uninsulated crimp connectors and terminators for instrumentation, control, and power circuit conductors 4 AWG through 2/0 AWG.
 - 5. Install uninsulated, bolted, two-way connectors and terminators for power circuit conductors 3/0 AWG and larger.
 - 6. Install uninsulated terminators bolted together on motor circuit conductors 10 AWG and larger.
 - 7. Place no more than one conductor in any single-barrel pressure connection.
 - 8. Install crimp connectors with tools approved by connector manufacturer.
 - 9. Install terminals and connectors acceptable for type of material used.
 - 10. Compression Lugs:
 - a. Attach with a tool specifically designed for purpose. Tool shall provide complete, controlled crimp and shall not release until crimp is complete.
 - b. Do not use plier type crimpers.
- D. Do not use soldered mechanical joints.
- E. Splices and Terminations:
 - 1. Insulate uninsulated connections.
 - 2. Indoors: Use general purpose, flame retardant tape or single wall heat shrink.
 - 3. Outdoors, Dry Locations: Use flame retardant, cold- and weather-resistant tape or single wall heat shrink.
 - 4. Below Grade and Wet or Damp Locations: Use dual wall heat shrink.
- F. Cap spare conductors with UL listed end caps.

EXHIBIT H-4
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
ELECTRICAL CONDUCTORS

G. Cabinets, Panels, and Motor Control Centers:

1. Remove surplus wire, bridle and secure.
2. Where conductors pass through openings or over edges in sheet metal, remove burrs, chamfer edges, and install bushings and protective strips of insulating material to protect the conductors.

H. Control and Instrumentation Wiring:

1. Where terminals provided will accept such lugs, terminate control and instrumentation wiring, except solid thermocouple leads, with insulated, locking-fork compression lugs.
2. Terminate with methods consistent with terminals provided, and in accordance with terminal manufacturer's instructions.
3. Locate splices in readily accessible cabinets or junction boxes using terminal strips.
4. Where connections of cables installed under this section are to be made under Section 40 90 00, Instrumentation and Control for Process Systems, leave pigtails of adequate length for bundled connections.
5. Cable Protection:
 - a. Under Infinite Access Floors: May install without bundling.
 - b. All Other Areas: Install individual wires, pairs, or triads in flex conduit under floor or grouped into bundles at least 1/2 inch in diameter.
 - c. Maintain integrity of shielding of instrumentation cables.
 - d. Ensure grounds do not occur because of damage to jacket over shield.

I. Extra Conductor Length: For conductors to be connected by others, install minimum 6 feet of extra conductor in freestanding panels and minimum 2 feet in other assemblies.

END OF SECTION

EXHIBIT H-5
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Institute of Electrical and Electronics Engineers (IEEE): C2, National Electrical Safety Code (NESC).
2. National Fire Protection Association (NFPA): 70, National Electrical Code. (NEC).

1.2 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
 - a. Product data for the following:
 - 1) Exothermic weld connectors.
 - 2) Mechanical connectors.
 - 3) Compression connectors.

1.3 QUALITY ASSURANCE

A. Authority Having Jurisdiction (AHJ):

1. Provide the Work in accordance with NFPA 70, National Electrical Code (NEC). Where required by the AHJ, material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ in order to provide a basis for approval under NEC.
2. Materials and equipment manufactured within the scope of standards published by UL shall conform to those standards and shall have an applied UL listing mark.

PART 2 PRODUCTS

2.1 GROUND ROD

- A. Material: Copper-clad.
- B. Diameter: Minimum 5/8 inch.
- C. Length: 8 feet.

EXHIBIT H-5
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

2.2 GROUND CONDUCTORS

- A. As specified in Section 26 05 05, Conductors.

2.3 CONNECTORS

- A. Exothermic Weld Type:

1. Outdoor Weld: Suitable for exposure to elements or direct burial.
2. Indoor Weld: Utilize low-smoke, low-emission process.
3. Manufacturers and Products:
 - a. Erico Products, Inc.; Cadweld and Cadweld Exolon.
 - b. Thermoweld.
 - c. Or approved equal.

- B. Compression Type:

1. Compress-deforming type; wrought copper extrusion material.
2. Single indentation for conductors 6 AWG and smaller.
3. Double indentation with extended barrel for conductors 4 AWG and larger.
4. Barrels prefilled with oxide-inhibiting and anti-seizing compound and sealed.
5. Manufacturers and Products:
 - a. Burndy Corp.; Hyground Irreversible Compression.
 - b. Thomas and Betts Co.
 - c. ILSCO.
 - d. Or approved equal.

- C. Mechanical Type: Split-bolt, saddle, or cone screw type; copper alloy material.

1. Manufacturers:
 - a. Burndy Corp.
 - b. Thomas and Betts Co.
 - c. Or approved equal.

2.4 GROUNDING WELLS

- A. Ground rod box complete with cast iron riser ring and traffic cover marked GROUND ROD.

- B. Manufacturers and Products:

1. Christy Co.; No. G5.

EXHIBIT H-5
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

2. Lightning and Grounding Systems, Inc.; I-R Series.
3. Or approved equal.

PART 3 EXECUTION

3.1 GENERAL

- A. Grounding shall be in compliance with NFPA 70 and IEEE C2.
- B. Ground electrical service neutral at service entrance equipment with grounding electrode conductor to grounding electrode system.
- C. Ground each separately derived system neutral with common grounding electrode conductor to grounding electrode system.
- D. Bond together all grounding electrodes that are present at each building or structure served to form one common grounding electrode system.
- E. Bond together system neutrals, service equipment enclosures, exposed noncurrent-carrying metal parts of electrical equipment, metal raceways, ground conductor in raceways and cables, receptacle ground connections, and metal piping systems.
- F. Shielded Power Cables: Ground shields at each splice or termination in accordance with recommendations of splice or termination manufacturer.
- G. Shielded Instrumentation Cables:
 1. Ground shield to ground bus at power supply for analog signal.
 2. Expose shield minimum 1 inch at termination to field instrument and apply heat shrink tube.
 3. Do not ground instrumentation cable shield at more than one point.

3.2 WIRE CONNECTIONS

- A. Ground Conductors: Install in conduit containing power conductors and control circuits above 50 volts.
- B. Nonmetallic Raceways and Flexible Tubing: Install equipment grounding conductor connected at both ends to noncurrent-carrying grounding bus.
- C. Connect ground conductors to raceway grounding bushings.
- D. Extend and connect ground conductors to ground bus in all equipment

EXHIBIT H-5
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

containing a ground bus.

- E. Connect enclosure of equipment containing ground bus to that bus.
- F. Bolt connections to equipment ground bus.
- G. Bond grounding conductors to metallic enclosures at each end, and to intermediate metallic enclosures.
- H. Junction Boxes: Furnish materials and connect to equipment grounding system with grounding clips mounted directly on box, or with 3/8-inch machine screws.
- I. Metallic Equipment Enclosures: Use furnished ground lug; if none furnished, tap equipment housing and install solderless terminal connected to box with machine screw. For circuits greater than 20 amps use minimum 5/16-inch diameter bolt.

3.3 MOTOR GROUNDING

- A. Extend equipment ground bus via grounding conductor installed in motor feeder raceway; connect to motor frame.
- B. Nonmetallic Raceways and Flexible Tubing: Install an equipment grounding conductor connected at both ends to noncurrent-carrying grounding bus.
- C. Motors Less Than 10 hp: Use furnished ground lug in motor connection box; if none furnished, provide compression, spade-type terminal connected to conduit box mounting screw.
- D. Motors 10 hp and Above: Use furnished ground lug in motor connection box; if none furnished, tap motor frame or equipment housing; furnish compression, one-hole, lug type terminal connected with minimum 5/16-inch brass threaded stud with bolt and washer.
- E. Circuits 20 Amps or Above: Tap motor frame or equipment housing; install solderless terminal with minimum 5/16-inch diameter bolt.

3.4 GROUND RODS

- A. Install full length with conductor connection at upper end.
- B. Install with connection point below finished grade, unless otherwise shown.
- C. Space multiple ground rods by one rod length.

EXHIBIT H-5
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

- D. Install to 8 feet below local frost depth.

3.5 GROUNDING WELLS

- A. Install for ground rods located inside buildings, asphalt and paved areas, and where shown on Drawings.
- B. Install riser ring and cover flush with surface.
- C. Place 6 inches of crushed rock in bottom of each well.

3.6 CONNECTIONS

- A. General:

- 1. Above grade Connections: Install exothermic weld, mechanical, or compression-type connectors; or brazing.
- 2. Below grade Connections: Install exothermic weld or compression type connectors.
- 3. Remove paint, dirt, or other surface coverings at connection points to allow good metal-to-metal contact.
- 4. Notify Owner prior to backfilling ground connections.

- B. Exothermic Weld Type:

- 1. Wire brush or file contact point to bare metal surface.
- 2. Use welding cartridges and molds in accordance with manufacturer's recommendations.
- 3. Avoid using badly worn molds.
- 4. Mold to be completely filled with metal when making welds.
- 5. After completed welds have cooled, brush slag from weld area and thoroughly clean joint.

- C. Compression Type:

- 1. Install in accordance with connector manufacturer's recommendations.
- 2. Install connectors of proper size for grounding conductors and ground rods specified.
- 3. Install using connector manufacturer's compression tool having proper sized dies and operate per manufacturer's instructions.

- D. Mechanical Type:

- 1. Apply homogeneous blend of colloidal copper and rust and corrosion inhibitor before making connection.

EXHIBIT H-5
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

2. Install in accordance with connector manufacturer's recommendations.
3. Do not conceal mechanical connections.

3.7 METAL STRUCTURE GROUNDING

- A. Bond metal sheathing and exposed metal vertical structural elements to grounding system.
- B. Bond electrical equipment supported by metal platforms to the platforms.
- C. Provide electrical contact between metal frames and railings supporting pushbutton stations, receptacles, and instrument cabinets, and raceways carrying circuits to these devices.

3.8 MANHOLE AND HANDHOLE GROUNDING

- A. Install one ground rod inside each manhole and handhole larger than 24-inch by 24-inch inside dimensions.
- B. Ground Rod Floor Protrusion: 4 inches to 6 inches above floor.
- C. Make connections of grounding conductors fully visible and accessible.
- D. Connect all noncurrent-carrying metal parts, and any metallic raceway grounding bushings to ground rod with 6 AWG copper conductor.

