

CITY OF CEDAR RAPIDS

No. \_\_\_\_\_

PROJECT MANUAL  
for  
**2018**  
Kjeldahl Hood Procurement  
CONTRACT NO. 6150024-02

PREPARED BY  
HDR Engineering Inc.

FILED IN THE OFFICE OF THE CITY CLERK ON  
April, 2018

**Certification of City Utilities Engineer**





These Bid Documents are recommended for filing with the City Clerk.

\_\_\_\_\_  
James J. Flamming, P.E.  
Utilities Process & Facilities Engineering Manager

\_\_\_\_\_  
Date



**KJELDAHL HOOD PROCUREMENT**  
**PROJECT NO. 6150024-02**  
**CERTIFICATIONS**

	<p>I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and that I am a duly registered Professional Engineer under the laws of the State of Iowa.</p> <hr/> <p>Michael C. Butterfield <span style="float: right;">04/26/2018</span></p> <p>Pages or sheets covered by this seal:          Division 1</p>
	<p>I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and that I am a duly registered Professional Engineer under the laws of the State of Iowa.</p> <hr/> <p>Jeffrey A. Lewis <span style="float: right;">04/26/2018</span></p> <p>Pages or sheets covered by this seal:          Division 23</p>
	<p>I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and that I am a duly registered Professional Architect under the laws of the State of Iowa.</p> <hr/> <p>John S. Rickert <span style="float: right;">04/26/2018</span></p> <p>Pages or sheets covered by this seal:          Division 10 and 11</p>
	<p>I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and that I am a duly registered Professional Engineer under the laws of the State of Iowa.</p> <hr/> <p>Kevin Vander Kolk <span style="float: right;">04/26/2018</span></p> <p>Pages or sheets covered by this seal:          Division 26</p>



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**DIVISION 01**  
**GENERAL REQUIREMENTS**







2 **SECTION 01 25 13**  
3 **PRODUCT SUBSTITUTIONS**

4 **PART 1 - GENERAL**

5 **1.1 SUMMARY**

6 A. Section Includes:

- 7 1. The procedure for requesting the approval of substitution of a product that is not equivalent  
8 to a product which is specified by descriptive or performance criteria or defined by  
9 reference to one or more of the following:  
10 a. Name of manufacturer.  
11 b. Name of vendor.  
12 c. Trade name.  
13 d. Catalog number.  
14 2. Substitutions are not "or-equals."  
15 3. This Specification Section does not address substitutions for major equipment.

16 B. Related Specification Sections include but are not necessarily limited to:

- 17 1. Division 00 - Procurement and Contracting Requirements.  
18 2. Division 01 - General Requirements.

19 C. Request for Substitution - General:

- 20 1. Base all bids on materials, equipment, and procedures specified.  
21 2. Certain types of equipment and kinds of material are described in specifications by means of  
22 references to names of manufacturers and vendors, trade names, or catalog numbers.  
23 a. When this method of specifying is used, it is not intended to exclude from consideration  
24 other products bearing other manufacturer's or vendor's names, trade names, or catalog  
25 numbers, provided said products are "or-equals," as determined by Engineer.  
26 3. Other types of equipment and kinds of material may be acceptable substitutions under the  
27 following conditions:  
28 a. Or-equals are unavailable due to strike, discontinued production of products meeting  
29 specified requirements, or other factors beyond control of Contractor; or,  
30 b. Contractor proposes a cost and/or time reduction incentive to the Owner.

31 **1.2 QUALITY ASSURANCE**

32 A. In making request for substitution or in using an approved product, Contractor represents they:

- 33 1. Have investigated proposed product, and have determined that it is adequate or superior in  
34 all respects to that specified, and that it will perform function for which it is intended.  
35 2. Will provide same guarantee for substitute item as for product specified.  
36 3. Will coordinate installation of accepted substitution into Work, to include building  
37 modifications if necessary, making such changes as may be required for Work to be  
38 complete in all respects.  
39 4. Waives all claims for additional costs related to substitution which subsequently arise.

40 **1.3 DEFINITIONS**

- 41 A. Product: Manufactured material or equipment.

42 **1.4 PROCEDURE FOR REQUESTING SUBSTITUTION DURING BIDDING PERIOD**

- 43 A. See Section 00200, Instructions to Bidders.

44 **1.5 PROCEDURE FOR REQUESTING SUBSTITUTION AFTER AWARD OF CONTRACT**

- 45 A. Substitution will only be considered under the conditions stated herein.

- 1 B. Written request through Contractor only.
- 2 C. Transmittal Mechanics:
- 3 1. Follow the transmittal mechanics prescribed for Shop Drawings in Specification Section 01
- 4 33 00.
- 5 a. Product substitution will be treated in a manner similar to "deviations," as described in
- 6 Specification Section 01 33 00.
- 7 b. List the letter describing the deviation and justifications on the transmittal form in the
- 8 space provided under the column with the heading DESCRIPTION.
- 9 1) Include in the transmittal letter, either directly or as a clearly marked attachment,
- 10 the items listed in Paragraph D below.
- 11 D. Transmittal Contents:
- 12 1. Product identification:
- 13 a. Manufacturer's name.
- 14 b. Telephone number and representative contact name.
- 15 c. Specification Section or Drawing reference of originally specified product, including
- 16 discrete name or tag number assigned to original product in the Contract Documents.
- 17 2. Manufacturer's literature clearly marked to show compliance of proposed product with
- 18 Contract Documents.
- 19 3. Itemized comparison of original and proposed product addressing product characteristics
- 20 including but not necessarily limited to:
- 21 a. Size.
- 22 b. Composition or materials of construction.
- 23 c. Weight.
- 24 d. Electrical or mechanical requirements.
- 25 4. Product experience:
- 26 a. Location of past projects utilizing product.
- 27 b. Name and telephone number of persons associated with referenced projects
- 28 knowledgeable concerning proposed product.
- 29 c. Available field data and reports associated with proposed product.
- 30 5. Data relating to changes in construction schedule.
- 31 6. Data relating to changes in cost.
- 32 7. Samples:
- 33 a. At request of Engineer.
- 34 b. Full size if requested by Engineer.
- 35 c. Held until substantial completion.
- 36 d. Engineer not responsible for loss or damage to samples.

## 37 1.6 APPROVAL OR REJECTION

- 38 A. Written approval or rejection of substitution given by the Engineer.
- 39 B. Engineer reserves the right to require proposed product to comply with color and pattern of
- 40 specified product if necessary to secure design intent.
- 41 C. In the event the substitution is approved, the resulting cost and/or time reduction will be
- 42 documented by Change Order in accordance with the General Conditions.
- 43 D. Substitution will be rejected if:
- 44 1. Submittal is not through the Contractor with his stamp of approval.
- 45 2. Request is not made in accordance with this Specification Section.
- 46 3. In the Engineer's opinion, acceptance will require substantial revision of the original design.
- 47 4. In the Engineer's opinion, substitution will not perform adequately the function consistent
- 48 with the design intent.
- 49 E. Contractor shall reimburse Owner for the cost of Engineer's evaluation whether or not
- 50 substitution is approved.

1 **PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)**

2 **PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)**

3 **END OF SECTION**

4





**EXHIBIT A Substitution Request Form**  
**(One Item per each Form)**

Project:		Date:
Substitution Requestor:		
Contractor:		
Specification Section No:	Paragraph No. (i.e. 2.1.A.1.c):	Specified Item:
Proposed Substitution:		
Provide Product Data Sheets, Manufacturer's written installation instructions, drawings, diagrams, or any other information as an attached to this Form that will demonstrate the proposed substitution is an Approved Equal.		
In the lines provided state differences between proposed substitutions and specified item. Differences include but are not limited to interrelationship with other items; materials, equipment, function, utility, life cycle costs, applied finished, appearances, and quality.		
<p>_____</p> <p>_____</p> <p>_____</p>		
In the lines provided demonstrate how the proposed substitution is compatible with or modifies other systems, parts, equipment or components of the Project and Work under the Contract:		
<p>_____</p> <p>_____</p> <p>_____</p>		
In the lines provided, describe what effect the proposed substitution has on dimensions indicated on the Drawings and previously reviewed Shop Drawings?		
<p>_____</p> <p>_____</p> <p>_____</p>		
In the lines provided, describe what effect the proposed substitution has on the Construction Schedule and Contract Time.		
<p>_____</p> <p>_____</p> <p>_____</p>		
In the lines provided, describe what effect the proposed substitution has on the Contract Price. This includes all direct, indirect, impact and delay costs.		
<p>_____</p> <p>_____</p> <p>_____</p>		
Manufacturer's guarantees of the proposed and specified items are:		
<input type="checkbox"/> Same <input type="checkbox"/> Different (explain on attachment)		
The undersigned state that the function, utility, life cycle costs, applied finishes, appearance and quality of the proposed substitution are equal or superior to those of the specified item.		
For use by Project Representative:		
<input type="checkbox"/> Accepted <input type="checkbox"/> Accepted as Noted <input type="checkbox"/> Not Accepted <input type="checkbox"/> Received Too Late	<p>_____</p> <p style="text-align: center;"><i>(Contractor's Signature)</i></p> <p>_____</p> <p style="text-align: center;"><i>(Contractor's Firm)</i></p> <p>_____</p> <p style="text-align: center;"><i>(Firms Address)</i></p> <p>_____</p>	
<p>_____</p> <p style="text-align: center;"><i>(Date)</i></p> <p>_____</p> <p style="text-align: center;"><i>(Telephone)</i></p>		
Comments:		
_____		
_____		

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**SECTION 01 30 00**  
**SPECIAL CONDITIONS**

4 **PART 1 - GENERAL**

5 **1.1 SUMMARY**

- 6 A. Section Includes:
- 7 1. Administrative and procedural requirements for:
- 8 a. Summary of Work.
- 9 b. Work by Others.
- 10 c. Work by Owner.
- 11 d. Contractor's Use of Site and Premises.
- 12 e. Coordination with Owner's Operations.
- 13 f. Order of Construction and Construction Schedule.
- 14 g. Preconstruction Conference.
- 15 h. Contractor's Superintendent's Field Office.
- 16 i. Drawings and Contract Documents for Contractor use.
- 17 j. Project meetings.
- 18 B. Related Specification Sections include but are not necessarily limited to:
- 19 1. Division 00 - Procurement and Contracting Requirements.
- 20 2. Division 01 - General Requirements.

21 **1.2 QUALITY ASSURANCE**

- 22 A. Referenced Standards:
- 23 1. Building Code:
- 24 a. International Code Council (ICC):
- 25 1) International Building Code and associated standards, 2015 Edition including all
- 26 amendments, referred to herein as Building Code.

27 **1.3 SUBMITTALS**

- 28 A. Shop Drawings:
- 29 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of
- 30 the submittal process.

31 **1.4 SUMMARY OF WORK**

- 32 A. Work covered by Lump Sum Bid, excluding the Allowance, shall be as shown on the Drawings
- 33 and specified herein, and as reasonably inferred there from.
- 34 B. Work covered by the Allowance, as shown on Bid form, shall be included in the Total Lump
- 35 Sum Bid Plus Allowance and shall consist of the following:
- 36 1. Other unanticipated scope of work identified, authorized by the Owner, and performed
- 37 during renovations.

38 **1.5 WORK BY OTHERS**

- 39 A. Other Contractors will be onsite performing work under separate contract(s) at the booster
- 40 stations.
- 41 B. Contractor shall coordinate and cooperate with the work of others.

42 **1.6 WORK BY OWNER**

- 43 A. Prior to work by Contractor, the Owner may be conducting other construction projects at the
- 44 booster station sites.

- 1 B. Following work by the Contractor, the Owner may take over operation of the booster stations  
2 while the Contractor finishes up on other non-critical activities.

3 **1.7 CONTRACTOR'S USE OF SITE AND PREMISES**

- 4 A. Locate field office, materials storage and staging areas, and limit use of site and premises to  
5 allow:

- 6 1. Owner occupancy and uninterrupted operation of the booster stations.  
7 2. Work by others and work by Owner.  
8 3. Continuous Owner access to the booster stations through all existing entrances.  
9 4. Ongoing material and equipment deliveries.

- 10 B. Coordinate onsite lay down and temporary materials storage in the areas designated the Project  
11 Location Plan of the Contract Drawings and with Owner's representatives.

- 12 C. Temporary Utilities:

- 13 1. Electricity:  
14 a. Power will be available to Contractor at no cost as long as its use does not hinder  
15 Owner's operations at Owner's sole discretion.  
16 b. Provide and maintain required facilities for use of electric power.  
17 2. Heat:  
18 a. Provide and pay for heat devices and heat as required to maintain specified condition  
19 for construction purposes.  
20 3. Water Service:  
21 a. Potable and non-potable water will be available to Contractor at no cost as long as  
22 usage is reasonable does not hinder Owner's operations at Owner's sole discretion.  
23 b. Provide and maintain required facilities for use of water including meter and certified  
24 backflow device for potable water.  
25 4. Sanitary Facilities:  
26 a. Provide and maintain required facilities and enclosures for employees.  
27 5. Disconnect, dismantle, and/or remove temporary utilities when no longer required for the  
28 work.

- 29 D. Safety:

- 30 1. The Contractor is responsible for becoming fully acquainted with the safety and health  
31 policies/procedures at the Cedar Rapids Water Treatment Plants as outlined in  
32 Section 00800 SC-6.13 prior to the commencement of work.  
33 a. This responsibility also extends to any subcontractors or suppliers retained or used by  
34 the Contractor.  
35 b. All employees of the Contractor who will be at the work site for more than four (4)  
36 consecutive hours shall participate in site-specific safety orientation and pass a written  
37 examination prior to work on site.  
38 c. Upon request of Owner, Contractor to provide to Owner a current list of Contractor's  
39 employees that have successfully completed the site-specific safety orientation.  
40 2. As specified in the General Conditions the Contractor is responsible for safety of their  
41 personnel and shall designate a site safety supervisor.  
42 3. Contractor's site safety supervisor will jointly investigate with the Cedar Rapids Water  
43 Utilities Safety Coordinator any reported condition(s) that may pose a hazard to the safety  
44 and health of City employees that the Contractor's employees, including subcontractors and  
45 suppliers, may have created in the course of their work.  
46 4. The Contractor will notify the Cedar Rapids Water Utilities Safety Coordinator of any  
47 OSHA-recordable illnesses or injuries sustained by the Contractor's employees, including  
48 subcontractors and suppliers, on City property and of any OSHA inspections or citations  
49 related to work conducted on City property.