3.9 TRANSFORMER GROUNDING

- A. Bond neutrals of transformers within buildings to system ground network, and to any additional indicated grounding electrodes.
- B. Bond neutrals of substation transformers to substation grounding grid and system grounding network.
- C. Bond neutrals of pad-mounted transformers to four locally driven ground rods and buried ground wire encircling transformer and system ground network.

3.10 SURGE PROTECTION EQUIPMENT GROUNDING

- A. Connect surge arrestor ground terminals to equipment ground bus.

END OF SECTION

EXHIBIT H-6
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
RACEWAY AND BOXES

PART 1 GENERAL

1.1 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. American Association of State Highway and Transportation Officials (AASHTO): HB, Standard Specifications for Highway Bridges.
 2. ASTM International (ASTM):
 - a. A123/123M, Standard Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.
 - b. A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - c. A240/A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 - d. C857, Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
 - e. D149, Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies.
 3. National Electrical Contractors Association, Inc. (NECA): Installation standards.
 4. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - b. C80.1, Electrical Rigid Steel Conduit (ERSC).
 - c. RN 1, Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
 - d. TC 2, Electrical Polyvinyl Chloride (PVC) Conduit.
 - e. TC 3, Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
 - f. TC 6, Polyvinyl Chloride (PVC) Plastic Utilities Duct for Underground Installation.
 - g. TC 14, Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
 - h. VE 1, Metallic Cable Tray Systems.
 5. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
 6. Telecommunications Industry Association (TIA): 569B, Commercial Building Standard for Telecommunications Pathways and Spaces.
 7. UL:
 - a. 1, Standard for Safety for Flexible Metal Conduit.
 - b. 5, Standard for Safety for Surface Metal Raceways and Fittings.
 - c. 6, Standard for Safety for Electrical Rigid Metal Conduit – Steel.
 - d. 6A, Standard for Safety for Electrical Rigid Metal Conduit –

EXHIBIT H-6
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
RACEWAY AND BOXES

Aluminum, Red Brass and Stainless.

- e. 360, Standard for Safety for Liquid-Tight Flexible Steel Conduit.
- f. 514B, Standard for Safety for Conduit, Tubing, and Cable Fittings.
- g. 651, Standard for Safety for Schedule 40 and 80 Rigid PVC Conduit and Fittings.
- h. 651A, Standard for Safety for Type EB and A Rigid PVC Conduit and HDPE Conduit.
- i. 870, Standard for Safety for Wireways, Auxiliary Gutters, and Associated Fittings.
- j. 1660, Standard for Safety for Liquid-Tight Flexible Nonmetallic Conduit.
- k. 1684, Standard for Safety for Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
- l. 2024, Standard for Safety for Optical Fiber and Communication Cable Raceway.

1.2 SUBMITTALS

A. Action Submittals:

- 1. Manufacturer's Literature:
 - a. Conduit and conduit fittings.
 - b. Wireways.
 - c. Junction boxes.
 - d. Terminal junction boxes.
- 2. Precast Manholes and Handholes:
 - a. Dimensional drawings and descriptive literature.
 - b. Traffic loading calculations.
 - c. Accessory information.
- 3. Seismic anchorage and bracing drawings and cut sheets, as required by Section 01 88 15, Anchorage and Bracing.
- 4. Conduit Layout:
 - a. Provide drawings for conduit installations including, but not limited to ductbanks, under floor slabs, concealed in slabs, and concealed in walls.
 - b. Provide plan and section showing arrangement and location of conduit and duct bank required for:
 - 1) Low and medium voltage feeder and branch circuits.
 - 2) Instrumentation and control systems.
 - 3) Communications systems.
 - 4) Empty conduit for future use.
 - c. Reproducible scale not greater than 1-inch equals 20 feet.

B. Informational Submittals:

- 1. Seismic anchorage and bracing calculations as required by

EXHIBIT H-6
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
RACEWAY AND BOXES

Section 01 88 15, Anchorage and Bracing.

2. Manufacturer's certification of training for PVC-coated rigid galvanized steel conduit installer.

1.3 QUALITY ASSURANCE

A. Authority Having Jurisdiction (AHJ):

1. Provide the Work in accordance with NFPA 70, National Electrical Code (NEC). Where required by the AHJ, material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ in order to provide a basis for approval under NEC.
2. Materials and equipment manufactured within scope of standards published by UL shall conform to those standards and shall have an applied UL listing mark.

- B. PVC-Coated, Rigid Galvanized Steel Conduit Installer: Certified by conduit manufacturer as having received minimum 2 hours of training on installation procedures.**

PART 2 PRODUCTS

2.1 CONDUIT AND TUBING

A. Rigid Galvanized Steel Conduit (RGS):

1. Meet requirements of NEMA C80.1 and UL 6.
2. Material: Hot-dip galvanized with chromated protective layer.

B. Electric Metallic Tubing (EMT):

1. Meet requirements of NEMA C80.3 and UL 797.
2. Material: Hot-dip galvanized with chromated and lacquered protective layer.

C. PVC Schedule 40 Conduit:

1. Meet requirements of NEMA TC 2 and UL 651.
2. UL listed for concrete encasement, underground direct burial, concealed or direct sunlight exposure, and 90 degrees C insulated conductors.

D. PVC Schedule 80 Conduit:

1. Meet requirements of NEMA TC 2 and UL 651.
2. UL listed for concrete encasement, underground direct burial, concealed or direct sunlight exposure, and 90 degrees C insulated conductors.

EXHIBIT H-6
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
RACEWAY AND BOXES

- E. PVC-Coated Rigid Galvanized Steel Conduit:
1. Meet requirements of NEMA RN 1 and ETL.
 2. Material:
 - a. Meet requirements of NEMA C80.1 and UL 6.
 - b. Exterior Finish: PVC coating, 40-mil nominal thickness; bond to metal shall have tensile strength greater than PVC.
 - c. Interior Finish: Urethane coating, 2-mil nominal thickness.
 3. Threads: Hot-dipped galvanized and factory coated with urethane.
 4. Bendable without damage to interior or exterior coating.
- F. Flexible Metal, Liquid-Tight Conduit:
1. UL 360 listed for 105 degrees C insulated conductors.
 2. Material: Galvanized steel with extruded PVC jacket.
- G. Flexible, Nonmetallic, Liquid-Tight Conduit:
1. Material: PVC core with fused flexible PVC jacket.
 2. UL 1660 listed for:
 - a. Dry Conditions: 80 degrees C insulated conductors.
 - b. Wet Conditions: 60 degrees C insulated conductors.
 3. Manufacturers and Products:
 - a. Carlon; Carflex or X-Flex.
 - b. T & B; Xtraflex LTC or EFC.
 - c. Or approved equal.
- H. Innerduct:
1. Resistant to spread of fire, per requirements of UL 2024.
 2. Smooth or corrugated HDPE.

2.2 FITTINGS

- A. Rigid Galvanized Steel:
1. General:
 - a. Meet requirements of UL 514B.
 - b. Type: Threaded, galvanized. Set screw and threadless compression fittings not permitted.
 2. Bushing:
 - a. Material: Malleable iron with integral insulated throat, rated for 150 degrees C.
 - b. Manufacturers and Products:
 - 1) Appleton; Series BU-I.
 - 2) O-Z/Gedney; Type HB.
 - 3) Or approved equal.
 3. Grounding Bushing:

EXHIBIT H-6
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
RACEWAY AND BOXES

- a. Material: Malleable iron with integral insulated throat rated for 150 degrees C, with solderless lugs.
- b. Manufacturers and Products:
 - 1) Appleton; Series GIB.
 - 2) O-Z/Gedney; Type HBLG.
 - 3) Or approved equal.
- 4. Conduit Hub:
 - a. Material: Malleable iron with insulated throat with bonding screw.
 - b. UL listed for use in wet locations.
 - c. Manufacturers and Products:
 - 1) Appleton, Series HUB-B.
 - 2) O-Z/Gedney; Series CH.
 - 3) Meyers; ST Series.
 - 4) Or approved equal.
- 5. Conduit Bodies:
 - a. Sized as required by NFPA 70.
 - b. Manufacturers and Products (For Normal Conditions):
 - 1) Appleton; Form 35 threaded unilets.
 - 2) Crouse-Hinds; Form 7 or Form 8 threaded condulets.
 - 3) Killark; Series O electrolets.
 - 4) Thomas & Betts; Form 7 or Form 8.
 - 5) Or approved equal.
 - c. Manufacturers (For Hazardous Locations):
 - 1) Appleton.
 - 2) Crouse-Hinds.
 - 3) Killark.
 - 4) Or approved equal.
- 6. Couplings: As supplied by conduit manufacturer.
- 7. Unions:
 - a. Concrete tight, hot-dip galvanized malleable iron.
 - b. Manufacturers and Products:
 - 1) Appleton; Series SCC bolt-on coupling or Series EC three-piece union.
 - 2) O-Z/Gedney; Type SSP split coupling or Type 4 Series, three-piece coupling.
 - 3) Or approved equal.
- 8. Conduit Sealing Fitting:
 - a. Manufacturers and Products:
 - 1) Appleton; Type EYF, EYM, or ESU.
 - 2) Crouse-Hinds; Type EYS or EZS.
 - 3) Killark; Type EY or Type EYS.
 - 4) Or approved equal.
- 9. Drain Seal:
 - a. Manufacturers and Products:
 - 1) Appleton; Type EYD.

EXHIBIT H-6
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
RACEWAY AND BOXES

- 2) Crouse-Hinds; Type EYD or Type EZD.
 - 3) Or approved equal.
 10. Drain/Breather Fitting:
 - a. Manufacturers and Products:
 - 1) Appleton; Type ECDB.
 - 2) Crouse-Hinds; ECD.
 - 3) Or approved equal.
 11. Expansion Fitting:
 - a. Manufacturers and Products:
 - 1) Deflection/Expansion Movement:
 - a) Appleton; Type DF.
 - b) Crouse-Hinds; Type XD.
 - c) Or approved equal.
 - 2) Expansion Movement Only:
 - a) Appleton; Type XJ.
 - b) Crouse-Hinds; Type XJ.
 - c) Thomas & Betts; XJG-TP.
 - d) Or approved equal.
 12. Cable Sealing Fitting:
 - a. To form watertight nonslip cord or cable connection to conduit.
 - b. For Conductors with OD of 1/2 inch or Less: Neoprene bushing at connector entry.
 - c. Manufacturers and Products:
 - 1) Appleton; CG-S.
 - 2) Crouse-Hinds; CGBS.
 - 3) Or approved equal.
- B. Electric Metallic Tubing:
1. Meet requirements of UL 514B.
 2. Type: Steel body and locknuts with steel or malleable iron compression nuts. Set screw and drive-on fittings not permitted.
 3. Electro zinc-plated inside and out.
 4. Raintight.
 5. Coupling Manufacturers and Products:
 - a. Appleton; Type 95T.
 - b. Crouse-Hinds.
 - c. Thomas & Betts.
 - d. Or approved equal.
 6. Connector Manufacturers and Products:
 - a. Appleton; Type ETP.
 - b. Crouse-Hinds.
 - c. Thomas & Betts.
 - d. Or approved equal.
- C. PVC Conduit and Tubing:
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EXHIBIT H-6
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
RACEWAY AND BOXES

1. Meet requirements of NEMA TC 3.
 2. Type: PVC, slip-on.
- D. PVC-Coated Rigid Galvanized Steel Conduit:
1. Meet requirements of UL 514B.
 2. Fittings: Rigid galvanized steel type, PVC coated by conduit manufacturer.
 3. Conduit Bodies: Cast metal hot-dipped galvanized or urethane finish. Cover shall be of same material as conduit body. PVC coated by conduit manufacturer.
 4. Finish: 40-mil PVC exterior, 2-mil urethane interior.
 5. Overlapping pressure-sealing sleeves.
 6. Conduit Hangers, Attachments, and Accessories: PVC-coated.
 7. Manufacturers:
 - a. Robroy Industries.
 - b. Ocal.
 - c. Or approved equal.
 8. Expansion Fitting:
 - a. Manufacturer and Product:
 - 1) Ocal; OCAL-BLUE XJG.
 - 2) Or approved equal.
- E. Flexible Metal, Liquid-Tight Conduit:
1. Metal insulated throat connectors with integral nylon or plastic bushing rated for 105 degrees C.
 2. Insulated throat and sealing O-rings.
 3. Manufacturers and Products:
 - a. Thomas & Betts; Series 5331.
 - b. O-Z/Gedney; Series 4Q.
 - c. Or approved equal.
- F. Flexible, Nonmetallic, Liquid-Tight Conduit:
1. Meet requirements of UL 514B.
 2. Type: High strength plastic body, complete with lock nut, O-ring, threaded ferrule, sealing ring, and compression nut.
 3. Body/compression nut (gland) design to ensure high mechanical pullout strength and watertight seal.
 4. Manufacturers and Products:
 - a. Carlon; Type LT.
 - b. O-Z/Gedney; Type 4Q-P.
 - c. Thomas & Betts; Series 6300.
 - d. Or approved equal.
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EXHIBIT H-6
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
RACEWAY AND BOXES

G. Flexible Coupling, Hazardous Locations:

1. Approved for use in atmosphere involved.
2. Rating: Watertight and UL listed for use in Class I, Division 1 and 2 areas.
3. Outer bronze braid and an insulating liner.
4. Conductivity equal to a similar length of rigid metal conduit.
5. Manufacturers and Products:
 - a. Crouse-Hinds; Type ECGJH or Type ECLK.
 - b. Appleton; EXGJH or EXLK.
 - c. Or approved equal.

H. Watertight Entrance Seal Device:

1. New Construction:
 - a. Material: Oversized sleeve, malleable iron body with sealing ring, pressure ring, grommet seal, and pressure clamp.
 - b. Manufacturer and Product:
 - 1) O-Z/Gedney; Type FSK or Type WSK, as required.
 - 2) Or approved equal.
2. Cored-Hole Application:
 - a. Material: Assembled dual pressure disks, neoprene sealing ring, and membrane clamp.
 - b. Manufacturers and Products:
 - 1) O-Z/Gedney; Series CSM.
 - 2) Or approved equal.

2.3 OUTLET AND DEVICE BOXES

A. Sheet Steel: One-piece drawn type, zinc-plated or cadmium-plated.

B. Cast Metal:

1. Box: Malleable iron or cast ferrous metal.
2. Cover: Gasketed, weatherproof, malleable iron, or cast ferrous metal, with stainless steel screws.
3. Hubs: Threaded.
4. Lugs: Cast Mounting.
5. Manufacturers and Products, Nonhazardous Locations:
 - a. Crouse-Hinds; Type FS or Type FD.
 - b. Appleton; Type FS or Type FD.
 - c. Killark.
 - d. Or approved equal.
6. Manufacturers and Products, Hazardous Locations:
 - a. Crouse-Hinds; Type GUA or Type EAJ.
 - b. Appleton; Type GR.
 - c. Or approved equal.

EXHIBIT H-6
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
RACEWAY AND BOXES

C. Cast Aluminum:

1. Material:
 - a. Box: Cast, copper-free aluminum.
 - b. Cover: Gasketed, weatherproof, cast copper-free aluminum with stainless steel screws.
2. Hubs: Threaded.
3. Lugs: Cast mounting.
4. Manufacturers and Products, Nonhazardous Locations:
 - a. Crouse-Hinds; Type FS-SA or Type FD-SA.
 - b. Appleton; Type FS or Type FD.
 - c. Killark.
 - d. Or approved equal.
5. Manufacturers and Products, Hazardous Locations:
 - a. Crouse-Hinds; Type GUA-SA.
 - b. Appleton; Type GR.
 - c. Or approved equal.

D. PVC-Coated Cast Metal:

1. Type: One-piece.
2. Material: Malleable iron, cast ferrous metal, or cast aluminum.
3. Coating:
 - a. Exterior Surfaces: 40-mil PVC.
 - b. Interior Surfaces: 2-mil urethane.
4. Manufacturers:
 - a. Robroy Industries.
 - b. Ocal.
 - c. Or approved equal.

E. Nonmetallic:

1. Box: PVC.
2. Cover: PVC, weatherproof, with stainless steel screws.
3. Manufacturers and Products:
 - a. Carlon; Type FS or Type FD, with Type E98 or Type E96 covers.
 - b. Or approved equal.

2.4 JUNCTION AND PULL BOXES

- A. Outlet Box Used as Junction or Pull Box: As specified under Article Outlet and Device Boxes.
- B. Conduit Bodies Used as Junction Boxes: As specified under Article Fittings.
- C. Sheet Steel Box:

EXHIBIT H-6
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
RACEWAY AND BOXES

1. NEMA 250, Type 1.
 2. Box: Code-gauge, galvanized steel.
 3. Cover: Full access, screw type.
 4. Machine Screws: Corrosion-resistant.
- D. Cast Metal Box:
1. NEMA 250, Type 4.
 2. Box: Cast malleable iron, or ferrous metal, electrogalvanized finished, with drilled and tapped conduit entrances and exterior mounting lugs.
 3. Cover: Hinged with clamps.
 4. Gasket: Neoprene.
 5. Hardware and Machine Screws: ASTM A167, Type 316 stainless steel.
 6. Manufacturers and Products, Surface Mounted Nonhinged Type:
 - a. Crouse-Hinds; Series W.
 - b. O-Z/Gedney; Series Y.
 - c. Or approved equal.
 7. Manufacturer and Product:
 - a. Surface Mounted, Hinged Type: O-Z/Gedney; Series YW.
 - b. Or approved equal.
 8. Manufacturers and Products, Recessed Type:
 - a. Crouse-Hinds; Type WJBF.
 - b. O-Z/Gedney; Series YR.
 - c. Or approved equal.
- E. Cast Metal Box, Hazardous Locations:
1. NEMA 250 Type 7 or Type 9 as required for Class, Division, and Group involved.
 2. Box: Cast ferrous metal, electro-galvanize finished or copper-free aluminum with drilled and tapped conduit entrances.
 3. Cover: Nonhinged with bolts.
 4. Hardware and Machine Screws: ASTM A167, Type 316 stainless steel.
 5. Manufacturers and Products:
 - a. Crouse-Hinds; Type EJB.
 - b. Appleton; Type AJBEW.
 - c. Or approved equal.
- F. Stainless Steel Box:
1. NEMA 250 Type 4X.
 2. Box: 14-gauge, ASTM A240/A240M, Type 316 stainless steel, with white enamel painted interior mounting panel.
 3. Cover: Hinged with clamps.
 4. Hardware and Machine Screws: ASTM A167, Type 316 stainless steel.
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EXHIBIT H-6
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
RACEWAY AND BOXES

5. Manufacturers:
 - a. Hoffman Engineering Co.
 - b. Robroy Industries.
 - c. Wiegman.
 - d. Or approved equal.
- G. Steel Box:
1. NEMA 250 Type 1, 3R and 12.
 2. Box: 10-gauge steel, with white enamel painted interior and gray primed exterior, over phosphated surfaces. Provide gray finish.
 3. Cover: Hinged with clamps.
 4. Hardware and Machine Screws: ASTM A167, Type 316 stainless steel.
 5. Manufacturers:
 - a. Hoffman Engineering Co.
 - b. Robroy Industries.
 - c. Wiegman.
 - d. Or approved equal.
- H. Nonmetallic Box:
1. NEMA 250 Type 4X.
 2. Box: High-impact, fiberglass-reinforced polyester or engineered thermoplastic, with stability to high heat.
 3. Cover: Hinged with clamps.
 4. Hardware and Machine Screws: ASTM A167, Type 316 stainless steel.
 5. Conduit hubs and mounting lugs.
 6. Manufacturers and Products:
 - a. Crouse-Hinds; Type NJB.
 - b. Carlon; Series N, C, or H.
 - c. Robroy Industries.
 - d. Or approved equal.
- I. Concrete Box, Nontraffic Areas:
1. Box: Reinforced, cast concrete with extension.
 2. Cover: Steel diamond plate with locking bolts.
 3. Cover Marking: ELECTRICAL, TELEPHONE, or as shown.
 4. Size: 10 inches by 17 inches, minimum.
 5. Manufacturers and Products:
 - a. Utility Vault Co.; Series 36-1017.
 - b. Christy, Concrete Products, Inc.; N9.
 - c. Quazite; "PG" Style.
 - d. Or approved equal.
- J. Concrete Box, Traffic Areas:

EXHIBIT H-6
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
RACEWAY AND BOXES

1. Box: Reinforced, cast concrete with extension and bottom slab.
2. Cover: Steel checked plate; H/20 loading with screw down.
3. Cover Marking: ELECTRICAL, TELEPHONE, or as shown.
4. Manufacturers and Products:
 - a. Christy, Concrete Products, Inc.; B1017BOX.
 - b. Utility Vault Co.; 3030 SB.
 - c. Or approved equal.