- 50 E. Lockout/Tagout:

- 51 1. Contractor shall coordinate all lockout/tagout activities with Owner's Operations Supervisor  
52 as outlined in Section 00800- SC-6.13.



1 F. Security:

- 2 1. The perimeter of the booster station sites are fenced. Gates and doors are to be locked at all  
3 times that active work is not occurring.  
4 a. Contractor vehicles shall be clearly identified as such and a current list of vehicles and  
5 license plate numbers shall be given to resident inspector.  
6 b. Owner reserves the right to limit number of Contractor vehicles on site and to tow  
7 unidentified vehicles from the site.  
8 2. Contractor employee parking:  
9 a. Personal cars owned by Contractor employees shall be parked in the parking lot at the  
10 booster station sites without hindering adjacent roads or access for neighboring  
11 businesses and/or residents..  
12 3. Each employee is required to badge in, and badge out, each time he/she enters, or exits, the  
13 site whether exiting on foot or in vehicle.  
14 a. Badges will be issued by the Owner at no cost to the Contractor.  
15 b. Contractor employees will need to have a valid Kirkwood Community College safety  
16 card and a driver's license to receive an ID badge.  
17 c. Driver's licenses will be photocopied.  
18 d. Replacements for lost, stolen, or damaged badges will be issued by the Owner at a cost  
19 of \$15.00 per badge.  
20 e. Contractor employees shall wear ID badges so they are visible at all times.  
21 f. Contractor employees shall turn their ID badges in to the Owner when they are done  
22 working on the Project.  
23 g. Contractor to provide cell phone numbers for key personal to Owners representative.  
24 4. At all times during Project:  
25 a. Contractor shall keep roster of its employees and all visitors.  
26 b. Any employee discharged shall be immediately reported to construction inspector so  
27 discharged employee may be removed from access roster.  
28 5. Contractor shall provide, maintain, and pay for security services, fences, and lighting as  
29 required to protect stored material, equipment, and field offices.  
30 6. Deliveries:  
31 a. Contractor shall make arrangements for deliveries, loading, and unloading.  
32 b. Owner employees and/or equipment will not unload Contractor's deliveries.  
33 c. Contractor shall maintain log of delivery personnel entering and leaving plant site.  
34 d. All vehicles must be logged in and out, and be restricted to only those permitted  
35 deliveries and vehicles.  
36 e. If Contractor does not have a representative to receive truck shipment, that truck will  
37 not be allowed on plant Site.  
38 7. Visitors:  
39 a. Short term visitors (such as field engineers, day laborers and vendors) to the Project  
40 Site who can not reasonably attend the Kirkwood Community College training shall  
41 wear a visitor badge and be accompanied at all times by Contractor employee, who has  
42 been safety trained.

43 G. Cleaning:

- 44 1. Maintain areas free of waste materials, debris, and rubbish.  
45 a. Maintain site in a clean and orderly condition.  
46 2. Provide means of removing mud from vehicle wheels before entering plant roadways and  
47 adjacent streets.  
48 a. Remove project related mud and other debris from plant roadways and adjacent streets.  
49 3. Leave the site in a condition with an appearance equal to original condition.

50 H. Protect existing facilities and installed work.

- 51 1. Repair or replace damaged facilities to original condition.

52 I. Contractor shall report all damage to the City of Cedar Rapids:

- 53 1. Utilities, process equipment, and property immediately to the Resident Project  
54 Representative.

- 1 J. Salvage of Existing Materials and/or Equipment Removed from Service:  
2 1. Contractor is responsible for disposal of all material removed from service from this site.  
3 2. Remove from the site and dispose of all pipe materials removed during the project.

4 **1.8 COORDINATION WITH OWNER'S OPERATIONS**

- 5 A. All work requiring interface with existing facilities and operation of the booster stations must be  
6 coordinated with a representative of the Cedar Rapids Utilities Department to be designated by  
7 the Owner.
- 8 B. Coordinate and identify non-emergency shutdowns to facilitate installation of Contract  
9 components.  
10 1. Provide a minimum of two (2) week notice of scheduled shutdown.  
11 2. Shutdown request shall be submitted in writing only by the General Contractor's  
12 Superintendent, not the various subcontractors. Shutdown schedule shall be prepared by the  
13 General Contractor and reviewed by the Owner and Engineer. Only approved shutdowns  
14 may be conducted.  
15 3. Any shutdowns or exceptions to existing lockout shall be coordinated with the Owner's  
16 representative.  
17 4. The plant manager or authorized designee has the final decision concerning any process  
18 shutdown scheduled.
- 19 C. The Contractor is prohibited from operating any valves, gates or other equipment at any time.
- 20 D. City holidays will not count as business days for scheduled shutdown notification purposes.  
21 1. City holidays include:  
22 a. New Year's Day.  
23 b. President's Day.  
24 c. Good Friday.  
25 d. Memorial Day.  
26 e. Independence Day.  
27 f. Labor Day.  
28 g. Veterans Day.  
29 h. Thanksgiving.  
30 i. Day after Thanksgiving.  
31 j. Christmas Eve.  
32 k. Christmas.

33 **1.9 ORDER OF CONSTRUCTION AND CONSTRUCTION SCHEDULE**

- 34 A. The Engineer and Owner shall have authority to review, approve, and modify the Contractor's  
35 schedule in order to protect the operation of the existing facilities during construction.
- 36 B. Construction operations will be scheduled to allow the Owner uninterrupted operation of  
37 existing facilities.  
38 1. Coordinate connections with existing work to ensure timely completion of interfaced items.
- 39 C. At no time shall Contractor or his employees modify operation of the existing facilities or start  
40 construction modifications without approval of the Owner except in emergency to prevent or  
41 minimize damage.  
42 1. The Plant Manager's designee(s) will be identified at the preconstruction meeting.
- 43 D. Within 10 days after award of Contract, submit for approval a schedule for completion of the  
44 work.  
45 1. Account for schedule of Subcontracts. Include proper sequence of construction, various  
46 crafts, purchasing time, Shop Drawing approval, material delivery, equipment fabrication,  
47 startup, demonstration, and similar time consuming factors.  
48 2. Show on schedule as a minimum, anticipated starting and completion date for each major  
49 task or item.

- 1 E. Evaluate Schedule no less than Monthly:
- 2 1. Update, correct, and rerun schedule and submit to Engineer in triplicate with each partial
- 3 payment request to show rescheduling necessary to reflect true job conditions.
- 4 2. When shortening of various time intervals is necessary to correct for behind schedule
- 5 conditions, indicate actions to implement to accomplish work in shorter duration.
- 6 3. Information shall be submitted to Engineer in writing with revised schedule.
- 7 F. If Contractor does not take necessary action to accomplish work according to schedule,
- 8 Contractor may be ordered by Owner in writing to take necessary and timely action to improve
- 9 work progress.
- 10 1. Owner may require increased work forces, extra equipment, extra shifts or other action as
- 11 necessary.
- 12 2. Should Contractor refuse or neglect to take such action authorized, under provisions of this
- 13 contract, Owner may take necessary actions including, but not necessarily limited to,
- 14 withholding of payment and termination of Contract.
- 15 G. Construction Scheduling Requirements shall be as Follows:
- 16 1. Written authorization shall be provided by Owner before Contractor begins work in a
- 17 laboratory space.
- 18 2. Work in each lab shall be coordinated with the Owner's representative to minimize impacts
- 19 to Owner operations.
- 20 3. Demolition work shall be accomplished as shown on the Drawings with input from the
- 21 Owner.
- 22 a. The Contractor shall not demolish any structure and/or facility without the Owner's
- 23 prior approval.
- 24 b. Contractor shall be mindful that the existing facilities will remain in operation
- 25 throughout construction.
- 26 4. Other miscellaneous Work on this project not identified above shall be completed with the
- 27 Contract Time allotted.

#### 28 **1.10 PRECONSTRUCTION CONFERENCE**

- 29 A. A preconstruction conference shall be held at Water Pollution Control Facility Administration
- 30 Building after award of Contract.
- 31 1. Engineer will notify the Contractor as to the date and time of the conference two (2) weeks
- 32 in advance of the proposed date.
- 33 2. Contractor's Project Manager and Project Superintendent and Contractor's Subcontractor
- 34 Representatives shall attend.

#### 35 **1.11 CONTRACTOR'S SUPERINTENDENT'S FIELD OFFICE**

- 36 A. Establish at site of Project.
- 37 B. Equipment: Telephone, telecopy, mailing address, and sanitary facilities.
- 38 C. Ensure attendance at this office during the normal working day.
- 39 D. At this office, maintain complete field file of Shop Drawings, posted Contract Drawings and
- 40 Specifications, and other files of field operations including provisions for maintaining "As
- 41 Recorded Drawings."
- 42 E. Remove field office from site upon acceptance of the entire work by the Owner.

#### 43 **1.12 DRAWINGS AND CONTRACT DOCUMENTS FOR CONTRACTOR USE**

- 44 A. Refer to General Conditions.
- 45 B. Contractor shall pick up all "no-charge" documents within 10 days from date of Notice to
- 46 Proceed.
- 47 C. Additional documents after "no-charge" documents will be furnished to Contractor at cost.

1 **1.13 PROJECT MEETINGS**

2 A. Construction Meetings:

- 3 1. The Contractor will conduct construction meetings involving:  
4 a. Contractor's project manager.  
5 b. Contractor's project superintendent.  
6 c. Owner's designated representative(s).  
7 d. Engineer's designated representative(s).  
8 e. Contractor's subcontractors as appropriate to the Work in progress.  
9 f. Owner's Construction Quality Control Consultant.
- 10 2. Meetings will be conducted monthly. Additional meetings will be held as necessary based  
11 on on-site project activities.
- 12 3. The Contractor will take meeting minutes and submit copies of meeting minutes to  
13 participants and designated recipients identified at the Preconstruction Conference.  
14 a. Corrections, additions or deletions to the minutes shall be noted and addressed at the  
15 following meeting.
- 16 4. The Contractor will schedule meetings for most convenient time frame.
- 17 5. The Contractor will have available at each meeting full chronological files of all previous  
18 meeting minutes.
- 19 6. The Contractor shall have available at each meeting up-to-date Record Drawings.

20 B. Pre-Installation Conferences:

- 21 1. Coordinate and schedule with Resident Project Representative and Engineer for each  
22 material, product or system specified.  
23 a. Conferences to be held prior to initiating installation, but not more than two (2) weeks  
24 before scheduled initiation of installation.  
25 b. Conferences may be combined if installation schedule of multiple components occurs  
26 within the same two (2) week interval.  
27 c. Review manufacturer's recommendations and Contract Documents Specification  
28 Sections.
- 29 2. Contractor's Superintendent and individual who will actually act as foreman of the  
30 installation crew (installer), if other than the Superintendent, shall attend.

31 **PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)**

32 **PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)**

33 **END OF SECTION**

2 **SECTION 01 33 00**  
3 **SUBMITTALS**

4 **PART 1 - GENERAL**

5 **1.1 SUMMARY**

- 6 A. Section Includes:
- 7 1. Mechanics and administration of the submittal process for:
    - 8 a. Shop Drawings.
    - 9 b. Samples.
    - 10 c. Informational submittals.
  - 11 2. General content requirements for Shop Drawings.
- 12 B. Related Specification Sections include but are not necessarily limited to:
- 13 1. Division 00 - Procurement and Contracting Requirements.
  - 14 2. Division 01 - General Requirements.
  - 15 3. Operations and Maintenance Manual submittal requirements are specified in Specification
  - 16 Section 01 33 04.
  - 17 4. Technical Specification Sections identifying required submittals.

18 **1.2 DEFINITIONS**

- 19 A. Shop Drawings:
- 20 1. See General Conditions.
  - 21 2. Product data and samples are Shop Drawing information.
- 22 B. Informational Submittals:
- 23 1. Submittals other than Shop Drawings and samples required by the Contract Documents that
  - 24 do not require review and/or approval by the Engineer.
  - 25 2. Representative types of informational submittal items include but are not limited to:
    - 26 a. HVAC test and balance reports.
    - 27 b. Installed equipment and systems performance test reports.
    - 28 c. Manufacturer's installation certification letters.
    - 29 d. Instrumentation and control commissioning reports.
    - 30 e. Warranties.
    - 31 f. Service agreements.
    - 32 g. Construction photographs.
    - 33 h. Survey data.
    - 34 i. Health and safety plans.
    - 35 j. Work plans.
    - 36 k. Delegated designs per performance specification requirements
  - 37 3. For-Information-Only submittals upon which the Engineer is not expected to conduct
  - 38 review or take responsive action may be so identified in the Contract Documents.

39 **1.3 SUBMITTAL SCHEDULE**

- 40 A. Schedule of Shop Drawings:
- 41 1. Submitted and approved within 10 days of receipt of Notice to Proceed.
  - 42 2. Account for multiple transmittals under any specification section where partial submittals
  - 43 will be transmitted.
- 44 B. Shop Drawings: Submittal and approval prior to 30 percent completion of project.
- 45 C. Informational Submittals:
- 46 1. Reports and installation certifications submitted within five (5) days of conducting testing,
  - 47 installation, or examination.

1                   2. Submittals showing compliance with required qualifications submitted twenty (20) days  
2 prior to any work beginning using the subject qualifications.