2.5 TERMINAL JUNCTION BOX

- A. Cover: Hinged, unless otherwise shown.
- B. Interior Finish: Paint with white enamel or lacquer.
- C. Terminal Blocks:
 1. Separate connection point for each conductor entering or leaving box.
 2. Spare Terminal Points: 25 percent, minimum.

2.6 SURFACE METAL RACEWAY

- A. General:
 1. Meet requirements of UL 5.
 2. Material: Two-piece, code-gauge steel.
 3. Finish: Factory applied rust inhibiting primer and gray semi-gloss finish suitable for field painting.
 4. Configuration: Single, 1-17/32-inch by 2-3/4-inch section, unless otherwise indicated.
- B. Fittings and Accessories:
 1. Wire clips at 30 inches on center.
 2. Couplings, cover clips, supporting clips, ground clamps, and elbows as required; to comply with manufacturer's recommendations.
- C. Outlets:
 1. Provide bracket or device covers as required to support wiring devices indicated.
 2. Wiring Devices and Device Plates: In accordance with Section 26 27 26, Wiring Devices.
 3. Manufacturers:
 - a. The Wiremold Co.
 - b. Walker.
 - c. Or approved equal.

EXHIBIT H-6
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
RACEWAY AND BOXES

2.7 METAL WIREWAYS

- A. Meet requirements of UL 870.
- B. Type: Steel-enclosed, lay-in type.
- C. Cover: Removable, screw type.
- D. Rating: Indoor.
- E. Finish: Rust inhibiting phosphatizing primer and gray baked enamel.
- F. Hardware: Plated to prevent corrosion; screws installed toward the inside protected by spring nuts or otherwise guarded to prevent wire insulation damage.
- G. Knockouts: Without knockouts, unless otherwise indicated.
- H. Manufacturers:
 - 1. Circle AW.
 - 2. Hoffman.
 - 3. Square D.
 - 4. Or approved equal.

2.8 PRECAST MANHOLES AND HANDHOLES

- A. Concrete Strength: Minimum, 3,000 psi compressive, in 28 days.
- B. Loading: AASHTO, H-20 in accordance with ASTM C857.
- C. Access: Provide cast concrete risers and access hole adapters between top of manhole and finished grade at required elevations.
- D. Drainage:
 - 1. Slope floors toward drain points, leaving no pockets or other nondraining areas.
 - 2. Provide drainage outlet or sump at low point of floor constructed with a heavy, cast iron, slotted or perforated hinged cover, and a minimum 4-inch outlet and outlet pipe.
- E. Raceway Entrances:
 - 1. Provide on all four sides.
 - 2. Provide knockout panels or precast individual raceway openings.
 - 3. At entrances where raceways are to be installed by others, provide minimum 12-inch-high by 24-inch-wide knockout panels for future

EXHIBIT H-6
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
RACEWAY AND BOXES

raceway installation.

F. Embedded Pulling Iron:

1. Material: 3/4-inch-diameter stock, fastened to overall steel reinforcement before concrete is placed.
2. Location:
 - a. Wall: Opposite each raceway entrance and knockout panel for future raceway entrance.
 - b. Floor: Centered below manhole or handhole cover.

G. Cable Racks:

1. Arms and Insulators: Adjustable, of sufficient number to accommodate cables for each raceway entering or leaving manhole, including spares.
2. Wall Attachment:
 - a. Adjustable inserts in concrete walls. Bolts or embedded studs not permitted.
 - b. Insert Spacing: Maximum 3 feet on center for inside perimeter of manhole.
 - c. Arrange in order that spare raceway ends are clear for future cable installation.

H. Manhole Frames and Covers:

1. Material: Machined cast iron.
2. Diameter: 36-1/2 inch nominal unless otherwise indicated on Drawings.
3. Cover Type: Indented, solid top design, with two drop handles each.
4. Cover Loading: AASHTO H-20.
5. Cover Designation: Cast, on upper side, in integral letters, minimum 2 inches in height, appropriate titles:
 - a. Above 600 Volts: ELECTRIC HV.
 - b. 600 Volts and Below: ELECTRIC LV.
 - c. COMMUNICATIONS.

I. Handhole Frames and Covers:

1. Material: Steel, hot-dipped galvanized.
2. Cover Type: Solid, torsion spring, of nonskid design.
3. Cover Loading: AASHTO H-20.
4. Cover Designation: Burn by welder, on upper side in integral letters, minimum 2 inches in height, appropriate titles:
 - a. 600 Volts and Below: ELECTRIC LV.
 - b. COMMUNICATIONS.

J. Hardware: Steel, hot-dip galvanized.

K. Furnish knockout for ground rod in each handhole and manhole.

EXHIBIT H-6
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
RACEWAY AND BOXES

L. Manufacturers:

1. Utility Vault Co.
2. Penn-Cast Products, Inc.
3. Concrete Conduit Co.
4. Associated Concrete Products, Inc.
5. Pipe, Inc.
6. Or approved equal.

2.9 ACCESSORIES

A. Duct Bank Spacers:

1. Modular Type:
 - a. Nonmetallic, interlocking, for multiple conduit sizes.
 - b. Suitable for all types of conduit.
 - c. Manufacturers:
 - 1) Underground Device, Inc.
 - 2) Carlon.
 - 3) Or approved equal.
2. Template Type:
 - a. Nonmetallic, custom made one-piece spacers.
 - b. Suitable for all types of conduit.
 - c. Material: HDPE or polypropylene, 1/2-inch minimum thickness.
 - d. Conduit openings cut 1 inch larger than conduit outside diameter.
 - e. Additional openings for stake-down, rebar, and concrete flow through as required.
 - f. Manufacturers and Products
 - 1) SP Products; Quik Duct.
 - 2) Or approved equal.

B. Identification Devices:

1. Raceway Tags:
 - a. Material: Permanent, nylon.
 - b. Raceway Designation: Pressure stamped, embossed, or engraved.
 - c. Tags relying on adhesives or taped-on markers not permitted.
2. Warning Tape:
 - a. Material: Polyethylene, 4-mil gauge with detectable strip.
 - b. Color: Red.
 - c. Width: Minimum 6 inches.
 - d. Designation: Warning on tape that electric circuit is located below tape.
 - e. Identifying Letters: Minimum 1-inch-high permanent black lettering imprinted continuously over entire length.
 - f. Manufacturers and Products:

EXHIBIT H-6
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
RACEWAY AND BOXES

- 1) Panduit; Type HTDU.
- 2) Reef Industries; Terra Tape.
- 3) Or approved equal.

C. Heat Shrinkable Tubing:

1. Material: Heat-shrinkable, cross-linked polyolefin.
2. Semi-flexible with meltable adhesive inner liner.
3. Color: Black.
4. Manufacturers:
 - a. Raychem.
 - b. 3M.
 - c. Or approved equal.

D. Wraparound Duct Band:

1. Material: Heat-shrinkable, cross-linked polyolefin, precoated with hot-melt adhesive.
2. Width: 50 mm minimum.
3. Manufacturers and Products
 - a. Raychem; Type TWDB.
 - b. Or approved equal.

PART 3 EXECUTION

3.1 GENERAL

- A. Conduit and tubing sizes shown are based on use of copper conductors. Reference Section 26 05 05, Conductors, concerning conduit sizing for aluminum conductors.
- B. Comply with NECA Installation Standards.
- C. Crushed or deformed raceways not permitted.
- D. Maintain raceway entirely free of obstructions and moisture.
- E. Immediately after installation, plug or cap raceway ends with watertight and dust-tight seals until time for pulling in conductors.
- F. Sealing Fittings: Provide drain seal in vertical raceways where condensate may collect above sealing fitting.
- G. Avoid moisture traps where possible. When unavoidable in exposed conduit runs, provide junction box and drain fitting at conduit low point.
- H. Group raceways installed in same area.

EXHIBIT H-6
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
RACEWAY AND BOXES

- I. Proximity to Heated Piping: Install raceways minimum 12 inches from parallel runs.
- J. Follow structural surface contours when installing exposed raceways. Avoid obstruction of passageways.
- K. Run exposed raceways parallel or perpendicular to walls, structural members, or intersections of vertical planes.
- L. Block Walls: Do not install raceways in same horizontal course or vertical cell with reinforcing steel.
- M. Install watertight fittings in outdoor, underground, or wet locations.
- N. Paint threads and cut ends, before assembly of fittings, galvanized conduit, PVC-coated galvanized conduit, or IMC installed in exposed or damp locations with zinc-rich paint or liquid galvanizing compound.
- O. Metal conduit shall be reamed, burrs removed, and cleaned before installation of conductors, wires, or cables.
- P. Do not install raceways in concrete equipment pads, foundations, or beams without Engineer approval.
- Q. Horizontal raceways installed under floor slabs shall lie completely under slab, with no part embedded within slab.
- R. Install concealed, embedded, and buried raceways so that they emerge at right angles to surface and have no curved portion exposed.
- S. Install conduits for fiber optic cables, telephone cables, and Category 6 data cables in strict conformance with the requirements of TIA 569B.

3.2 REUSE OF EXISTING CONDUITS

- A. Where Drawings indicate existing conduits may be reused, they may be reused only where they meet the following criteria.
 - 1. Conduit is in useable condition with no deformation, corrosion, or damage to exterior surface.
 - 2. Conduit is sized per the NEC.
 - 3. Conduit is of the type specified in Contract Documents.
 - 4. Conduit is supported as specified in Contract Documents.
- B. Conduit shall be reamed with wire brush, then with a mandrel approximately 1/4 inch smaller than raceway inside diameter then cleaned prior to pulling new conductors.

EXHIBIT H-6
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
RACEWAY AND BOXES

3.3 INSTALLATION IN CAST-IN-PLACE STRUCTURAL CONCRETE

- A. Minimum Cover: 2 inches, including fittings.
- B. Conduit placement shall not require changes in reinforcing steel location or configuration.
- C. Provide nonmetallic support during placement of concrete to ensure raceways remain in position.
- D. Conduit larger than 1 inch shall not be embedded in concrete slabs, walls, foundations, columns, or beams unless approved by Engineer.
- E. Slabs and Walls (Requires Engineer Approval):
 - 1. Trade size of conduit not to exceed one-fourth of slab or wall thickness.
 - 2. Install within middle two-fourths of slab or wall.
 - 3. Separate conduit less than 2-inch trade size by a minimum ten times conduit trade size, center-to-center, unless otherwise shown.
 - 4. Separate conduit 2-inch and greater trade size by a minimum eight times conduit trade size, center-to-center, unless otherwise shown.
 - 5. Cross conduit at an angle greater than 45 degrees, with minimum separation of 1 inch.
 - 6. Separate conduit by a minimum six times the outside dimension of expansion/deflection fittings at expansion joints.
 - 7. Conduit shall not be installed below the maximum water surface elevation in walls of water holding structures.
- F. Columns and Beams (Requires Engineer Approval):
 - 1. Trade size of conduit not to exceed one-fourth of beam thickness.
 - 2. Conduit cross-sectional area not to exceed 4 percent of beam or column cross section.

3.4 CONDUIT APPLICATION

- A. Diameter: Minimum 3/4 inch.
- B. In addition to the requirements below, refer to the Area Classification Table on Drawings.
- C. Direct Earth Burial: PVC Schedule 40.
- D. Concrete-Encased Ductbank: PVC Schedule 40 for ac circuits, PVC-Coated Rigid Galvanized Steel for dc, analog, or copper communication or other circuits sensitive to electromagnetic interference.
- E. Under Slabs-on-Grade: PVC Schedule 40 for ac circuits, PVC-Coated Rigid

EXHIBIT H-6
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
RACEWAY AND BOXES

Galvanized Steel for dc, analog, or copper communication or other circuits sensitive to electromagnetic interference.

- F. Transition from Underground or Concrete Embedded to Exposed: PVC-coated rigid steel conduit.

3.5 FLEXIBLE CONNECTIONS

- A. For motors, wall or ceiling mounted fans and unit heaters, dry type transformers, electrically operated valves, instrumentation, and other locations approved by Engineer where flexible connection is required to minimize vibration:
 - 1. Conduit Size 4 Inches or Less: Flexible, liquid-tight conduit.
 - 2. Conduit Size Over 4 Inches: Nonflexible.
 - 3. Wet or Corrosive Areas: Flexible, nonmetallic liquid-tight.
 - 4. Dry Areas: Flexible, metallic liquid-tight.
 - 5. Hazardous Areas: Flexible coupling suitable for Class I, Division 1 and 2 areas.
- B. Suspended Lighting Fixtures in Dry Areas: Flexible steel, nonliquid-tight conduit.
- C. Outdoor Areas, Process Areas Exposed to Moisture, and Areas Required to be Oiltight and Dust-Tight: Flexible metal, liquid-tight conduit.
- D. Flexible Conduit Length: 18 inches minimum, 60 inches maximum; sufficient to allow movement or adjustment of equipment.

3.6 PENETRATIONS

- A. Make at right angles, unless otherwise shown.
- B. Notching or penetration of structural members, including footings and beams, not permitted.
- C. Fire-Rated Walls, Floors, or Ceilings: Firestop openings around penetrations to maintain fire-resistance rating as specified in Section 26 05 04, Basic Electrical Materials and Methods.
- D. Apply heat shrinkable tubing or single layer of wraparound duct band to metallic conduit protruding through concrete floor slabs to a point 2 inches above and 2 inches below concrete surface.
- E. Concrete Walls, Floors, or Ceilings (Aboveground): Provide non-shrink grout dry-pack, or use watertight seal device.
- F. Entering Structures:

EXHIBIT H-6
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
RACEWAY AND BOXES

1. General: Seal raceway at first box or outlet with oakum or expandable plastic compound to prevent entrance of gases or liquids from one area to another.
2. Concrete Roof or Membrane Waterproofed Wall or Floor:
 - a. Provide a watertight seal.
 - b. Without Concrete Encasement: Install watertight entrance seal device on each side.
 - c. With Concrete Encasement: Install watertight entrance seal device on accessible side.
 - d. Securely anchor malleable iron body of watertight entrance seal device into construction with one or more integral flanges.
 - e. Secure membrane waterproofing to watertight entrance seal device in a permanent, watertight manner.
3. Heating, Ventilating, and Air Conditioning Equipment:
 - a. Penetrate equipment in area established by manufacturer.
 - b. Terminate conduit with flexible nonmetallic conduit at junction box or conduit attached to exterior surface of equipment prior to penetrating equipment.
 - c. Seal penetration with Type 5 sealant, as specified in Section 07 92 00, Joint Sealants.
4. Corrosive-Sensitive Areas:
 - a. Seal conduit passing through walls.
 - b. Seal conduit entering equipment panel boards and field panels containing electronic equipment.
 - c. Seal penetration with Type 5 sealant, as specified in Section 07 92 00, Joint Sealants.
5. Existing or Precast Wall (Underground): Core drill wall and install watertight entrance seal device.
6. Nonwaterproofed Wall or Floor (Underground, without Concrete Encasement):
 - a. Provide Schedule 40 galvanized pipe sleeve, or watertight entrance seal device.
 - b. Fill space between raceway and sleeve with expandable plastic compound or oakum and lead joint, on each side.
7. Manholes and Handholes:
 - a. Metallic Raceways: Provide insulated grounding bushings.
 - b. Nonmetallic Raceways: Provide bell ends flush with wall.
 - c. Install such that raceways enter as near as possible to one end of wall, unless otherwise shown.

3.7 SUPPORT

- A. Support from structural members only, at intervals not exceeding NFPA 70 requirements. Do not exceed 10 feet in any application. Do not support from piping, pipe supports, or other raceways.

EXHIBIT H-6
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
RACEWAY AND BOXES

- B. Multiple Adjacent Raceways: Provide ceiling trapeze. For trapeze-supported conduit, allow 25 percent extra space for future conduit.
- C. Application/Type of Conduit Strap:
 - 1. Rigid Steel Conduit: Zinc coated steel, pre-galvanized steel or malleable iron.
 - 2. PVC-Coated Rigid Steel Conduit: PVC-coated metal.
 - 3. Nonmetallic Conduit: Nonmetallic or PVC-coated metal.
- D. Provide and attach wall brackets, strap hangers, or ceiling trapeze as follows:
 - 1. Wood: Wood screws.
 - 2. Hollow Masonry Units: Toggle bolts.
 - 3. Concrete or Brick: Expansion shields, or threaded studs driven in by powder charge, with lock washers and nuts.
 - 4. Steelwork: Machine screws.
 - 5. Location/Type of Hardware: Refer to the Area Classification and Materials Selection Table on Drawings.
- E. Nails or wooden plugs inserted in concrete or masonry for attaching raceway not permitted. Do not weld raceways or pipe straps to steel structures. Do not use wire in lieu of straps or hangers.
- F. Support aluminum conduit on concrete surfaces with stainless steel or nonmetallic spacers, or aluminum or nonmetallic framing channel.

3.8 BENDS

- A. Install concealed raceways with a minimum of bends in the shortest practical distance.
- B. Make bends and offsets of longest practical radius. Bends in conduits and ducts being installed for fiber optic cables shall be not less than 20 times cable diameter, 15 inches minimum.
- C. Install with symmetrical bends or cast metal fittings.
- D. Avoid field-made bends and offsets, but where necessary, make with acceptable hickey or bending machine. Do not heat metal raceways to facilitate bending.
- E. Make bends in parallel or banked runs from same center or centerline with same radius so that bends are parallel.
- F. Factory elbows may be installed in parallel or banked raceways if there is change in plane of run, and raceways are same size.

EXHIBIT H-6
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
RACEWAY AND BOXES

G. PVC Conduit:

1. Bends 30 Degrees and Larger: Provide factory-made elbows.
2. 90-Degree Bends: Provide rigid steel elbows, fiberglass where direct buried.
3. Use manufacturer's recommended method for forming smaller bends.

H. Flexible Conduit: Do not make bends that exceed allowable conductor bending radius of cable to be installed or that significantly restricts conduit flexibility.

3.9 EXPANSION/DEFLECTION FITTINGS

- A. Provide on raceways at structural expansion joints and in long tangential runs.
- B. Provide expansion/deflection joints for 50 degrees F maximum temperature variation.
- C. Install in accordance with manufacturer's instructions.

3.10 PVC CONDUIT

A. Solvent Welding:

1. Apply manufacturer recommended solvent to joints.
2. Install in order that joint is watertight.

B. Adapters:

1. PVC to Metallic Fittings: PVC terminal type.
2. PVC to Rigid Metal Conduit or IMC: PVC female adapter.

C. Belled-End Conduit: Bevel unbelled end of joint prior to joining.

3.11 PVC-COATED RIGID STEEL CONDUIT

- A. Install in accordance with manufacturer's instructions.
- B. Tools and equipment used in cutting, bending, threading and installation of PVC-coated rigid conduit shall be designed to limit damage to PVC coating.
- C. Provide PVC boot to cover exposed threading.

3.12 WIREWAYS

- A. Install in accordance with manufacturer's instructions.

EXHIBIT H-6
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
RACEWAY AND BOXES

- B. Locate with cover on accessible vertical face of wireway, unless otherwise shown.
- C. Applications:
 - 1. Metal wireway in indoor dry locations.
 - 2. Nonmetallic wireway in indoor wet, outdoor, and corrosive locations.