3                   D. The submittal schedule shall include the following columns as a minimum:  
4

Submittal Section	Submittal Description	Planned Submittal Date	Submittal Need Date	Actual Submittal Date	Actual Return Date	Disposition

5

6       **1.4 PREPARATION OF SUBMITTALS**

7           A. General:

- 8           1. All submittals and all pages of all copies of a submittal shall be completely legible.
- 9           2. Submittals which, in the Engineer’s sole opinion, are illegible will be returned without  
10 review.
- 11          3. Minimize extraneous information for equipment and products not relevant to the submittal.
- 12          4. Contractors or vendors written comments on the submittal drawings shall be in green

13          B. Shop Drawings, Product Data, and Samples:

- 14          1. Scope of any submittal and letter of transmittal:
  - 15           a. Limited to one (1) Specification Section.
  - 16           b. Submittals with more than one Specification section included will be rejected.
  - 17           c. Do not submit under any Specification Section entitled (in part) "Basic Requirements"  
18 unless the product or material submitted is specified, in total, in a "Basic Requirements"  
19 Specification Section.
- 20          2. Numbering letter of transmittal:
  - 21           a. Include as prefix the Specification Section number followed by a series number, "-xx",  
22 beginning with "01 IN and increasing sequentially with each additional transmittal for  
23 that Specification Section.
  - 24           b. If more than one (1) submittal under any Specification Section, assign consecutive  
25 series numbers to subsequent transmittal letters.
- 26          3. Describing transmittal contents:
  - 27           a. Provide listing of each component or item in submittal capable of receiving an  
28 independent review action.
  - 29           b. Identify for each item:
    - 30               1) Manufacturer and Manufacturer's Drawing or data number.
    - 31               2) Contract Document tag number(s).
    - 32               3) Unique page numbers for each page of each separate item.
  - 33           c. When submitting "or-equal" items that are not the products of named manufacturers,  
34 include the words "or-equal" in the item description.
- 35          4. Contractor certification of review and approval:
  - 36           a. Contractor shall execute Exhibit AA, Contractor's Submittal Certification form, to  
37 indicate Contractor has reviewed and approved the submittal contents.
    - 38               1) Clearly identify the person who reviewed the submittal and the date it was  
39 reviewed."
  - 40           b. Submittals containing multiple independent items shall be prepared with each item  
41 listed on the letter of transmittal or on an index sheet for all items listing the discrete  
42 page numbers for each page of each item, which shall be stamped with the Contractor's  
43 review and approval stamp.
    - 44               1) Each independent item shall have a cover sheet with the transmittal number and  
45 item number recorded.
      - 46                   a) Provide clear space of 3 IN SQ for Engineer stamping.
    - 47               2) Individual pages or sheets of independent items shall be numbered in a manner that  
48 permits the entire contents of a particular item to be readily recognized and  
49 associated with Contractor's certification.

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5. Resubmittals:
    - a. Number with original Specification Section and series number with a suffix letter starting with "A" on a (new) duplicate transmittal form.
    - b. Do not increase the scope of any prior transmittal.
    - c. Provide cover letter indicating how each "B", "C", or "D" Action from previous submittal was addressed and where the correction is found in the resubmittal.
    - d. Account for all components of prior transmittal.
      - 1) If items in prior transmittal received "A" or "B" Action code, list them and indicate "A" or "B" as appropriate.
        - a) Do not include submittal information for items listed with prior "A" or "B" Action in resubmittal.
      - 2) Indicate "Outstanding-To Be Resubmitted At a Later Date" for any prior "C" or "D" Action item not included in resubmittal.
        - a) Obtain Engineer's approval to exclude items.
  6. For 8-1/2 x 11 IN, 8-1/2 x 14 IN, and 11 x 17 IN size sheets, provide five (5) copies of each submittal for Engineer plus the number required by the Contractor.
    - a. The number of copies required by the Contractor will be defined at the Preconstruction Conference, but shall not exceed three (3).
    - b. All other size sheets:
      - 1) Submit one (1) reproducible transparency or high resolution print and one (1) additional print of each Drawing until approval is obtained.
      - 2) Utilize mailing tube; do not fold.
      - 3) The Engineer will mark and return the reproducible to the Contractor for reproduction and distribution.
  7. Contractor shall not use red color for marks on transmittals.
    - a. Duplicate all marks on all copies transmitted, and ensure marks are photocopy reproducible.
    - b. Engineer will use red marks or enclose marks in a cloud.
  8. Transmittal contents:
    - a. Coordinate and identify Shop Drawing contents so that all items can be easily verified by the Engineer.
    - b. Provide submittal information or marks defining specific equipment or materials utilized on the Project.
      - 1) Generalized product information, not clearly defining specific equipment or materials to be provided, will be rejected.
    - c. Identify equipment or material project use, tag number, Drawing detail reference, weight, and other Project specific information.
    - d. Provide sufficient information together with technical cuts and technical data to allow an evaluation to be made to determine that the item submitted is in compliance with the Contract Documents.
    - e. Do not modify the manufacturer's documentation or data except as specified herein.
    - f. Submit items such as equipment brochures, cuts of fixtures, product data sheets or catalog sheets not exceeding 8-1/2 x 11 IN pages.
      - 1) Indicate exact item or model and all options proposed by arrow and leader.
    - g. When a Shop Drawing submittal is called for in any Specification Section, include as appropriate, scaled details, sizes, dimensions, performance characteristics, capacities, test data, anchoring details, installation instructions, storage and handling instructions, color charts, layout Drawings, rough-in diagrams, wiring diagrams, controls, weights and other pertinent data in addition to information specifically stipulated in the Specification Section.
      - 1) Arrange data and performance information in format similar to that provided in Contract Documents.
      - 2) Provide, at minimum, the detail specified in the Contract Documents.

1 h. If proposed equipment or materials deviate from the Contract Drawings or  
2 Specifications in any way, clearly note the deviation and justify the said deviation in  
3 detail in a separate letter immediately following transmittal sheet. Any deviation from  
4 plans or specifications not depicted in the submittal or included but not clearly noted by  
5 the Contractor may not have been reviewed. Review by the Engineer shall not serve to  
6 relieve the Contractor of the contractual responsibility for any error or deviation from  
7 contract requirements.

8 9. Samples:

9 a. Identification:

- 10 1) Identify sample as to transmittal number, manufacturer, item, use, type, project  
11 designation, tag number, Specification Section or Drawing detail reference, color,  
12 range, texture, finish and other pertinent data.  
13 2) If identifying information cannot be marked directly on sample without defacing or  
14 adversely altering samples, provide a durable tag with identifying information  
15 securely attached to the sample.

16 b. Include application specific brochures, and installation instructions.

17 c. Provide Contractor's review and approval certification stamp or Contractor's Submittal  
18 Certification form as indication of Contractor's checking and verification of dimensions  
19 and coordination with interrelated work.

20 d. Resubmit revised samples of rejected items.

21 C. Informational Submittals:

- 22 1. Prepare in the format and detail specified in Specification requiring the informational  
23 submittal.

24 **1.5 TRANSMITTAL OF SUBMITTALS**

25 A. Shop Drawings and Samples:

- 26 1. Transmit all submittals to:

27  
HDR  
5815 Council Street NE Suite B  
Cedar Rapids, IA 52402  
Attn: Michael Butterfield, PE

- 28 2. Utilize two (2) copies of attached Exhibit A to transmit all Shop Drawings and samples.

- 29 3. All submittals must be from Contractor.

- 30 a. Submittals will not be received from or returned to subcontractors.  
31

32 B. Informational Submittals:

- 33 1. Transmit under Contractor's standard letter of transmittal or letterhead.

- 34 2. Submit in triplicate or as specified in individual Specification Section.

- 35 3. Transmit to:

36  
HDR  
5815 Council Street NE Suite B  
Cedar Rapids, IA 52402  
Attn: Michael Butterfield, PE

37  
38 C. Electronic Transmission of Submittals:

- 39 1. Transmittals may be made electronically.

- 40 a. Use email.

- 41 b. Protocols and processes will be determined at the Pre-Construction Conference.

- 42 2. Scan all transmittals into Adobe Acrobat Portable Document Format (PDF), latest version,  
43 with printing enabled.

- 44 a. Do not password protect or lock the PDF document.



- b. Rotate sheets that are normally viewed in landscape mode so that when the PDF file is opened the sheet is in the appropriate position for viewing.
3. Required signatures may be applied prior to scanning for transmittal..

#### 1.6 ENGINEER'S REVIEW ACTION

##### A. Shop Drawings and Samples:

1. Items within transmittals will be reviewed for overall design intent and will receive one (1) of the following actions:
  - a. A - FURNISH AS SUBMITTED.
  - b. B - FURNISH AS NOTED (BY ENGINEER).
  - c. C - REVISE AND RESUBMIT.
  - d. D - REJECTED.
  - e. E - ENGINEER'S REVIEW NOT REQUIRED.
2. Submittals received will be initially reviewed to ascertain inclusion of Contractor's approval stamp.
  - a. Submittals not stamped by the Contractor or stamped with a stamp containing language other than that specified herein will not be reviewed for technical content and will be returned rejected.
3. In relying on the representation on the Contractor's review and approval stamp, Owner and Engineer reserve the right to review and process poorly organized and poorly described submittals as follows:
  - a. Submittals transmitted with a description identifying a single item and found to contain multiple independent items:
    - 1) Review and approval will be limited to the single item described on the transmittal letter.
    - 2) Other items identified in the submittal will:
      - a) Not be logged as received by the Engineer.
      - b) Be removed from the submittal package and returned without review and comment to the Contractor for coordination, description and stamping.
      - c) Be submitted by the Contractor as a new series number, not as a re-submittal number.
  - b. Engineer, at Engineer's discretion, may revise the transmittal letter item list and descriptions, and conduct review.
    - 1) Unless Contractor notifies Engineer in writing that the Engineer's revision of the transmittal letter item list and descriptions was in error, Contractor's review and approval stamp will be deemed to have applied to the entire contents of the submittal package.
4. Submittals returned with Action "A" or "B" are considered ready for fabrication and installation.
  - a. If for any reason a submittal that has an "A" or "B" Action is resubmitted, it must be accompanied by a letter defining the changes that have been made and the reason for the resubmittal.
  - b. Destroy or conspicuously mark "SUPERSEDED" all documents having previously received "A" or "B" Action that are superseded by a resubmittal.
5. Submittals with Action "A" or "B" combined with Action "C" (Revise and Resubmit) or "D" (Rejected) will be individually analyzed giving consideration as follows:
  - a. The portion of the submittal given "C" or "D" will not be distributed (unless previously agreed to otherwise at the Preconstruction Conference).
    - 1) One (1) copy or the one (1) transparency of the "C" or "D" Drawings will be marked up and returned to the Contractor.
      - a) Correct and resubmit items so marked.
  - b. Items marked "A" or "B" will be fully distributed.

- 1 c. If a portion of the items or system proposed are acceptable, however, the major part of  
2 the individual Drawings or documents are incomplete or require revision, the entire  
3 submittal may be given "C" or "D" Action.  
4 1) This is at the sole discretion of the Engineer.  
5 2) In this case, some Drawings may contain relatively few or no comments or the  
6 statement, "Resubmit to maintain a complete package."  
7 3) Distribution to the Owner and field will not be made (unless previously agreed to  
8 otherwise).
- 9 6. Failure to include any specific information specified under the submittal paragraphs of the  
10 Specifications will result in the submittal being returned to the Contractor with "C" or "D"  
11 Action.  
12 7. Calculations required in individual Specification Sections will be received for information  
13 purposes only, as evidence calculations have been stamped by the professional as defined in  
14 the specifications and for limited purpose of checking conformance with given performance  
15 and design criteria. The Engineer is not responsible for checking the accuracy of the  
16 calculations and the calculations will be returned stamped "E. Engineer's Review Not  
17 Required" to acknowledge receipt.  
18 8. Contractor shall furnish required submittals with sufficient information and accuracy to  
19 obtain required approval of an item with no more than two submittals. Engineer will record  
20 Engineer's time for reviewing a fourth or subsequent submittal of a Shop Drawings, sample,  
21 or other item requiring approval, and Contractor shall be responsible for Engineer's charges  
22 to Owner for such time. Owner may impose a set-off against payments due to Contractor to  
23 secure reimbursement for such charges.  
24 9. Transmittals of submittals which the Engineer considers as "Not Required" submittal  
25 information, which is supplemental to but not essential to prior submitted information, or  
26 items of information in a transmittal which have been reviewed and received "A" or "B"  
27 action in a prior submittal, will be returned with action "E. Engineer's Review Not  
28 Required."  
29 10. Samples may be retained for comparison purposes.  
30 a. Remove samples when directed.  
31 b. Include in bid all costs of furnishing and removing samples.  
32 11. Approved samples submitted or constructed, constitute criteria for judging completed work.  
33 a. Finished work or items not equal to samples will be rejected.

34 **PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)**

35 **PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)**

36 **END OF SECTION**



# EXHIBIT A Shop Drawing Transmittal No.

\_\_\_\_\_  
(Spec Section) (Series)

Project Name:		Date Received:
Project Owner:		Checked By:
Contractor:	HDR Engineering, Inc.	Log Page:
Address:	Address:	HDR No.:
		Spec Section:
		Drawing/Detail No.:
Attn:	Attn:	1st. Sub      ReSub.
Date Transmitted:	Previous Transmittal Date:	

Item No.	No. Copies	Description	Manufacturer	Mfr/Vendor Dwg or Data No.	Action Taken*

Remarks:

\* The Action designated above is in accordance with the following legend:

<p>A - Furnish as Submitted</p> <p>B - Furnish as Noted</p> <p>C - Revise and Submit</p> <ol style="list-style-type: none"> <li>1. Not enough information for review.</li> <li>2. No reproduces submitted.</li> <li>3. Copies illegible.</li> <li>4. Not enough copies submitted.</li> <li>5. Wrong sequence number.</li> <li>6. Wrong resubmittal number.</li> <li>7. Wrong spec. section.</li> <li>8. Wrong form used.</li> <li>9. See comments.</li> </ol> <p>D - Rejected</p>	<p>E - Engineer's review not required</p> <ol style="list-style-type: none"> <li>1. Submittal not required.</li> <li>2. Supplemental Information. Submittal retained for informational purposes only.</li> <li>3. Information reviewed and approved on prior submittal.</li> <li>4. See comments.</li> <li>5. Delegated Design - Submittal received as requested by the Contract Documents. The Engineer did not review the engineering or technical content of the submittal.</li> </ol> <p>Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Any deviation from plans or specifications not depicted in the submittal or included but not clearly noted by the Contractor may not have been reviewed. Review by the Engineer shall not serve to relieve the Contractor of the contractual responsibility for any error or deviation from contract requirements.</p>
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Comments:

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By \_\_\_\_\_ Date \_\_\_\_\_

Distribution: Contractor | File | Field | Owner | Other |





# Contractor's Submittal Certification

Shop Drawing Transmittal No.: \_\_\_\_\_

Contract/Project Name: \_\_\_\_\_

Company Name: \_\_\_\_\_

has

- 1. reviewed and coordinated this Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
- 2. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
- 3. determined and verified the suitability of all materials offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
- 4. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.

This Submittal **does not** contain any variations from the requirements of the Contract Documents.

This Submittal **does** contain variations from the requirements of the Contract Documents. A separate description of said variations and a justification for them is provided in an attachment hereto identified as:

"Shop Drawing Transmittal No. \_\_\_\_\_ Variation and Justification Documentation"

Insert picture file or electronic signature of Authorized Representative

\_\_\_\_\_  
Authorized Representative

\_\_\_\_\_  
Date



1 2018/04/26

2

## SECTION 01 33 04

3

### OPERATION AND MAINTENANCE MANUALS

#### 4 PART 1 - GENERAL

##### 5 1.1 SUMMARY

6

A. Section Includes:

7

1. Administration of the submittal process for Operation and Maintenance Manuals.

8

2. Content requirements for Operation and Maintenance Manuals.

9

B. Related Specification Sections include but are not necessarily limited to:

10

1. Division 00 - Procurement and Contracting Requirements.

11

2. Division 01 - General Requirements.

12

3. General submittal requirements are specified in Specification Section 01 33 00 - Submittals.

13

4. Technical Specification Sections identifying required Operation and Maintenance Manual submittals.

14

15

##### 1.2 DEFINITIONS

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A. Equipment Operation and Maintenance Manuals:

17

1. Contain the technical information required for proper installation, operation and

18

maintenance of process, electrical and mechanical equipment and systems.

19

##### 1.3 SUBMITTALS

20

A. List of all the Operation and Maintenance Manuals required by the Contract as identified in the

21

Technical Specification Sections. These may be referred to as "Operation and Maintenance

22

Data" submittals.

23

B. Operation and Maintenance Manuals:

24

1. Draft and final electronic copies.

25

2. Final paper copies: One (1).

26

##### 1.4 SUBMITTAL SCHEDULE

27

A. List of Required Operation and Maintenance Manuals:

28

1. Submit list with Specification Section number and title within 90 days after Notice to

29

Proceed.

30

B. Draft Operation and Maintenance Manuals:

31

1. Submit approvable draft manuals in electronic format (PDF) within 30 days following approval of the respective Shop Drawing.

32

a. Include placeholders or fly sheet pages where information is not final or is missing from the draft manual.

33

2. All Draft Operation and Maintenance Manuals shall be received by no later than 50 PCT project completion.

34

35

36

C. Final Operation and Maintenance Manuals:

37

1. Final approval of Operation and Maintenance Manuals in electronic format (PDF) must be obtained 45 days prior to equipment start-up.

38

2. Provide paper copies and CD-ROMs of approved final Operation and Maintenance Manuals in electronic format (PDF), a minimum of 30 days prior to equipment start-up.

39

3. Issue addenda to Final Approved Operation and Maintenance Manual to include:

40

a. Equipment data that requires collection after start-up, for example but not limited to HVAC balancing reports, electrical switchgear, automatic transfer switch and circuit breaker settings.

41

b. Equipment field testing data.

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45

46

- 1 c. Equipment start-up reports.

2 **1.5 PREPARATION OF SUBMITTALS**

3 A. General:

- 4 1. All pages of the Operation and Maintenance Manual submittal shall be legible.  
5 a. Submittals which, in the Engineer's sole opinion, are illegible will be rejected without  
6 review.  
7 2. Identify each equipment item in a manner consistent with names and identification numbers  
8 used in the Contract Documents, not the manufacturer's catalog numbers.  
9 3. Neatly type any data not furnished in printed form.  
10 4. Operation and Maintenance Manuals are provided for Owner's use, to be reproduced and  
11 distributed as training and reference materials within Owner's organization.  
12 a. This requirement is:  
13 1) Applicable to both paper copy and electronic files.  
14 2) Applicable to materials containing copyright notice as well as those with no  
15 copyright notice.  
16 5. Notify supplier and/or manufacturer of the intended use of Operations and Maintenance  
17 Manuals provided under the Contract.

18 B. Operation and Maintenance Manual Format and Delivery:

- 19 1. Draft electronic submittals:  
20 a. Provide manual in Adobe Acrobat Portable Document Format (PDF), latest version.  
21 b. Create one (1) PDF file for each equipment Operation and Maintenance Manual.  
22 c. Do not password protect or lock the PDF document.  
23 d. Scanned images of paper documents are not acceptable. Create the Operation and  
24 Maintenance Manual PDF file from the original source document.  
25 e. Drawings or other graphics must be converted to PDF file format from the original  
26 drawing file format and made part of the PDF document.  
27 f. Scanning of drawings is to be used only where actual file conversion is not possible and  
28 drawings must be scanned at a resolution of 300 dpi or greater.  
29 g. Rotate sheets that are normally viewed in landscape mode so that when the PDF file is  
30 opened the sheet is in the appropriate position for viewing.  
31 h. Create bookmarks in the bookmarks panel for the Operation and Maintenance Manual  
32 cover, the Table of Contents and each major section of the Table of Contents.  
33 i. Using Adobe Acrobat Standard or Adobe Acrobat Professional, set the PDF document  
34 properties, initial view as follows:  
35 1) Select File → Properties → Initial View.  
36 2) Select the Navigation tab: Bookmarks Panel and Page.  
37 3) Select the Page layout: Single Page Continuous.  
38 4) Select the Magnification: Fit Page.  
39 5) Select Open to page: 1.  
40 6) Set the file to open to the cover page of the manual with bookmarks to the left, and  
41 the first bookmark linked to the cover page.  
42 7) Window Options: Check the "Resize window to initial page" box.  
43 j. Set the PDF file "Fast Web View" option to open the first several pages of the  
44 document while the rest of the document continues to load.  
45 1) To do this:  
46 a) Select Edit → Preferences → Documents → Save Settings.  
47 b) Check the "Save As optimizes for Fast Web View" box.  
48 k. PDF file naming convention:  
49 1) Use the Specification Section number, the manufacturer's name and the equipment  
50 description, separated by underscores.  
51 2) Example: 46 51 21\_Sanitaire\_Coarse\_Bubble\_Diffusers.pdf.  
52 3) Do not put spaces in the file name.



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2. Final electronic submittals:
    - a. Submit two (2) copies in PDF file format on two (2) CD-ROM discs (one (1) copy per CD-ROM), each secured in a jewel case.
    - b. CD-ROM Labeling:
      - 1) Provide the following printed labeling on all CD-ROM discs:
        - a) Project name.
        - b) Specification Section.
        - c) Equipment names and summary of tag(s) covered.
        - d) Manufacturer name.
        - e) Date (month, year).
      - c. CD-ROM Jewel Case Holder:
        - 1) Insert jewel cases containing labeled CD-ROM discs in three-ring binder holder (C-Line Products, www.c-lineproducts.com stock number CLI-61968 or equivalent) at the front of each final paper copy.
    3. Final paper copy submittals:
      - a. Quantity: Provide two (2) copies.
      - b. Paper: 8.5 x 11 IN or 11 x 17 IN bright white, 20 LB paper with standard three-hole punching.
      - c. 3-Ring Binder:
        - 1) Provide D-ring binder with clear vinyl sleeves (i.e. view binder) on front and spine.
        - 2) Insert binder title sheet with the following information under the front and spine sleeves:
          - a) Project name.
          - b) Specification Section.
          - c) Equipment names and summary of tag(s) covered.
          - d) Manufacturer name.
          - e) Date (month, year).
        - 3) Provide plastic sheet lifters prior to first page and following last page.
      - d. Drawings:
        - 1) Provide all drawings at 11 x 17 IN size, triple folded and three-hole punched for insertion into manual.
        - 2) Where reduction is not practical to ensure readability, fold larger drawings separately and place in three-hole punched vinyl envelopes inserted into the binder.
        - 3) Identify vinyl envelopes with drawing numbers.
      - e. Use plastic coated dividers to tab each section of each manual in accordance with the Table of Contents.
- C. Equipment Operation and Maintenance Manual Content:
1. Provide a cover page as the first page of each manual with the following information:
    - a. Manufacturer(s) Name and Contact Information.
    - b. Vendor's Name and Contact Information.
    - c. Date (month, year).
    - d. Project Owner and Project Name.
    - e. Specification Section.
    - f. Project Equipment Tag Numbers.
    - g. Model Numbers.
    - h. Engineer's Name.
    - i. Contractor's Name.
  2. Provide a Table of Contents for each manual.
  3. Provide Equipment Record sheets as follows:
    - a. Printed copies of the Equipment Record (Exhibits B1, B2 and B3), as the first tab following the Table of Contents.
    - b. Exhibits B1-B3 are available as Fillable PDF Form documents from the Engineer.
    - c. Each section of the Equipment Record must be completed in detail; simply referencing the related equipment Operation and Maintenance Manual sections for nameplate, maintenance, spare parts or lubricant information is not acceptable.

- d. For equipment involving separate components (for example, a motor and gearbox), a fully completed Equipment Record is required for each component.
  - e. Submittals that do not include the Equipment Record(s) will be rejected without further content review.
4. Provide the following detailed information, as applicable:
- a. Use equipment tag numbers from the Contract Documents to identify equipment and system components.
  - b. Equipment function, normal and limiting operating characteristics.
  - c. Instructions for assembly, disassembly, installation, alignment, adjustment, and inspection.
  - d. Operating instructions for start-up, normal operation, control, shutdown, and emergency conditions.
  - e. Lubrication and maintenance instructions.
  - f. Troubleshooting guide.
  - g. Mark each sheet to clearly identify specific products and component parts and data applicable to the installation for the Project; delete or cross out information that does not specifically apply to the Project.
  - h. Parts lists:
    - 1) A parts list and identification number of each component part of the equipment.
    - 2) Exploded view or plan and section views of the equipment with a detailed parts callout matching the parts list.
    - 3) A list of recommended spare parts.
    - 4) List of spare parts provided as specified in the associated Specification Section.
    - 5) A list of any special storage precautions which may be required for all spare parts.
  - i. General arrangement, cross-section, and assembly drawings.
  - j. Electrical diagrams, including elementary diagrams, wiring diagrams, connection diagrams, and interconnection diagrams.
  - k. Test data and performance curves.
  - l. As-constructed fabrication or layout drawings and wiring diagrams.
  - m. Copy of the equipment manufacturer's warranty meeting the requirements of the Contract.
  - n. Copy of any service contracts provided for the specific piece of equipment as part of the Contract.
5. Additional information as required in the associated equipment or system Specification Section.

## 1.6 TRANSMITTAL OF SUBMITTALS

- A. Operation and Maintenance Manuals.
1. Transmit all submittals to:
    - a. The address specified in Specification Section 01 33 00 - SUBMITTALS.
  2. Transmittal form: Use Operation and Maintenance Manual Transmittal, Exhibit A.
  3. Transmittal numbering:
    - a. Number each submittal with the Specification Section number followed by a series number beginning with "-01 IN and increasing sequentially with each additional transmittal, followed by "-OM" (for example: 43 23 14-01-OM).
  4. Submit draft and final Operation and Maintenance Manual in electronic format (PDF) to Engineer, until manual is approved.

## 1.7 ENGINEER'S REVIEW ACTION

- A. Draft Electronic (PDF) Submittals:
1. Engineer will review and indicate one of the following review actions:
    - a. A - ACCEPTABLE
    - b. B - FURNISH AS NOTED
    - c. C - REVISE AND RESUBMIT
    - d. D - REJECTED







**EXHIBIT A Operation and Maintenance Manual  
Transmittal \_\_\_\_\_ - \_\_\_\_\_ - OM  
(Spec Section) (Series)**

Project Name: \_\_\_\_\_ Date Received: \_\_\_\_\_

Project Owner: \_\_\_\_\_ Checked By: \_\_\_\_\_

Contractor: \_\_\_\_\_ Owner: \_\_\_\_\_ Log Page: \_\_\_\_\_

Address: \_\_\_\_\_ Address: \_\_\_\_\_ HDR No.: \_\_\_\_\_

Attn: \_\_\_\_\_ Attn: \_\_\_\_\_  
1st. Sub. \_\_\_\_\_ ReSub. \_\_\_\_\_

Date Transmitted: \_\_\_\_\_ Previous Transmittal Date: \_\_\_\_\_

No. Copies	Description of Item	Manufacturer	Dwg. or Data No.	Action Taken*

Remarks: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

To: \_\_\_\_\_ From: *HDR Engineering, Inc.*

Date: \_\_\_\_\_

- \* The Action designated above is in accordance with the following legend:
- |   |  |
|---|--|
| <p>A - Acceptable, provide one (1) additional paper copy and two (2) electronic copies on CD-ROM for final review.</p> <p>B - <del>Furnish as Noted</del> - Not Used</p> <p>C - Revise and Resubmit<br/>This Operation and Maintenance Manual Submittal is deficient in the following area:</p> <ol style="list-style-type: none"> <li>1. Equipment Records.</li> <li>2. Functional description.</li> <li>3. Assembly, disassembly, installation, alignment, adjustment &amp; checkout instructions.</li> <li>4. Operating instructions.</li> </ol> | <ol style="list-style-type: none"> <li>5. Lubrication &amp; maintenance instructions.</li> <li>6. Troubleshooting guide.</li> <li>7. Parts list and ordering instructions.</li> <li>8. Organization (binder, binder titles, index &amp; tabbing).</li> <li>9. Wiring diagrams &amp; schematics specific to installation.</li> <li>10. Outline, cross section &amp; assembly diagrams.</li> <li>11. Test data &amp; performance curves.</li> <li>12. Tag or equipment identification numbers.</li> <li>13. Inclusion of all components &amp; subcomponents.</li> <li>14. Other - see comments.</li> </ol> |
|---|--|
- D - ~~Rejected~~ - Not Used

Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

By		Date	
Distribution:	Contractor	File	Field
		Owner	Other

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**Equipment Data and Spare Parts Summary**

Project Name	Specification Section:
Equipment Name	Year Installed:

Project Equipment Tag No(s).