3.13 TERMINATION AT ENCLOSURES

- A. Cast Metal Enclosure: Install manufacturer's pre-molded insulating sleeve inside metallic conduit terminating in threaded hubs.
- B. Nonmetallic, Cabinets, and Enclosures:
 - 1. Terminate conduit in threaded conduit hubs, maintaining enclosure integrity.
 - 2. Metallic Conduit: Provide ground terminal for connection to maintain continuity of ground system.
- C. Sheet Metal Boxes, Cabinets, and Enclosures:
 - 1. General:
 - a. Install insulated bushing on ends of conduit where grounding is not required.
 - b. Provide insulated throat when conduit terminates in sheet metal boxes having threaded hubs.
 - c. Utilize sealing locknuts or threaded hubs on sides and bottom of NEMA 3R and NEMA 12 enclosures.
 - d. Terminate conduits at threaded hubs at the tops of NEMA 3R and NEMA 12 boxes and enclosures.
 - e. Terminate conduits at threaded conduit hubs at NEMA 4 and NEMA 4X boxes and enclosures.
 - 2. Rigid Galvanized Conduit:
 - a. Provide one lock nut each on inside and outside of enclosure.
 - b. Install grounding bushing at source enclosure.
 - c. Provide bonding jumper from grounding bushing to equipment ground bus or ground pad.
 - 3. Electric Metallic Tubing: Provide gland compression, insulated connectors.
 - 4. Flexible Metal Conduit: Provide two screw type, insulated, malleable iron connectors.
 - 5. Flexible, Nonmetallic Conduit: Provide nonmetallic, liquid-tight strain relief connectors.
 - 6. PVC-Coated Rigid Galvanized Steel Conduit: Provide PVC-coated, liquid-tight, metallic connector.
 - 7. PVC Schedule 40 Conduit: Provide PVC terminal adapter with lock nut,

EXHIBIT H-6
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
RACEWAY AND BOXES

except where threaded hubs required above.

D. Control Center, Switchboard, Switchgear, and Free-Standing Enclosures:

1. Terminate metal conduit entering bottom with grounding bushing; provide grounding jumper extending to equipment ground bus or grounding pad.
2. Terminate PVC conduit entering bottom with bell end fittings.

3.14 UNDERGROUND RACEWAYS

- A. Grade: Maintain minimum grade of 4 inches in 100 feet, either from one manhole, handhole, or pull box to the next, or from a high point between them, depending on surface contour.
- B. Cover: Maintain minimum 2-foot cover above concrete encasement, unless otherwise shown.
- C. Make routing changes as necessary to avoid obstructions or conflicts.
- D. Couplings: In multiple conduit runs, stagger so couplings in adjacent runs are not in same transverse line.
- E. Union type fittings not permitted.
- F. Spacers:
1. Provide preformed, nonmetallic spacers designed for such purpose, to secure and separate parallel conduit runs in a trench or concrete encasement.
 2. Install at intervals not greater than that specified in NFPA 70 for support of the type conduit used, but in no case greater than 10 feet.
- G. Support conduit so as to prevent bending or displacement during backfilling or concrete placement.
- H. Installation with Other Piping Systems:
1. Crossings: Maintain minimum 12-inch vertical separation.
 2. Parallel Runs: Maintain minimum 12-inch separation.
 3. Installation over valves or couplings not permitted.
- I. Provide expansion fittings that allow minimum of 4 inches of movement in vertical conduit runs from underground where exposed conduit will be fastened to or will enter building or structure.
- J. Provide expansion/deflection fittings in conduit runs that exit building or structure below grade. Conduit from building wall to fitting shall be

EXHIBIT H-6
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
RACEWAY AND BOXES

PVC-coated rigid steel.

- K. Concrete Encasement: As specified in Section 03 30 01, Reinforced Concrete.
- L. Backfill: As specified in Section 31 23 23.15, Trench Backfill.

3.15 UNDER SLAB RACEWAYS

- A. Make routing changes as necessary to avoid obstructions or conflicts.
- B. Support raceways to prevent bending or displacement during backfilling or concrete placement.
- C. Install raceways with no part embedded within slab and with no interference with slab on grade construction.
- D. Raceway spacing, in a single layer or multiple layers:
 - 1. 3 inches clear between adjacent 2-inch or larger raceway.
 - 2. 2 inches clear between adjacent 1-1/2-inch or smaller raceway.
- E. Multiple Layers of Raceways: Install under slab on grade in trench below backfill zone, as specified in Section 31 23 23.15, Trench Backfill.
- F. Individual Raceways and Single Layer Multiple Raceways: Install at lowest elevation of backfill zone with spacing as specified herein. Where conduits cross at perpendicular orientation, installation of conduits shall not interfere with placement of under slab fill that meets compaction and void limitations of earthwork specifications.
- G. Under slab raceways that emerge from below slab to top of slab as exposed, shall be located to avoid conflicts with structural slab rebar. Coordinate raceway stub ups with location of structural rebar.
- H. Fittings:
 - 1. Union type fittings are not permitted.
 - 2. Provide expansion/deflection fittings in raceway runs that exit building or structure below slab. Locate fittings 18 inches, maximum, beyond exterior wall. Raceway type between building exterior wall to fitting shall be PVC-coated rigid steel.
 - 3. Couplings: In multiple raceway runs, stagger so couplings in adjacent runs are not in same traverse line.

3.16 OUTLET AND DEVICE BOXES

- A. General:

EXHIBIT H-6
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
RACEWAY AND BOXES

1. Install plumb and level.
 2. Install suitable for conditions encountered at each outlet or device in wiring or raceway system, sized to meet NFPA 70 requirements.
 3. Open no more knockouts in sheet steel device boxes than are required; seal unused openings.
 4. Install galvanized mounting hardware in industrial areas.
- B. Size:
1. Depth: Minimum 2 inches, unless otherwise required by structural conditions. Box extensions not permitted.
 - a. Hollow Masonry Construction: Install with sufficient depth such that conduit knockouts or hubs are in masonry void space.
 2. Ceiling Outlet: Minimum 4-inch octagonal device box, unless otherwise required for installed fixture.
 3. Switch and Receptacle: Minimum 2-inch by 4-inch device box.
- C. Locations:
1. Drawing locations are approximate.
 2. To avoid interference with mechanical equipment or structural features, relocate outlets as directed by Engineer.
 3. Light Fixture: Install in symmetrical pattern according to room layout, unless otherwise shown.
- D. Mounting Height:
1. General:
 - a. Dimensions given to centerline of box.
 - b. Where specified heights do not suit building construction or finish, adjust up or down to avoid interference.
 - c. Do not straddle CMU block or other construction joints.
 2. Light Switch:
 - a. 48 inches above floor.
 - b. When located next to door, install on lock side of door.
 3. Thermostat: 54 inches above floor.
 4. Telephone Outlet:
 - a. 15 inches above floor.
 - b. 6 inches above counter tops.
 - c. Wall Mounted: 52 inches above floor.
 5. Convenience Receptacle:
 - a. General Interior Areas: 15 inches above floor.
 - b. General Interior Areas (Counter Tops): Install device plate bottom or side flush with top of backsplash, or 6 inches above counter tops without backsplash.
 - c. Outdoor Areas: 24 inches above finished grade.
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EXHIBIT H-6
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
RACEWAY AND BOXES

6. Special-Purpose Receptacle: 24 inches above floor or as shown.
 7. Switch, Motor Starting: 48 inches above floor, unless otherwise indicated on Drawings.
- E. Flush Mounted:
1. Install with concealed conduit.
 2. Install proper type extension rings or plaster covers to make edges of boxes flush with finished surface.
 3. Holes in surrounding surface shall be no larger than required to receive box.
- F. Supports:
1. Support boxes independently of conduit by attachment to building structure or structural member.
 2. Install bar hangers in frame construction or fasten boxes directly as follows:
 - a. Wood: Wood screws.
 - b. Concrete or Brick: Bolts and expansion shields.
 - c. Hollow Masonry Units: Toggle bolts.
 - d. Steelwork: Machine screws.
 3. Threaded studs driven in by powder charge and provided with lock washers and nuts are acceptable in lieu of expansion shields.
 4. Provide plaster rings where necessary.
 5. Boxes embedded in concrete or masonry need not be additionally supported.
- G. Install separate junction boxes for flush or recessed lighting fixtures where required by fixture terminal temperature.
- H. Boxes Supporting Fixtures: Provide means of attachment with adequate strength to support fixture.

3.17 JUNCTION AND PULL BOXES

- A. General:
1. Install plumb and level.
 2. Installed boxes shall be accessible.
 3. Do not install on finished surfaces.
 4. Use outlet boxes as junction and pull boxes wherever possible and allowed by applicable codes.
 5. Use conduit bodies as junction and pull boxes where no splices are required and allowed by applicable codes.
 6. Install pull boxes where necessary in raceway system to facilitate

EXHIBIT H-6
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
RACEWAY AND BOXES

conductor installation.

7. Install where shown and where necessary to terminate, tap-off, or redirect multiple conduit runs.
 8. Install in conduit runs at least every 150 feet or after the equivalent of three right-angle bends.
- B. Mounting Hardware: Refer to the Area Classification and Material Selection Table on Drawings.
- C. Supports:
1. Support boxes independently of conduit by attachment to building structure or structural member.
 2. Install bar hangers in frame construction or fasten boxes directly as follows:
 - a. Wood: Wood screws.
 - b. Concrete or Brick: Bolts and expansion shields.
 - c. Hollow Masonry Units: Toggle bolts.
 - d. Steelwork: Machine screws.
 3. Threaded studs driven in by powder charge and provided with lock washers and nuts are acceptable in lieu of expansion shields.
 4. Boxes embedded in concrete or masonry need not be additionally supported.
- D. At or Below Grade:
1. Install boxes for below grade conduit flush with finished grade in locations outside of paved areas, roadways, or walkways.
 2. If adjacent structure is available, box may be mounted on structure surface just above finished grade in accessible but unobtrusive location.
 3. Obtain Engineer's written acceptance prior to installation in paved areas, roadways, or walkways.
 4. Use boxes and covers suitable to support anticipated weights.
- E. Install Drain/breather fittings in NEMA 250 Type 4 and Type 4X enclosures.