Equipment Manufacturer	Project/Order No.
Address	Phone
Fax	Web Site
	E-mail

Local Vendor/Service Center	Phone
Address	
Fax	Web Site
	E-mail

**MECHANICAL NAMEPLATE DATA**

Equip.		Serial No.		
Make		Model No.		
ID No.	Frame No.	HP	RPM	Cap.
Size	TDH	Imp. Sz.	CFM	PSI
Other:				

**ELECTRICAL NAMEPLATE DATA**

Equip.		Serial No.						
Make		Model No.						
ID No.	Frame No.	HP	V.	Amp.	HZ	PH	RPM	SF
Duty	Code	Ins. Cl.	Type	NEMA	C Amb.	Temp. Rise	Rating	
Other:								

**SPARE PARTS PROVIDED PER CONTRACT**

Part No.	Part Name	Quantity

**RECOMMENDED SPARE PARTS**

Part No.	Part Name	Quantity

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2  
3











Lubrication Summary

Equipment Description	Project Equip. Tag No(s).
-----------------------	---------------------------

Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

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**SECTION 01 35 05**

**ENVIRONMENTAL PROTECTION AND SPECIAL CONTROLS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Minimizing the pollution of air, water, or land; control of noise, the disposal of solid waste materials, and protection of deposits of historical or archaeological interest.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Procurement and Contracting Requirements.

2. Division 01 - General Requirements.

**1.2 SUBMITTALS**

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

2. Prior to the start of any construction activities submit:

- a. A detailed proposal of all methods of control and preventive measures to be utilized for environmental protection.

- b. A drawing of the work area, haul routes, storage areas, access routes and current land conditions including trees and vegetation.

- c. A copy of the NPDES permit for storm water discharges from construction activities.

- d. A copy of the approved pollution prevention plan.

**PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)**

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Employ and utilize environmental protection methods, obtain all necessary permits, and fully observe all local, state, and federal regulations.

B. Land Protection:

1. Except for any work or storage area and access routes specifically assigned for the use of the Contractor, the land areas outside the limits of construction shall be preserved in their present condition.

- a. Contractor shall confine his construction activities to areas defined for work within the Contract Documents.

C. Surface Water Protection:

1. Discharges from the construction site shall not contain pollutants at concentrations that produce objectionable films, colors, turbidity, deposits or noxious odors in the receiving stream or waterway.

D. Solid Waste Disposal:

1. Collect solid waste on a daily basis.

2. Provide disposal of degradable solid waste to an approved solid waste disposal site.

3. Provide disposal of nondegradable solid waste to an approved solid waste disposal site or in an alternate manner approved by Engineer and regulatory agencies.

4. No building materials wastes or unused building materials shall be buried, dumped, or disposed of on the site.

- 1 E. Fuel and Chemical Handling:  
2 1. Store and dispose of chemical wastes in a manner approved by regulatory agencies.  
3 2. Take special measures to prevent chemicals, fuels, oils, greases, herbicides, and insecticides  
4 from entering drainage ways.  
5 3. Do not allow water used in onsite material processing, concrete curing, cleanup, and other  
6 waste waters to enter a drainage way(s) or stream.  
7 4. The Contractor shall provide containment around fueling and chemical storage areas to  
8 ensure that spills in these areas do not reach waters of the state.
- 9 F. Control of Dust:  
10 1. Utilize methods and practices of construction to eliminate dust in full observance of agency  
11 regulations.  
12 2. The Engineer will determine the effectiveness of the dust control program and may request  
13 the Contractor to provide additional measures, at no additional cost to Owner.
- 14 G. Burning:  
15 1. Do not burn material on the site.  
16 2. If the Contractor elects to dispose of waste materials by burning, make arrangements for an  
17 off-site burning area and conform to all agency regulations.
- 18 H. Control of Noise: Control noise by fitting equipment with appropriate mufflers.
- 19 I. Completion of Work:  
20 1. Upon completion of work, leave area in a clean, natural looking condition.  
21 2. Ensure all signs of temporary construction and activities incidental to construction of  
22 required permanent work are removed.

23

**END OF SECTION**

**SECTION 01 61 03**  
**EQUIPMENT: BASIC REQUIREMENTS**

4 **PART 1 - GENERAL**

5 **1.1 SUMMARY**

- 6 A. Section Includes:
- 7 1. Requirements of this Specification Section apply to all equipment provided on the Project
- 8 including those found in other Divisions even if not specifically referenced in individual
- 9 "Equipment" Articles of those Specification Sections.
- 10 B. Related Sections include but are not necessarily limited to:
- 11 1. Division 00 - Procurement and Contracting Requirements.
- 12 2. Division 01 - General Requirements.

13 **1.2 QUALITY ASSURANCE**

- 14 A. Referenced Standards:
- 15 1. American Bearing Manufacturers Association (ABMA).
- 16 2. American Gear Manufacturers Association (AGMA).
- 17 3. ASTM International (ASTM):
- 18 a. E1934, Standard Guide for Examining Electrical and Mechanical Equipment with
- 19 Infrared Thermography.
- 20 b. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
- 21 4. Hydraulic Institute (HI):
- 22 a. 9.6.4, Centrifugal and Vertical Pumps for Vibration Measurements and Allowable
- 23 Valves.
- 24 5. International Electrotechnical Commission (IEC).
- 25 6. Institute of Electrical and Electronics Engineers, Inc. (IEEE).
- 26 7. International Organization for Standardization (ISO):
- 27 a. 1940, Mechanical Vibration - Balance Quality Requirements for Rotors in a Constant
- 28 (Rigid) State - Part 1: Specification and Verification of Balance Tolerances.
- 29 b. 21940-11, Mechanical Vibration - Rotor Balancing - Part 11: Procedures and
- 30 Tolerances for Rotors with Rigid Behavior.
- 31 8. National Electrical Manufacturers Association (NEMA):
- 32 a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
- 33 b. ICS 6, Enclosures for Industrial Control and System.
- 34 c. MG 1, Motors and Generators.
- 35 9. InterNational Electrical Testing Association (NETA):
- 36 a. ATS, Acceptance Testing Specification for Electrical Power Distribution Equipment
- 37 and Systems.
- 38 10. National Fire Protection Association (NFPA):
- 39 a. 70, National Electrical Code (NEC):
- 40 11. National Institute for Certification in Engineering Technologies (NICET).
- 41 12. National Institute of Standards and Technology (NIST).
- 42 13. Occupational Safety and Health Administration (OSHA):
- 43 a. 29 CFR 1910, Occupational Safety and Health Standards, referred to herein as OSHA
- 44 Standards.
- 45 14. Underwriters Laboratories, Inc. (UL).
- 46 a. 508, Standard for Safety Industrial Control Equipment.
- 47 b. 508A, Standard for Safety Industrial Control Panels.
- 48 c. 698A, Standard for Industrial Control Panels Relating to Hazardous (Classified)
- 49 Locations.
- 50 15. Vibration Institute.

- 1 B. Electrical Equipment and Connections Testing Program:
- 2 1. Testing firm:
- 3 a. An independent firm performing, as the sole or principal part of its business for a
- 4 minimum of 10 years, the inspection, testing, calibration , and adjusting of systems.
- 5 b. Must have an established monitoring and testing equipment calibration program with
- 6 accuracy traceable in an unbroken chain, according to NIST.
- 7 2. Field personnel:
- 8 a. Minimum of one (1) year field experience covering all phases of electrical equipment
- 9 inspection, testing, and calibration.
- 10 b. Relay test technician having previous experience with testing and calibration of relays
- 11 of the same manufacturer and type used on project and proficient in setting and testing
- 12 the types of protection elements used.
- 13 c. Supervisor certified by NETA or NICET.
- 14 3. Analysis personnel:
- 15 a. Minimum three (3) years combined field testing and data analysis experience.
- 16 b. Supervisor certified by NETA or NICET.
- 17 C. Miscellaneous:
- 18 1. A single manufacturer of a "product" shall be selected and utilized uniformly throughout
- 19 Project even if:
- 20 a. More than one (1) manufacturer is listed for a given "product" in Specifications.
- 21 b. No manufacturer is listed.
- 22 2. Equipment, electrical assemblies, related electrical wiring, instrumentation, controls, and
- 23 system components shall fully comply with specific NEC requirements related to area
- 24 classification and to NEMA 250 and NEMA ICS 6 designations shown on Electrical Power
- 25 Drawings and defined in the Electrical specifications.

### 26 1.3 DEFINITIONS

- 27 A. Product: Manufactured materials and equipment.
- 28 B. Major Equipment Supports - Supports for Equipment:
- 29 1. Located on or suspended from roofs with supported equipment weighing 500 LBS or
- 30 greater, or;
- 31 C. Equipment:
- 32 1. One (1) or more assemblies capable of performing a complete function.
- 33 2. Mechanical, electrical, instrumentation or other devices requiring an electrical, pneumatic,
- 34 electronic or hydraulic connection.
- 35 3. Not limited to items specifically referenced in "Equipment" articles within individual
- 36 Specifications.
- 37 D. Installer or Applicator:
- 38 1. Installer or applicator is the person actually installing or applying the product in the field at
- 39 the Project site.
- 40 2. Installer and applicator are synonymous.

### 41 1.4 SUBMITTALS

- 42 A. Shop Drawings:
- 43 1. General for all equipment:
- 44 a. See Section 01 33 00 for requirements for the mechanics and administration of the
- 45 submittal process.
- 46 b. Data sheets that include manufacturer's name and complete product model number.
- 47 1) Clearly identify all optional accessories that are included.
- 48 c. Acknowledgement that products submitted comply with the requirements of the
- 49 standards referenced.
- 50 d. Manufacturer's delivery, storage, handling, and installation instructions.
- 51 e. Equipment identification utilizing numbering system and name utilized in Drawings.



- 1 f. Equipment installation details:
  - 2 1) Location of anchorage.
  - 3 2) Type, size, and materials of construction of anchorage.
  - 4 3) Anchorage setting templates.
  - 5 4) Manufacturer's installation instructions.
- 6 g. Equipment area classification rating.
- 7 h. Shipping and operating weight.
- 8 i. Equipment physical characteristics:
  - 9 1) Dimensions (both horizontal and vertical).
  - 10 2) Materials of construction and construction details.
- 11 j. Equipment factory primer and paint data.
- 12 k. Manufacturer's recommended spare parts list.
- 13 l. Equipment lining and coatings.
- 14 m. Equipment utility requirements include air, natural gas, electricity, and water.
- 15 n. Ladders and platforms provided with equipment:
  - 16 1) Certification that all components comply fully with OSHA requirements.
  - 17 2) Full details of construction/fabrication.
  - 18 3) Scaled plan and sections showing relationship to equipment.
- 19 2. Mechanical and process equipment:
  - 20 a. Operating characteristics:
    - 21 1) Technical information including applicable performance curves showing specified
    - 22 equipment capacity, rangeability, and efficiencies.
    - 23 2) Brake horsepower requirements.
    - 24 3) Copies of equipment data plates.
  - 25 b. Piping and duct connection size, type and location.
  - 26 c. Equipment bearing life certification.
  - 27 d. Equipment foundation data:
    - 28 1) Equipment center of gravity.
    - 29 2) Criteria for designing vibration, special or unbalanced forces resulting from
    - 30 equipment operation.
- 31 3. Electric motor:
  - 32 a. Motor manufacturer and model number.
  - 33 b. Complete motor nameplate data.
  - 34 c. Weight.
  - 35 d. NEMA design type.
  - 36 e. Enclosure type.
  - 37 f. Frame size.
  - 38 g. Winding insulation class and temperature rise.
  - 39 h. Starts per hour.
  - 40 i. Performance data:
    - 41 1) Guaranteed minimum efficiencies at 100 PCT, 75 PCT, and 50 PCT of full load.
    - 42 2) Guaranteed minimum power factor at 100 PCT, 75 PCT, and 50 PCT of full load.
    - 43 3) Locked rotor and full load current at rated terminal voltage and minimum
    - 44 permissible or specified terminal voltage.
    - 45 4) Starting, full load, and breakdown torque at rated terminal voltage and minimum
    - 46 permissible or specified terminal voltage.
  - 47 j. Fabrication and/or Layout Drawings:
    - 48 1) Dimensioned Outlined Drawing.
    - 49 2) Connection diagrams including accessories (strip heaters, thermal protection, etc.).
  - 50 k. Electrical gear:
    - 51 1) Unless specified in a narrow-scope Specification Section, provide the following:
      - 52 a) Equipment ratings: Voltage, continuous current, kVa, watts, short circuit with
      - 53 stand, etc., as applicable.
    - 54 2) Control panels:
      - 55 a) Panel construction.

- 1 b) Point-to-point ladder diagrams.
- 2 c) Scaled panel face and subpanel layout.
- 3 d) Technical product data on panel components.
- 4 e) Panel and subpanel dimensions and weights.
- 5 f) Panel access openings.
- 6 g) Nameplate schedule.
- 7 h) Panel anchorage.
- 8 i) Short Circuit Current Rating (SCCR) nameplate marking per NFPA 70.
- 9 Include any required calculations.
- 10 4. Systems schematics and data:
- 11 a. Provide system schematics where required in system specifications.
- 12 1) Acknowledge all system components being supplied as part of the system.
- 13 2) Utilize equipment, instrument and valving tag numbers defined in the Contract
- 14 Documents for all components.
- 15 3) Provide technical data for each system component showing compliance with the
- 16 Contract Document requirements.
- 17 4) For piping components, identify all utility connections, vents and drains which will
- 18 be included as part of the system.
- 19 5. For factory painted equipment, provide paint submittals.
- 20 B. Contract Closeout Information:
- 21 1. Operation and Maintenance Data:
- 22 a. See Section 01 33 04 for requirements for the mechanics, administration, and the
- 23 content of Operation and Maintenance Manual submittals.
- 24 C. Informational Submittals:
- 25 1. Sample form letter for equipment field certification.
- 26 2. Certification that equipment has been installed properly, has been initially started up, has
- 27 been calibrated and/or adjusted as required, and is ready for operation.
- 28 3. Certification from equipment manufacturer that all manufacturer-supplied control panels
- 29 that interface in any way with other controls or panels have been submitted to and
- 30 coordinated with the supplier/installer of those interfacing systems.
- 31 4. Motor test reports.
- 32 5. Preliminary field quality control testing format to be used as a basis for final field quality
- 33 control reporting.
- 34 6. Testing and monitoring reports in accordance with PART 3 of this Specification Section.

## 35 PART 2 - PRODUCTS

### 36 2.1 MANUFACTURERS

- 37 A. Subject to compliance with the Contract Documents, the following manufacturers are
- 38 acceptable:
- 39 1. Motors:
- 40 a. Baldor.
- 41 b. General Electric.
- 42 c. Marathon Electric.
- 43 d. Rockwell - Reliance.
- 44 e. Siemens.
- 45 f. TECO-Westinghouse.
- 46 g. Toshiba U.S.
- 47 h. U.S. Motors, Nidec Motor Corporation.
- 48 i. WEG.
- 49 B. Submit request for substitution in accordance with Section 01 25 13.

1 **2.2 MANUFACTURED UNITS**

2 A. Electric Motors:

- 3 1. Where used in conjunction with adjustable speed AC or DC drives, provide motors that are  
4 fully compatible with the speed controllers.
- 5 2. Design for frequent starting duty equivalent to duty service required by driven equipment.
- 6 3. Design for full voltage starting.
- 7 4. Design bearing life based upon actual operating load conditions imposed by driven  
8 equipment.
- 9 5. Size for altitude of Project.
- 10 6. Furnish with stainless steel nameplates which include all data required by NEC Article 430.
- 11 7. Use of manufacturer's standard motor will be permitted on integrally constructed motor  
12 driven equipment specified by model number in which a redesign of the complete unit  
13 would be required in order to provide a motor with features specified.
- 14 8. AC electric motors less than 1/3 HP:
- 15 a. Single phase, 60 Hz, designed for the supply voltage shown on the Drawings.
- 16 b. Permanently lubricated sealed bearings conforming to ABMA standards.
- 17 c. Built-in manual reset thermal protector or integrally mounted manual motor starter with  
18 thermal overload element with stainless steel enclosure.
- 19 9. AC electric motors 1/3 to 1 HP:
- 20 a. Single or 3 PH, 60 Hz, designed for the supply voltage shown on the Drawings.
- 21 b. Permanently lubricated sealed bearings conforming to ABMA standards.
- 22 1) For single phase motors, provide built-in manual reset thermal protector or  
23 integrally mounted manual motor starter with thermal overload element.
- 24 10. AC electric motors 1-1/2 to 10 HP:
- 25 a. Single or 3 PH, 60 Hz, designed for the supply voltage shown on the Drawings.
- 26 b. Permanently lubricated sealed bearings conforming to ABMA standards.
- 27 c. For vertical motors provide 15 year, average-life thrust bearings conforming to ABMA  
28 standards.
- 29 11. AC electric motors greater than 10 HP:
- 30 a. Single or 3 PH, 60 Hz, designed for the supply voltage shown on the Drawings.
- 31 b. Oil or grease lubricated antifriction bearings conforming to ABMA standards.
- 32 1) Design bearing life for 90 PCT survival rating at 50,000 HRS of operation for  
33 motors up to and including 100 HP.
- 34 2) For motors greater than 100 HP, design bearing life for 90 PCT survival rating at  
35 100,000 HRS of operation.
- 36 c. For vertical motors provide 15 year, average-life thrust bearings conforming to ABMA  
37 standards.

38 B. NEMA Design Squirrel Cage Induction Motors:

- 39 1. Provide motors designed and applied in compliance with NEMA and IEEE for the specific  
40 duty imposed by the driven equipment.
- 41 2. Motors to meet NEMA MG 1 (NEMA Premium) efficiencies.
- 42 3. Do not provide motors having a locked rotor kVA per HP exceeding the NEMA standard  
43 for the assigned NEMA code letter.
- 44 4. Design motor insulation in accordance with NEMA standards for Class F insulation with  
45 Class B temperature rise above a 40 DEGC ambient.
- 46 5. Design motors for continuous duty.
- 47 6. Size motors having a 1.0 service factor so that nameplate HP is a minimum of 15 PCT  
48 greater than the maximum HP requirements of the driven equipment over its entire  
49 operating range.
- 50 a. As an alternative, furnish motors with a 1.15 service factor and size so that nameplate  
51 HP is at least equal to the maximum HP requirements of the driven equipment over its  
52 entire operating range.

- 1           7. Motor enclosure and winding insulation application:  
 2           a. The following shall apply unless modified by specific Specification Sections:  
 3

MOTOR LOCATION	MOTOR ENCLOSURE / WINDING INSULATION
Unclassified Indoor Areas	DPFG (for horizontal motors), WP-I (for vertical motors)TEFC, Standard Insulation
Wet outdoor Areas	TEFC, Extra Dip and Bake for Moisture WP-II (for vertical motors)

4 NOTE: Provide TENV motors in the smaller horsepower ratings where TEFC is not available.

- 5  
 6           8. Provide oversize conduit box complete with clamp type grounding terminals inside the  
 7           conduit box.  
 8           9. Balance motors to ISO G2.5 level.  
 9           a. Submit prior to shipping to OEM or job site.  
 10          C. Submersible Motors: Refer to individual narrow-scope Specification Sections for submersible  
 11          motor requirements.  
 12          D. Vibration Isolators:  
 13           1. Provide all equipment subject to vibration with restrained spring type vibration isolators or  
 14           pads according to the manufacturer's written recommendation.

15 **2.3 COMPONENTS**

- 16          A. Gear Drives and Drive Components:  
 17           1. Size drive equipment capable of supporting full load including losses in speed reducers and  
 18           power transmission.  
 19           2. Provide nominal input horsepower rating of each gear or speed reducer at least equal to  
 20           nameplate horsepower of drive motor.  
 21           3. Design drive units for 24 HR continuous service, constructed so oil leakage around shafts is  
 22           precluded.  
 23           4. Utilize gears, gear lubrication systems, gear drives, speed reducers, speed increasers and  
 24           flexible couplings meeting applicable standards of AGMA.  
 25           5. Gear reducers:  
 26           a. Provide gear reducer totally enclosed and oil lubricated.  
 27           b. Utilize antifriction bearings throughout.  
 28           c. Provide worm gear reducers having a service factor of at least 1.20.  
 29           d. Furnish other helical, spiral bevel, and combination bevel-helical gear reducers with a  
 30           service factor of at least 1.50.

31 **2.4 ACCESSORIES**

- 32          A. Guards:  
 33           1. Provide each piece of equipment having exposed moving parts with full length, easily  
 34           removable guards, meeting OSHA requirements.  
 35           2. Interior applications:  
 36           a. Construct from expanded galvanized steel rolled to conform to shaft or coupling  
 37           surface.  
 38           b. Utilize non-flattened type 16 GA galvanized steel with nominal 1/2 IN spacing.  
 39           c. Connect to equipment frame with hot-dip galvanized bolts and wing nuts.  
 40           3. Exterior applications:  
 41           a. Construct from 16 GA stainless steel or aluminum.  
 42           b. Construct to preclude entrance of rain, snow, or moisture.  
 43           c. Roll to conform to shaft or coupling surface.  
 44           d. Connect to equipment frame with stainless steel bolts and wing nuts.  
 45          B. Anchorage:  
 46           1. Cast-in-place anchorage:  
 47           a. Provide ASTM F593, Type 316 stainless steel anchorage for all equipment.

- 1                   b. Configuration and number of anchor bolts shall be per manufacturer's
- 2                    recommendations.
- 3                   c. Provide two (2) nuts for each bolt.
- 4                   2. Drilled anchorage:
- 5                    a. Threaded rods same as cast-in-place.
- 6                   C. Data Plate:
- 7                    1. Attach a stainless steel data plate to each piece of rotary or reciprocating equipment.
- 8                    2. Permanently stamp information on data plate including manufacturer's name, equipment
- 9                    operating parameters, serial number and speed.
- 10                  D. Gages:
- 11                  1. Provide at the following locations:
- 12                  a. Inlet and outlet of all reciprocating, centrifugal and positive displacement mechanical
- 13                  and process equipment.
- 14                  b. At locations identified on Drawings.
- 15                  E. Lifting Eye Bolts or Lugs:
- 16                  1. Provide on all equipment 50 LBS or greater.
- 17                  2. Provide on other equipment or products as specified in the narrow-scope Specification
- 18                  Sections.
- 19                  **2.5 FABRICATION**
- 20                  A. Design, fabricate, and assemble equipment in accordance with modern engineering and shop
- 21                  practices.
- 22                  B. Manufacture individual parts to standard sizes and gages so that repair parts, furnished at any
- 23                  time, can be installed in field.
- 24                  C. Furnish like parts of duplicate units to be interchangeable.
- 25                  D. Ensure that equipment has not been in service at any time prior to delivery, except as required by
- 26                  tests.
- 27                  E. Furnish equipment which requires periodic internal inspection or adjustment with access panels
- 28                  which will not require disassembly of guards, dismantling of piping or equipment or similar
- 29                  major efforts.
- 30                  1. Quick opening but sound, securable access ports or windows shall be provided for
- 31                  inspection of chains, belts, or similar items.
- 32                  F. Provide common, lipped base plate mounting for equipment and equipment motor where said
- 33                  mounting is a manufacturer's standard option.
- 34                  1. Provide drain connection for 3/4 IN PVC tubing.
- 35                  G. Machine the mounting feet of rotating equipment.
- 36                  H. Fabricate equipment which will be subject to Corrosive Environment in such a way as to avoid
- 37                  back to back placement of surfaces that cannot be properly prepared and painted.
- 38                  1. When such back to back fabrication cannot be avoided, provide continuous welds to seal
- 39                  such surfaces from contact with corrosive environment.
- 40                  2. Where continuous welds are not practical, after painting seal the back to back surfaces from
- 41                  the environment with sealant.
- 42                  I. Control Panels Engineered and Provided with the Equipment by the Manufacturer:
- 43                  1. Manufacturer's standard design for components and control logic unless specific
- 44                  requirements are specified in the specific equipment Specification Section.
- 45                  2. NEMA or IEC rated components are acceptable, whichever is used in the manufacturer's
- 46                  standard engineered design, unless specific requirements are required in the specific
- 47                  equipment Specification Section.

3. Affix entire assembly with a UL 508A or UL 698A label "Listed Enclosed Industrial Control Panel" prior to delivery.
  - a. Control panels without an affixed UL 508A or UL 698A label shall be rejected.
4. Provide equipment or control panels with Short Circuit Current Rating (SCCR) labeling as required by NFPA 70 and other applicable codes.
  - a. Determine the SCCR rating by one of the following methods:
    - 1) Method 1: SCCR rating meets or exceeds the available fault current of the source equipment when indicated on the Drawings.
    - 2) Method 2: SCCR rating meets or exceeds the source equipment's Amp Interrupting Current (AIC) rating as indicated on the Drawings.
    - 3) Method 3: SCCR rating meets or exceeds the calculated available short circuit current at the control panel.
  - b. The source equipment is the switchboard, panelboard, motor control center or similar equipment where the control panel circuit originates.
  - c. For Method 3, provide calculations justifying the SCCR rating. Utilize source equipment available fault current or AIC rating as indicated on the Drawings.

## 2.6 SOURCE QUALITY CONTROL

### A. Motor Tests:

1. Test motors in accordance with NEMA and IEEE standards.
2. Provide routine test for all motors.
3. The Owner reserves the right to select and have tested, either routine or complete, any motor included in the project.
  - a. The Owner will pay all costs, including shipping and handling, for all motors successfully passing the tests.
  - b. The Contractor shall pay all costs, including shipping and handling, for all motors failing the tests.
  - c. If two (2) successive motors of the same manufacturer fail testing, the Owner has the right to reject all motors from that manufacturer.

### B. Balance:

1. Unless specified otherwise, for all equipment 10 HP or greater, all rotating elements in motors, pumps, blowers, and centrifugal compressors shall be fully assembled, including coupling hubs, before being statically and dynamically balanced. Balance all rotating elements to the following criteria, per ISO 21940-11:

$$U_{per} = \frac{G \times 6.015 \times W/2}{N}$$

Where:

$U_{per}$  = Permissible residual unbalance for each correction plane in ounce-inches (OZ-IN). See ISO 21940-11 for acceptable values.

G = ISO Balance Quality Grade Number, per ISO 21940-11

W = Rotor weight in pounds.

N = Maximum continuous operating RPM

- a. Where specified, balancing reports, demonstrating compliance with this requirement, shall be submitted as product data.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install equipment as shown on Drawings and in accordance with manufacturer's directions.
- B. Utilize templates for anchorage placement for slab-mounted equipment.

- 1 C. For equipment having drainage requirements such as seal water, provide 3/4 IN PVC or clear  
2 plastic tubing from equipment base to nearest floor or equipment drain.  
3 1. Route clear of major traffic areas and as approved by Engineer.
- 4 D. DO NOT construct foundations until major equipment supports are approved.
- 5 E. Extend all non-accessible grease fittings using stainless steel tubing to a location which allows  
6 easy access of fittings from closest operating floor level.
- 7 F. Equipment Base:  
8 1. Construct level in both directions.  
9 2. Take particular care at anchor bolt locations so these areas are flat and level.
- 10 G. Machine Base:  
11 1. Mount machine base of rotating equipment on equipment base.  
12 a. Level in both directions, using a machinist level, according to machined surfaces on  
13 base.  
14 2. Level machine base on equipment base and align couplings between driver and driven unit  
15 using stainless steel blocks and shims.  
16 a. Blocks and shims milled flat and coplanar of both faces.  
17 b. Maximum of 3 shims under each foot.  
18 c. Size blocks and shims to provide solid support at each mounting bolt location.  
19 1) Provide area size of blocks and shims approximately 1-1/2 times area support  
20 surface at each mounting bolt point.  
21 d. Provide blocks and shims at each mounting bolt.  
22 1) Furnish blocks and shims that are square shape with "U" cut out to allow blocks  
23 and shims to be centered on mounting bolts.  
24 e. After all leveling and alignment has been completed and before grouting, tighten  
25 mounting bolts to proper torque value.
- 26 H. Rotating equipment Couplings:  
27 1. Align in the annular and parallel positions.  
28 a. For equipment rotating at 1200 RPM or less, align both annular and parallel within  
29 0.001 IN tolerance for couplings 4 IN size and smaller.  
30 b. Couplings larger than 4 IN size: Increase tolerance 0.0005 IN per inches of coupling  
31 diameter, i.e., allow 6 IN coupling 0.002 IN tolerance, and allow a 10 IN coupling  
32 0.004 IN tolerance.  
33 c. For equipment rotating at speeds greater than 1200 RPM allow both annular and  
34 parallel positions within a tolerance rate of 0.00025 IN per inch coupling diameter.  
35 2. If equipment is delivered as a mounted unit from factory, verify factory alignment on site  
36 after installation and realigned if necessary.  
37 3. Check surfaces for runout before attempting to trim or align units.
- 38 I. Grouting:  
39 1. After machine base has been shimmed, leveled onto equipment base, couplings aligned and  
40 mounting bolts tightened to correct torque value, place a dam or formwork around base to  
41 contain grouting between equipment base and equipment support pad.  
42 a. Extend dam or formwork to cover leveling shims and blocks.  
43 b. Do not use nuts below the machine base to level the unit.  
44 2. Saturate top of roughened concrete subbase with water before grouting.  
45 a. Add grout until entire space under machine base is filled to the top of the base  
46 underside.  
47 b. Puddle grout by working a stiff wire through the grout and vent holes to work grout in  
48 place and release any entrained air in the grout or base cavity.  
49 3. When the grout has sufficiently hardened, remove dam or formwork and finish the exposed  
50 grout surface to fine, smooth surface.  
51 a. Cover exposed grout surfaces with wet burlap and keep covering sufficiently wet to  
52 prevent too rapid evaporation of water from the grout.