3.18 MANHOLES AND HANDHOLES

- A. Excavate, shore, brace, backfill, and final grade in accordance with Section 31 23 16, Excavation, and Section 31 23 23.15, Trench Backfill.
- B. Do not install until final raceway grading has been determined.
- C. Install such that raceway enters at nearly right angle and as near as possible to end of wall, unless otherwise shown.

EXHIBIT H-6
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
RACEWAY AND BOXES

- D. Grounding: As specified in Section 26 05 26, Grounding and Bonding for Electrical Systems.
- E. Identification: Field stamp covers with manhole or handhole number as shown. Stamped numbers to be 1-inch minimum height.

3.19 EMPTY RACEWAYS

- A. Provide permanent, removable cap over each end.
- B. Provide PVC plug with pull tab for underground raceways with end bells.
- C. Provide nylon pull cord.
- D. Identify, as specified in Article Identification Devices, with waterproof tags attached to pull cord at each end, and at intermediate pull point.

3.20 IDENTIFICATION DEVICES

- A. Raceway Tags:
 - 1. Identify origin and destination.
 - 2. For exposed raceways, install tags at each terminus, near midpoint, and at minimum intervals of every 50 feet, whether in ceiling space or surface mounted.
 - 3. Install tags at each terminus for concealed raceways.
 - 4. Provide nylon strap for attachment.
- B. Warning Tape: Install approximately 12 inches above underground or concrete-encased raceways. Align parallel to, and within 12 inches of, centerline of run.

3.21 PROTECTION OF INSTALLED WORK

- A. Protect products from effects of moisture, corrosion, and physical damage during construction.
- B. Provide and maintain manufactured watertight and dust-tight seals over conduit openings during construction.
- C. Touch up painted conduit threads after assembly to cover nicks or scars.
- D. Touch up coating damage to PVC-coated conduit with patching compound approved by manufacturer. Compound shall be kept refrigerated according to manufacturers' instructions until time of use.

END OF SECTION

EXHIBIT H-7
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. ASTM International (ASTM):
 - a. D877, Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes.
 - b. D923, Standard Practice for Sampling Electrical Insulating Liquids.
 - c. D924, Standard Test Method for Dissipation Factor (or Power Factor) and Relative Permittivity (Dielectric Constant) of Electrical Insulating Liquids.
 - d. D971, Standard Test Method for Interfacial Tension of Oil Against Water by the Ring Method.
 - e. D974, Standard Test Method for Acid and Base Number by Color-Indicator Titration.
 - f. D1298, Standard Test Method for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method.
 - g. D1500, Standard Test Method for ASTM Color of Petroleum Products (ASTM Color Scale).
 - h. D1524, Standard Test Method for Visual Examination of Used Electrical Insulating Oils of Petroleum Origin in the Field.
 - i. D1533, Standard Test Method for Water in Insulating Liquids by Coulometric Karl Fischer Titration.
 - j. D1816, Standard Test Method for Dielectric Breakdown Voltage of Insulating Oils of Petroleum Origin Using VDE Electrodes.
 2. Institute of Electrical and Electronics Engineers (IEEE):
 - a. 43, Recommended Practice for Testing Insulating Resistance of Rotating Machinery.
 - b. 81, Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.
 - c. 400, Guide for Field Testing and Evaluation of the Insulation of Shielded Power Cable Systems.
 - d. C2, National Electrical Safety Code.
 - e. C37.20.1, Standard for Metal-Enclosed Low Voltage Power Circuit Breaker Switchgear.
 - f. C37.20.2, Standard for Metal-Clad Switchgear.
 - g. C37.20.3, Standard for Metal-Enclosed Interrupter Switchgear.
 - h. C37.23, Standard for Metal-Enclosed Bus.
 - i. C62.33, Standard Test Specifications for Varistor Surge-Protective Devices.

EXHIBIT H-7
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
COMMISSIONING OF ELECTRICAL SYSTEMS

3. InterNational Electrical Testing Association (NETA): ATS, Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
4. National Electrical Manufacturers Association (NEMA):
 - a. AB 4, Guidelines for Inspection and Preventive Maintenance of Molded Case Circuit Breakers Used in Commercial and Industrial Applications.
 - b. PB 2, Deadfront Distribution Switchboards.
5. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 - b. 70B, Recommended Practice for Electrical Equipment Maintenance.
 - c. 70E, Standard for Electrical Safety in the Workplace.
 - d. 101, Life Safety Code.
6. National Institute for Certification in Engineering Technologies (NICET).
7. Occupational Safety and Health Administration (OSHA): CFR 29, Part 1910, Occupational Safety and Health Standards.

1.2 SUBMITTALS

A. Informational Submittals:

1. Submit 30 days prior to performing inspections or tests:
 - a. Schedule for performing inspection and tests.
 - b. List of references to be used for each test.
 - c. Sample copy of equipment and materials inspection form(s).
 - d. Sample copy of individual device test form.
 - e. Sample copy of individual system test form.
2. Energization Plan: Prior to initial energization of electrical distribution equipment; include the following:
 - a. Owner's representative sign-off form for complete and accurate arc flash labeling and proper protective device settings for equipment to be energized.
 - b. Staged sequence of initial energization of electrical equipment.
 - c. Lock-Out-Tag-Out plan for each stage of the progressive energization.
 - d. Barricading, signage, and communication plan notifying personnel of newly energized equipment.
3. Submit test or inspection reports and certificates for each electrical item tested within 30 days after completion of test:
4. Operation and Maintenance Data:
 - a. In accordance with Section 01 78 23, Operation and Maintenance Data.

EXHIBIT H-7
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
COMMISSIONING OF ELECTRICAL SYSTEMS

- b. After test or inspection reports and certificates have been reviewed by Engineer and returned, insert a copy of each in Operation and Maintenance Manual.
- 5. Programmable Settings: At completion of Performance Demonstration Test, submit final hardcopy printout and electronic files on compact disc of as-left setpoints, programs, and device configuration files for:
 - a. Protective relays.
 - b. Intelligent overload relays.
 - c. Variable frequency drives.
 - d. Electrical communications modules.

1.3 QUALITY ASSURANCE

- A. Test equipment shall have an operating accuracy equal to or greater than requirements established by NETA ATS.
- B. Test instrument calibration shall be in accordance with NETA ATS.

1.4 SEQUENCING AND SCHEDULING

- A. Perform inspection and electrical tests after equipment listed herein has been installed.
- B. Perform tests with apparatus de-energized whenever feasible.
- C. Inspection and electrical tests on energized equipment shall be:
 - 1. Scheduled with Engineer prior to de-energization.
 - 2. Minimized to avoid extended period of interruption to the operating plant equipment.
- D. Notify Engineer at least 24 hours prior to performing tests on energized electrical equipment.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 GENERAL

- A. Perform tests in accordance with requirements of Section 01 91 14, Equipment Testing and Facility Startup.
- B. Tests and inspections shall establish:
 - 1. Electrical equipment is operational within industry and manufacturer's

EXHIBIT H-7
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
COMMISSIONING OF ELECTRICAL SYSTEMS

- tolerances and standards.
 - 2. Installation operates properly.
 - 3. Equipment is suitable for energization.
 - 4. Installation conforms to requirements of Contract Documents and NFPA 70, NFPA 70E, NFPA 101, and IEEE C2.
- C. Perform inspection and testing in accordance with NETA ATS, industry standards, and manufacturer's recommendations.
- D. Set, test, and calibrate protective relays, circuit breakers, fuses, power monitoring meters, and other applicable devices.
- E. Adjust mechanisms and moving parts of equipment for free mechanical movement.
- F. Adjust and set electromechanical electronic relays and sensors to correspond to operating conditions, or as recommended by manufacturer.
- G. Verify nameplate data for conformance to Contract Documents and approved Submittals.
- H. Realign equipment not properly aligned and correct unlevelness.
- I. Properly anchor electrical equipment found to be inadequately anchored.
- J. Tighten accessible bolted connections, including wiring connections, with calibrated torque wrench/screw driver to manufacturer's recommendations, or as otherwise specified in NETA ATS.
- K. Clean contaminated surfaces with cleaning solvents as recommended by manufacturer.
- L. Provide proper lubrication of applicable moving parts.
- M. Inform Engineer of working clearances not in accordance with NFPA 70.
- N. Investigate and repair or replace:
- 1. Electrical items that fail tests.
 - 2. Active components not operating in accordance with manufacturer's instructions.
 - 3. Damaged electrical equipment.
- O. Electrical Enclosures:
- 1. Remove foreign material and moisture from enclosure interior.

EXHIBIT H-7
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
COMMISSIONING OF ELECTRICAL SYSTEMS

2. Vacuum and wipe clean enclosure interior.
 3. Remove corrosion found on metal surfaces.
 4. Repair or replace, as determined by Engineer door and panel sections having dented surfaces.
 5. Repair or replace, as determined by Engineer poor fitting doors and panel sections.
 6. Repair or replace improperly operating latching, locking, or interlocking devices.
 7. Replace missing or damaged hardware.
 8. Finish:
 - a. Provide matching paint and touch up scratches and mars.
 - b. If required because of extensive damage, as determined by Engineer, refinish entire assembly.
- P. Replace fuses and circuit breakers that do not conform to size and type required by the Contract Documents or approved Submittals.

3.2 CHECKOUT AND STARTUP

- A. Voltage Field Test: Check voltage amplitude and balance between phases for loaded and unloaded conditions.
- B. Equipment Line Current Tests:
1. Check line current in each phase for each piece of equipment.
 2. If phase current for a piece of equipment is above rated nameplate current, prepare Equipment Line Phase Current Report that identifies cause of problem and corrective action taken.

3.3 LOW VOLTAGE CABLES, 600 VOLTS MAXIMUM

- A. Visual and Mechanical Inspection:
1. Inspect each individual exposed power cable No. 6 and larger for:
 - a. Physical damage.
 - b. Proper connections in accordance with single-line diagram.
 - c. Cable bends not in conformance with manufacturer's minimum allowable bending radius where applicable.
 - d. Color coding conformance with specification.
 - e. Proper circuit identification.
 2. Mechanical Connections For:
 - a. Proper lug type for conductor material.
 - b. Proper lug installation.
 - c. Bolt torque level in accordance with NETA ATS, Table 100.12, unless otherwise specified by manufacturer.