- b. When the grout has fully hardened (after a minimum of seven (7) days) tighten all anchor bolts to engage equipment base to grout, shims, and equipment support pad.
- c. Recheck driver-driven unit for proper alignment.

**3.2 INSTALLATION CHECKS**

- A. For all equipment specifically required in detailed specifications, secure services of experienced, competent, and authorized representative(s) of equipment manufacturer to visit site of work and inspect, check, adjust and approve equipment installation.
  - 1. In each case, representative(s) shall be present during placement and start-up of equipment and as often as necessary to resolve any operational issues which may arise.
- B. Secure from equipment manufacturer's representative(s) a written report certifying that equipment:
  - 1. Has been properly installed and lubricated.
  - 2. Is in accurate alignment.
  - 3. Is free from any undue stress imposed by connecting piping or anchor bolts.
  - 4. Has been operated under full load conditions and that it operated satisfactorily.
    - a. Secure and deliver a field written report to Owner immediately prior to leaving jobsite.
- C. No separate payment shall be made for installation checks.
  - 1. All or any time expended during installation check does not qualify as Operation and Maintenance training or instruction time when specified.

**3.3 IDENTIFICATION OF EQUIPMENT AND HAZARD WARNING SIGNS**

- A. Identify equipment and install hazard warning signs in accordance with Section 10 14 00.

**3.4 WIRING CONNECTIONS AND TERMINATION**

- A. Clean wires before installing lugs and connectors.
- B. Coat connection with oxidation eliminating compound for aluminum wire.
- C. Terminate motor circuit conductors with copper lugs bolted to motor leads.
- D. Tape stripped ends of conductors and associated connectors with electrical tape.
  - 1. Wrapping thickness shall be 150 PCT of the conductor insulation thickness.
- E. Connections to carry full ampacity of conductors without temperature rise.
- F. Terminate spare conductors with electrical tape.

**3.5 FIELD QUALITY CONTROL**

- A. General:
  - 1. Furnish equipment manufacturer's field quality control services and testing as specified in the individual equipment Specification Sections.
  - 2. Perform and report on all tests required by the equipment manufacturer's Operation and Maintenance Manual.
  - 3. Provide testing of electrical equipment and connections in accordance with the Electrical specifications.
  - 4. Equip testing and analysis personnel with all appropriate project related reference material required to perform tests, analyze results, and provide documentation including, but not limited to:
    - a. Contract Drawings and Specifications.
    - b. Related construction change documentation.
    - c. Approved Shop Drawings.
    - d. Approved Operation and Maintenance Manuals.
    - e. Other pertinent information as required.



- 1 B. Instruments Used in Equipment and Connections Quality Control Testing:  
2 1. Minimum calibration frequency:  
3 a. Field analog instruments: Not more than 6 months.  
4 b. Field digital instruments: Not more than 12 months.  
5 c. Laboratory instruments: Not more than 12 months.  
6 d. If instrument manufacturer's calibration requirements are more stringent, those  
7 requirements shall govern.  
8 2. Carry current calibration status and labels on all testing instruments.  
9 3. See individual testing programs for additional instrumentation compliance requirements.
- 10 C. Testing and Monitoring Program Documentation:  
11 1. Provide reports with tabbed sections for each piece of equipment tested.  
12 2. Include all testing results associated with each piece of equipment under that equipment's  
13 tabbed section.  
14 a. Include legible copies of all forms used to record field test information.  
15 3. Prior to start of testing, submit one (1) copy of preliminary report format for Engineer  
16 review and comment.  
17 a. Include data gathering and sample test report forms that will be utilized.  
18 4. In the final report, include as a minimum, the following information for all equipment  
19 tested:  
20 a. Equipment identification, including:  
21 1) Name and tag numbers identified in the Contract Documents.  
22 2) Manufacturer's serial numbers.  
23 3) Other pertinent manufacturer identification,  
24 b. Date and time of each test.  
25 c. Ambient conditions including temperature, humidity, and precipitation.  
26 d. Visual inspection report.  
27 e. Description of test and referenced standards, if any, followed while conducting tests.  
28 f. Results of initial and all retesting.  
29 g. Acceptance criteria.  
30 h. "As found" and "as left" conditions.  
31 i. Corrective action, if required, taken to meet acceptance.  
32 j. Verification of corrective action signed by the Contractor, equipment supplier, and  
33 Owner's representative.  
34 k. Instrument calibration dates of all instruments used in testing.  
35 5. Provide three (3) bound final reports prior to Project final completion.
- 36 D. Electrical Equipment and Connections Testing Program:  
37 1. Perform testing on Electrical equipment and connections in accordance with the Electrical  
38 specification requirements.  
39 2. Testing of motors:  
40 a. Ensure motor has been lubricated.  
41 b. Bump motor to check for correct rotation.  
42 3. Repair or replace equipment shown to be out of range of the acceptable tolerance until the  
43 equipment meets or exceeds acceptability standards.
- 44 E. Other Testing:  
45 1. Perform tests and inspections not specifically listed but required to assure equipment is safe  
46 to energize and operate.  
47 2. Subbase that supports the equipment base and that is made in the form of a cast iron or steel  
48 structure that has supporting beams, legs, and cross members that are cast, welded, or bolted  
49 shall be tested for a natural frequency of vibration after equipment is mounted.  
50 a. The ratio of the natural frequency of the structure to the frequency of the disturbing  
51 force shall not be between 0.5 and 1.5.

52

## END OF SECTION



1 2017/11/17

2

## SECTION 01 65 50

3

### PRODUCT DELIVERY, STORAGE, AND HANDLING

#### 4 PART 1 - GENERAL

##### 5 1.1 SUMMARY

6

###### A. Section Includes:

7

1. Scheduling of product delivery.

8

2. Packaging of products for delivery.

9

3. Protection of products against damage from:

10

a. Handling.

11

b. Exposure to elements or harsh environments.

12

###### B. Related Specification Sections include but are not necessarily limited to:

13

1. Division 00 - Procurement and Contracting Requirements.

14

2. Division 01 - General Requirements.

15

###### C. Payment:

16

1. No payment will be made to Contractor for equipment or materials not properly stored and insured or without approved Shop Drawings.

17

a. Previous payments for items will be deducted from subsequent progress estimate(s) if proper storage procedures are not observed.

18

19

20

##### 1.2 DELIVERY

21

A. Scheduling: Schedule delivery of products or equipment as required to allow timely installation and to avoid prolonged storage.

22

23

B. Packaging: Deliver products or equipment in manufacturer's original unbroken cartons or other containers designed and constructed to protect the contents from physical or environmental damage.

24

25

26

C. Identification: Clearly and fully mark and identify as to manufacturer, item, and installation location.

27

28

D. Protection and Handling: Provide manufacturer's instructions for storage and handling.

29

#### PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

30

#### PART 3 - EXECUTION

31

##### 3.1 PROTECTION, STORAGE AND HANDLING

32

###### A. Manufacturer's Instruction:

33

1. Protect all products or equipment in accordance with manufacturer's written directions.

34

a. Store products or equipment in location to avoid physical damage to items while in storage.

35

36

b. Handle products or equipment in accordance with manufacturer's recommendations and instructions.

37

38

2. Protect equipment from exposure to elements and keep thoroughly dry.

39

3. Store pumps, motors, electrical equipment, and other equipment having antifriction or

40

sleeve bearings in weathertight warehouses which are maintained at a temperature of at least 60 DegF.

41

42

4. When space heaters are provided in equipment, connect and operate heaters during storage until equipment is placed in service.

43

1 **3.2 STORAGE FACILITIES**

- 2 A. Temporary Storage Building:
- 3 1. Provide a weatherproof temporary storage building specifically for the purpose of providing
- 4 for protection of products and equipment.
- 5 a. Size building to accommodate anticipated storage items.
- 6 2. Equip building with lockable doors and lighting, and provide electrical service for
- 7 equipment space heaters and heating or ventilation as necessary to provide storage
- 8 environments acceptable to specified manufacturers.
- 9 3. Provide methods of storage of products and equipment off the ground.
- 10 4. Provide this structure within 60 days after Notice to Proceed.
- 11 a. Locate building on-site where shown on the Drawings or in location approved by
- 12 Engineer.
- 13 b. Remove building from site prior to startup and demonstration period.

14 **3.3 FIELD QUALITY CONTROL**

- 15 A. Inspect Deliveries:
- 16 1. Inspect all products or equipment delivered to the site prior to unloading.
- 17 a. Reject all products or equipment that are damaged, used, or in any other way
- 18 unsatisfactory for use on Project.
- 19 B. Monitor Storage Area: Monitor storage area to ensure suitable temperature and moisture
- 20 conditions are maintained as required by manufacturer or as appropriate for particular items.

21 **END OF SECTION**

1 2018/04/26

2

## SECTION 01 73 20

3

### OPENINGS AND PENETRATIONS IN CONSTRUCTION

4

#### **PART 1 - GENERAL**

5

##### **1.1 SUMMARY**

6

###### A. Section Includes:

7

1. Methods of installing and sealing openings and penetrations in construction.

8

###### B. Related Specification Sections include but are not necessarily limited to:

9

1. Division 00 - Procurement and Contracting Requirements.

10

2. Division 01 - General Requirements.

11

##### **1.2 QUALITY ASSURANCE**

12

###### A. Referenced Standards:

13

1. ASTM International (ASTM):

14

- a. A36, Standard Specification for Carbon Structural Steel.

15

- b. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

16

- c. A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

17

- d. A312, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.

18

- e. A351, Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.

19

- f. A554, Standard Specification for Welded Stainless Steel Mechanical Tubing.

20

- g. A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

21

- h. A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

22

- i. A995, Castings, Austenitic-Ferritic (Duplex) Stainless Steel, for Pressure-Containing Parts.

23

2. National Fire Protection Association (NFPA):

24

- a. 70, National Electrical Code (NEC):

25

- 1) Article 501, Class 1 Locations.

26

- b. 90A, Standard for Installation of Air Conditioning and Ventilating Systems.

27

- c. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

28

29

30

31

32

33

34

##### **1.3 SUBMITTALS**

35

###### A. Shop Drawings:

36

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

37

2. For each structure provide dimensioned or scaled (minimum 1/8 IN = 1 FT) plan view drawings containing the following information:

38

- a. Vertical and horizontal location of all required openings and penetrations.

39

- b. Size of all openings and penetrations.

40

- c. Opening type.

41

- d. Seal type.

42

3. Manufacturer's installation instructions for standard manufactured products.

43

44

1 **PART 2 - PRODUCTS**

2 **2.1 MATERIALS**

- 3 A. Pipe Sleeves:
- 4 1. All other Areas:
- 5 a. Steel, Hot-dipped galvanized after fabrication.
- 6 b. Penetrations 24 IN DIA or less: ASTM A53, Schedule 40.
- 7 c. Penetrations larger than 24 IN DIA: ASTM A36, Minimum 1/4 IN thickness.
- 8 B. Backing Rod and Sealant.
- 9 C. Modular Mechanical Seals:
- 10 1. Acceptable manufacturers:
- 11 a. Link-Seal.
- 12 2. 304 stainless steel bolts, nuts and washers.
- 13 D. Sheet Metal Sleeves:
- 14 1. All other areas: Galvanized steel: ASTM A653, G90.
- 15 2. Minimum 12 GA.
- 16 E. Commercial Wall Castings:
- 17 1. Ductile iron, ASTM A536.
- 18 2. Grade equal to connecting piping system.

19 **PART 3 - EXECUTION**

20 **3.1 FABRICATION**

- 21 A. Provide waterstop plate/anchor flange for piping, ducts, castings and sleeves cast-in-place in
- 22 concrete.
- 23 1. For fabricated units, weld plate to sleeve, pipe, or ductwork.
- 24 2. For commercial castings, cast water stop/anchor with wall pipe.
- 25 3. Plate is to be same thickness as sleeve, pipe, casting or ductwork.
- 26 4. For fabricated units, diameter of plate or flange to be 4 IN larger than outside diameter of
- 27 sleeve, pipe or ductwork.
- 28 5. For commercial castings, waterstop/anchor size to be manufacturer standard.
- 29 6. Provide continuous around entire circumference of sleeve, pipe, or ductwork.