EXHIBIT H-7
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
COMMISSIONING OF ELECTRICAL SYSTEMS

3. Shielded Instrumentation Cables For:
 - a. Proper shield grounding.
 - b. Proper terminations.
 - c. Proper circuit identification.
 4. Control Cables For:
 - a. Proper termination.
 - b. Proper circuit identification.
 5. Cables Terminated Through Window Type CTs: Verify neutrals and grounds are terminated for correct operation of protective devices.
- B. Electrical Tests for Conductors No. 6 and Larger:
1. Insulation Resistance Tests:
 - a. Utilize 1,000Vdc megohmmeter for 600-volt insulated conductors and 500V dc megohmmeter for 300-volt insulated conductors.
 - b. Test each conductor with respect to ground and to adjacent conductors for 1 minute.
 - c. Evaluate ohmic values by comparison with conductors of same length and type.
 - d. Investigate values less than 50 megohms.
 2. Continuity test by ohmmeter method to ensure proper cable connections.
- C. Low-voltage cable tests may be performed by installer in lieu of independent testing firm.

3.4 SAFETY SWITCHES, 600 VOLTS MAXIMUM

- A. Visual and Mechanical Inspection:
1. Proper blade pressure and alignment.
 2. Proper operation of switch operating handle.
 3. Adequate mechanical support for each fuse.
 4. Proper contact-to-contact tightness between fuse clip and fuse.
 5. Cable connection bolt torque level in accordance with NETA ATS, Table 100.12.
 6. Proper phase barrier material and installation.
 7. Verify fuse sizes and types correspond to one-line diagram or approved Submittals.
 8. Perform mechanical operational test and verify mechanical interlocking system operation and sequencing.
- B. Electrical Tests:

EXHIBIT H-7
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
COMMISSIONING OF ELECTRICAL SYSTEMS

1. Insulation Resistance Tests:
 - a. Applied megohmmeter dc voltage in accordance with NETA ATS, Table 100.1.
 - b. Phase-to-phase and phase-to-ground for 1 minute on each pole.
 - c. Insulation resistance values equal to, or greater than, ohmic values established by manufacturer.
2. Contact Resistance Tests:
 - a. Contact resistance in microhms across each switch blade and fuse holder.
 - b. Investigate deviation of 50 percent or more from adjacent poles or similar switches.

3.5 MOLDED AND INSULATED CASE CIRCUIT BREAKERS

- A. General: Inspection and testing limited to circuit breakers 70 amperes and larger and to motor circuit protector breakers rated 50 amperes and larger.
- B. Visual and Mechanical Inspection:
 1. Proper mounting.
 2. Proper conductor size.
 3. Feeder designation according to nameplate and one-line diagram.
 4. Cracked casings.
 5. Connection bolt torque level in accordance with NETA ATS, Table 100.12.
 6. Operate breaker to verify smooth operation.
 7. Compare frame size and trip setting with circuit breaker schedules or one-line diagram.
 8. Verify that terminals are suitable for 75 degrees C rated insulated conductors.
- C. Electrical Tests:
 1. Insulation Resistance Tests:
 - a. Utilize 1,000V dc megohmmeter for 480-volt and 600-volt circuit breakers and 500V dc megohmmeter for 240-volt circuit breakers.
 - b. Pole-to-pole and pole-to-ground with breaker contacts opened for 1 minute.
 - c. Pole-to-pole and pole-to-ground with breaker contacts closed for 1 minute.
 - d. Test values to comply with NETA ATS, Table 100.1.
 2. Contact Resistance Tests:
 - a. Contact resistance in microhms across each pole.
 - b. Investigate deviation of 50 percent or more from adjacent poles

EXHIBIT H-7
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
COMMISSIONING OF ELECTRICAL SYSTEMS

and similar breakers.

3. Primary Current Injection Test to Verify:
 - a. Long-time minimum pickup and delay.
 - b. Short-time pickup and delay.
 - c. Ground fault pickup and delay.
 - d. Instantaneous pickup by run-up or pulse method.
 - e. Trip characteristics of adjustable trip breakers shall be within manufacturer's published time-current characteristic tolerance band, including adjustment factors.
 - f. Trip times shall be within limits established by NEMA AB 4, Table 5-3. Alternatively, use NETA ATS, Table 100.7.
 - g. Instantaneous pickup value shall be within values established by NEMA AB 4, Table 5-4. Alternatively, use NETA ATS, Table 100.8.

3.6 INSTRUMENT TRANSFORMERS

A. Visual and Mechanical Inspection:

1. Visually check current, potential, and control transformers for:
 - a. Cracked insulation.
 - b. Broken leads or defective wiring.
 - c. Proper connections.
 - d. Adequate clearances between primary and secondary circuit wiring.
2. Verify Mechanically:
 - a. Grounding and shorting connections have good contact.
 - b. Withdrawal mechanism and grounding operation, when applicable, operate properly.
3. Verify proper primary and secondary fuse sizes for potential transformers.

B. Electrical Tests:

1. Current Transformer Tests:
 - a. Insulation resistance test of transformer and wiring-to-ground at 1,000V dc for 30 seconds.
 - b. Polarity test.
2. Potential Transformer Tests:
 - a. Insulation resistance test at test voltages in accordance with NETA ATS, Table 100.9, for 1 minute on:
 - 1) Winding-to-winding.
 - 2) Winding-to-ground.
 - b. Polarity test to verify polarity marks or H1-X1 relationship as

EXHIBIT H-7
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
COMMISSIONING OF ELECTRICAL SYSTEMS

applicable.

3. Insulation resistance measurement on instrument transformer shall not be less than that shown in NETA ATS, Table 100.5.

3.7 AC INDUCTION MOTORS

- A. General: Inspection and testing limited to motors rated 1/2 horsepower and larger.
- B. Visual and Mechanical Inspection:
 1. Proper electrical and grounding connections.
 2. Shaft alignment.
 3. Blockage of ventilating air passageways.
 4. Operate motor and check for:
 - a. Excessive mechanical and electrical noise.
 - b. Overheating.
 - c. Correct rotation.
 - d. Check vibration detectors, resistance temperature detectors, or motor inherent protectors for functionability and proper operation.
 - e. Excessive vibration, in excess of values in NETAATS, Table 100.10.
 5. Check operation of space heaters.
- C. Electrical Tests:
 1. Insulation Resistance Tests:
 - a. In accordance with IEEE 43 at test voltages established by NETA ATS, Table 100.1 for:
 - 1) Motors above 200 horsepower for 10-minute duration with resistances tabulated at 30 seconds, 1 minute, and 10 minutes.
 - 2) Motors 200 horsepower and less for 1-minute duration with resistances tabulated at 30 seconds and 60 seconds.
 - b. Insulation resistance values equal to, or greater than, ohmic values established by manufacturers.
 2. Calculate polarization index ratios for motors above 200 horsepower. Investigate index ratios less than 1.5 for Class A insulation and 2.0 for Class B insulation.
 3. Insulation resistance test on insulated bearings in accordance with manufacturer's instructions.
 4. Measure running current and voltage, and evaluate relative to load conditions and nameplate full-load amperes.

3.8 LOW-VOLTAGE MOTOR CONTROL

EXHIBIT H-7
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
COMMISSIONING OF ELECTRICAL SYSTEMS

A. Visual and Mechanical Inspection:

1. Proper operation of indicating and monitoring devices.
2. Proper overload protection for each motor.
3. Improper blockage of air-cooling passages.
4. Check door and device interlocking system by:
 - a. Closure attempt of device when door in in OPEN position.
 - b. Opening attempt of door when device in in ON position.
5. Check nameplates for proper identification of:
 - a. Equipment title and tag number with latest one-line diagram.
 - b. Pushbuttons.
 - c. Control switches.
 - d. Pilot lights.
 - e. Control relays.
 - f. Circuit breakers.
 - g. Indicating meters.
6. Verify fuse and circuit breaker sizes and types conform to Contract Documents.
7. Verify current and potential transformer ratios conform to Contract Documents.
8. Check bus connections for high resistance by low-resistance ohmmeter and thermographic survey:
9. Ohmic value to be zero.
 - a. Thermographic survey temperature gradient of 2 degrees C, or less per NETA ATS, Table 100.18.
10. Check operation and sequencing of electrical and mechanical interlock systems by:
 - a. Closure attempt for locked open devices.
 - b. Opening attempt for locked closed devices.
 - c. Key exchange to operate devices in OFF-NORMAL positions.
11. Verify performance of each control device and feature furnished as part of motor control center.
12. Control Wiring:
 - a. Compare wiring to local and remote control, and protective devices with elementary diagrams.
 - b. Check for proper conductor lacing and bundling.
 - c. Check for proper conductor identification.
 - d. Check for proper conductor lugs and connections.
13. Exercise active components.
14. Inspect contactors for:
 - a. Correct mechanical operations.
 - b. Correct contact gap, wipe, alignment, and pressure.
 - c. Correct torque of connections.
15. Compare overload heater rating with full-load current for proper size.

EXHIBIT H-7
COMNET DISTRIBUTED CONTROL SYSTEM (DCS)
COMMISSIONING OF ELECTRICAL SYSTEMS

16. Compare fuse motor protector and circuit breaker with motor characteristics for proper size.

B. Electrical Tests:

1. Insulation Resistance Tests:
 - a. Applied megohmmeter dc voltage in accordance with NETA ATS, Table 100.1.
 - b. Contactor phase-to-ground and across open contacts for 1 minute on each phase.
 - c. Starter section phase-to-phase and phase-to-ground on each phase with starter contacts closed and protective devices open.
 - d. Test values to comply with NETA ATS, Table 100.1.
2. Control Wiring Tests:
 - a. Apply secondary voltage to control power and potential circuits.
 - b. Check voltage levels at each point on terminal board and each device terminal.
 - c. Insulation resistance test at 1,000V dc on control wiring, except that connected to solid state components; 1 megohm minimum insulation resistance.
3. Operational test by initiating control devices to affect proper operation.

END OF SECTION