30 **3.2 INSTALLATION AND APPLICATION**

- 31 A. Seal openings and penetrations.
- 32 B. Obtain prior approval from Engineer when any opening larger than 100 SQIN must be made in
- 33 existing or newly completed construction.
- 34 C. Perform HVAC penetrations in accordance with NFPA 90A.
- 35 D. Perform electrical penetrations in accordance with NFPA 70, Article 501.
- 36 E. When mechanical or electrical work cannot be installed as structure is being erected, provide and
- 37 arrange for building-in of boxes, sleeves, insets, fixtures or devices necessary to permit
- 38 installation later.
- 39 1. Lay out chases, holes or other openings which must be provided in masonry, concrete or
- 40 other work.
- 41 F. In non-washdown areas, install sleeves with ends flush with finished surfaces.
- 42 G. Size sleeves, blockouts and cutouts which will receive sealant seal such that free area to receive
- 43 sealant is minimized and seal integrity may be obtained.
- 44 H. For insulated piping and ducts, size sleeves, blockouts and cutouts large enough to accommodate
- 45 full thickness of insulation.

- 1 I. Do not cut into or core drill any beams, joists, or columns.
- 2 J. Do not install sleeves in beams, joists, or columns.
- 3 K. Do not install recesses in beams, joists, columns, or slabs.
- 4 L. Field Cutting and Coring:
- 5 1. Saw or core drill with non-impact type equipment.
- 6 2. Mark opening and drill small 3/4 IN or less holes through structure following opening
- 7 outline.
- 8 3. Sawcut opening outline on both surfaces.
- 9 a. Knock out within sawcuts using impact type equipment.
- 10 b. Do not chip or spall face of surface to remain intact.
- 11 c. Do not allow any overcut with saw kerf.
- 12 M. Precast-Prestressed Concrete Construction:
- 13 1. Do not cut openings or core drill vertically or horizontally through stems of members.
- 14 2. Do not locate or install sleeves or recess sleeves vertically or horizontally through or in
- 15 stems of members.
- 16 3. Cast openings and sleeves into flanges of units.
- 17 4. Cast openings larger than 6 IN in diameter or 6 IN maximum dimension in units at time of
- 18 manufacture.
- 19 5. Cast openings smaller than 6 IN in diameter or 6 IN maximum dimensions in flanges of
- 20 units at time of manufacture or field cut.
- 21 N. Where alterations are necessary or where new and old work join, restore adjacent surfaces to
- 22 their condition existing prior to start of work.
- 23 O. Where area is blocked out to receive sheet metal sleeve at later date:
- 24 1. If blockout size is sufficient to allow placement, utilize dowels for interface of initially
- 25 placed concrete and sleeve encasement concrete which is placed later.
- 26 a. Size blockout based on sleeve size required plus 4 to 6 IN each side of sleeve for
- 27 concrete encasement.
- 28 b. Provide #4 dowels at 12 IN spacing along each side of blockout with minimum of
- 29 two (2) dowels required per side.
- 30 2. If blockout size is not sufficient to allow placement of dowels, provide keyway along all
- 31 sides of blockout.
- 32 a. Size blockout based on sleeve size required plus 2 to 4 IN each side of sleeve for
- 33 concrete encasement.
- 34 P. For interior wall applications where backer rod and sealant are specified, provide backer rod and
- 35 sealant at each side of wall.
- 36 Q. Refer to Drawings for location of fire-rated walls, floors, and ceilings.
- 37 R. Use full depth expanding foam sealant for seal applications where single or multiple pipes,
- 38 conduits, etc., pass through a single sleeve.
- 39 S. Do not make duct or conduit penetrations below high water levels when entering or leaving
- 40 tankage, wet wells, or other water holding structures.
- 41 T. Modular Mechanical Seals:
- 42 1. Utilize one (1) seal for concrete thickness less than 8 IN and two (2) seals for concrete, 8 IN
- 43 thick or greater.
- 44 2. Utilize two (2) seals for piping 16 IN diameter and larger if concrete thickness permits.
- 45 3. Install seals such that bolt heads are located on the most accessible side of the penetration.
- 46 U. Backer Rod and Sealant:
- 47 1. Install per Drawings and Manufacturer's recommendations.
- 48 2. Provide backer rod and sealant for modular mechanical seal applications.
- 49 a. Apply on top side of slab penetrations and on interior, dry side wall penetrations.

1 **3.3 SCHEDULES**

- 2 A. General Schedule of Penetrations through Floors, Roofs, Foundation Base Slabs, Foundation  
3 Walls, Foundation Footings, Partitions and Walls for Ductwork, Piping, and Conduit:
- 4 1. Provide the following opening and penetration types:
- 5 a. Type A - Block out 2 IN larger than outside dimensions of duct, pipe, or conduits.
  - 6 b. Type B - Saw cut or line-drill opening. Place new concrete with integrally cast sheet  
7 metal or pipe sleeve.
  - 8 c. Type C - Fabricated sheet metal sleeve or pipe sleeve cast-in-place. Provide pipe  
9 sleeve with water ring for wet and/or washdown areas.
  - 10 d. Type D - Commercial type casting or fabrication.
  - 11 e. Type E - Saw cut or line-drill opening. Place new concrete with integrally cast pipe,  
12 duct or conduit spools.
  - 13 f. Type F - Integrally cast pipe, duct or conduit.
  - 14 g. Type G - Saw cut or line-drill and remove area 1 IN larger than outside dimensions of  
15 duct, pipe or conduit.
  - 16 h. Type H - Core drill.
  - 17 i. Type I - Block out area. At later date, place new concrete with integrally cast sheet  
18 metal or pipe sleeve.
  - 19 j. Type J- Grating Banding for any field cut openings.
- 20 2. Provide seals of material and method described as follows.
- 21 a. Category 1 - Modular Mechanical Seal.
  - 22 b. Category 2 - Roof curb and flashing according to SMACNA specifications unless  
23 otherwise noted on Drawings.
  - 24 c. Category 3 - 12 GA sheet metal drip sleeve set in bed of silicon sealant with backing  
25 rod and sealant used in sleeve annulus.
  - 26 d. Category 4 - Backer rod and sealant.
  - 27 e. Category 5 - Full depth compressible sealant with escutcheons on both sides of  
28 opening.
  - 29 f. Category 6 - Full depth compressible sealant and flanges on both sides of opening.  
30 Flanges constructed of same material as duct, fastened to duct and minimum 1/2 IN  
31 larger than opening.
  - 32 g. Category 7 - Full depth compressible sealant and finish sealant or full depth expanding  
33 foam sealant depending on application.
  - 34 h. Category 8 - Banding for all grating openings and banding and cover plate of similar  
35 materials for abandoned openings.
- 36 3. Furnish openings and sealing materials through new floors, roofs, grating, partitions and  
37 walls in accordance with Schedule A, Openings and Penetrations for New Construction.
- 38 4. Furnish openings and sealing materials through existing floors, grating, roofs, partitions and  
39 walls in accordance with Schedule B, Openings and Penetrations for Existing Construction.  
40  
41



1  
2  
3

**SCHEDULE A. OPENINGS AND PENETRATIONS SCHEDULE  
FOR NEW CONSTRUCTION**

APPLICATIONS	DUCTS		PIPING		CONDUIT	
	OPENING TYPE	SEAL CATEGORY	OPENING TYPE	SEAL CATEGORY	OPENING TYPE	SEAL CATEGORY
Through floors with bottom side a hazardous location	C F I	7 Not Req 7	D F I <sup>(1)</sup>	Not Req Not Req 7	C F	7 Not Req
Through floors on grade above water table	C F I	4 Not Req 4	C F I <sup>(1)</sup>	7 Not Req 7	C F I <sup>(1)</sup>	4 Not Req 7
Through slab on grade below water table	F	Not Req	F	Not Req	F	Not Req
Through floors in washdown areas	C I	4 4	C H <sup>(2)</sup> I <sup>(1)</sup>	4 3 4	F H <sup>(2)</sup> I <sup>(1)</sup>	Not Req 3 7
Through walls where one side is a hazardous area	C F I	7 Not Req 7	D F I <sup>(1)</sup>	Not Req Not Req 7	C F	7 Not Req
Through exterior wall below grade above water table	C F I	7 Not Req 7	C D F I <sup>(1)</sup>	1 Not Req Not Req 1	F I <sup>(1)</sup>	Not Req 7
Through wall from tankage or wet well (above high water level) to dry well or dry area	C F I	7 Not Req 7	C D F H <sup>(2)</sup>	1 Not Req Not Req 1	C F H <sup>(2)</sup> I <sup>(1)</sup>	7 Not Req 7 7
Through wall from tankage or wet well (below high water level) to dry well or dry area	F	Not Req	F	Not Req	F	Not Req
Through exterior wall above grade	A B C	6 6 6	A B D H <sup>(2)</sup>	5 5 Not Req 5	C H <sup>(2)</sup>	5 4
Roof penetrations	A	2	A	2	A	2
Through interior walls and slabs not covered by the above applications	A C	4 4	A C	4 4	A C F	4 4 Not Req
Grating openings and penetrations	J	8	J	8	J	8

4  
5

1  
2

1  
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3

**SCHEDULE B. OPENINGS AND PENETRATIONS SCHEDULE  
FOR EXISTING CONSTRUCTION**

APPLICATIONS	DUCTS		PIPING		CONDUIT	
	OPENING TYPE	SEAL CATEGORY	OPENING TYPE	SEAL CATEGORY	OPENING TYPE	SEAL CATEGORY
Through floors with bottom side a hazardous location	B E	7 Not Req	B <sup>(1)</sup> E <sup>(3)</sup> H <sup>(2)</sup>	7 Not Req 7	B <sup>(1)</sup> E <sup>(3)</sup> H <sup>(2)</sup>	7 Not Req 7
Through floors on grade above water table	B	7	B	7	B	7
Through slab on grade below water table	E	Not Req	E	Not Req	E	Not Req
Through floors in washdown areas	G	3	G H <sup>(2)</sup>	3 3	G H <sup>(2)</sup>	3 3
Through walls where one side is a hazardous area	B E	7 Not Req	B <sup>(1)</sup> B <sup>(3)</sup> E H <sup>(2)</sup>	7 1 Not Req 7	B <sup>(1)(3)</sup> E H <sup>(2)</sup>	7 Not Req 7
Through exterior wall below grade above water table	B	7	B <sup>(1)</sup> B <sup>(3)</sup> H <sup>(2)</sup>	7 1 7	B <sup>(1)(3)</sup> H <sup>(2)</sup>	7 7
Through wall from tankage or wet well (above high water level) to dry well or dry area	B E	7 Not Req	B E H <sup>(2)</sup>	1 Not Req 1	B <sup>(1)(3)</sup> E H <sup>(2)</sup>	7 Not Req 7
Through wall from tankage or wet well (below high water level) to dry well or dry area	E	Not Req	E	Not Req	E	Not Req
Through exterior wall above grade	G	6	G <sup>(1)(3)</sup> H <sup>(2)</sup>	5 5	G <sup>(1)(3)</sup> H <sup>(2)</sup>	5 7
Roof penetrations	G	2	G <sup>(1)(3)</sup> H <sup>(2)</sup>	2	G	2
Through interior walls and slabs not covered by the above applications	G	4	G <sup>(1)(3)</sup> H <sup>(2)</sup>	4 4	G <sup>(1)(3)</sup> H <sup>(2)</sup>	4 4
Grating openings and penetrations	J	8	J	8	J	8

4 (1) Multiple piping 3 IN and smaller or multiple conduits.  
5 (2) Single pipe 3 IN and smaller or single conduit.  
6 (3) Single pipe or conduit larger than 3 IN.  
7

**END OF SECTION**

8  
9



1 2018/04/26

2

## SECTION 01 73 29

3

### DEMOLITION, CUTTING AND PATCHING

#### 4 PART 1 - GENERAL

##### 5 1.1 SUMMARY

6

###### A. Section Includes:

7

1. Demolition, cutting and patching of existing construction where shown on Drawings, or as required to accommodate new work shown or specified.

8

9

2. Removal and protection of items identified to be saved or reused.

10

###### B. Related Specification Sections include but are not necessarily limited to:

11

1. Division 00 - Procurement and Contracting Requirements.

12

2. Division 01 - General Requirements.

13

##### 1.2 SUBMITTALS

14

###### A. Shop Drawings:

15

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

16

2. Provide documentation of demolition and removal. Indicate limits and sequencing to be used. Show and identify any items to be kept for Owner reuse or retention.

17

18

3. Provide schedule of demolition activities including overall schedule, planned utility interruptions, interruptions of Owner/Using Agency services and traffic control if required.

19

20

4. Indicating manufacturer and type of:

21

a. Proposed non-shrink grout.

22

b. Epoxy bonding adhesive.

23

c. Proposed materials and methods to be used for matching and repairing existing construction.

24

25

26

##### 1.3 DELIVERY, STORAGE, AND HANDLING

27

###### A. General:

28

1. Salvage items, designated for Owner's salvage, as a functional unit.

29

2. Clean, list and tag for storage.

30

3. Protect from damage and deliver to location designated.

31

4. Salvage each item with auxiliary or associated equipment required for operation.

32

##### 1.4 PROJECT CONDITIONS

33

A. Perform preliminary investigations as required to ascertain extent of work.

34

##### 1.5 SEQUENCING AND SCHEDULING

35

A. Coordinate and reschedule work as required to preclude interference with other operations.

36

#### PART 2 - PRODUCTS

37

##### 2.1 MANUFACTURERS

38

A. Subject to compliance with the Contract Documents, the following products and manufacturers are acceptable:

39

1. Epoxy bonding adhesive:

40

a. Euco No.452 MV by Euclid Chemical Co.

41

b. Sikadur 32, Hi-Mod by Sika Corporation.

42

- 1           2. Epoxy patch:
- 2           a. Depth of patch:
- 3           1) Greater than 3/4 IN: Five Star MP Epoxy Patch.
- 4           2) Between 1/8 IN and 3/4 IN: Five Star Fluid Epoxy.
- 5        B. Submit request for substitution in accordance with Specification Section 01 25 13.

6   **2.2 MATERIALS**

- 7    A. Temporary Partitions:
- 8       1. Plywood: 1/2 IN minimum for interior or exterior use.
- 9       2. Paneling: 1/4 IN minimum for interior use.
- 10   B. Non-shrink Grout:
- 11       1. Non-metallic, non-corrosive and non-staining.
- 12       2. Premixed with only water to be added in accordance with manufacturer's instructions at
- 13         jobsite.
- 14       3. Grout to produce a positive but controlled expansion.
- 15       4. Mass expansion not to be created by gas liberation or by other means.
- 16       5. Minimum compressive strength at 28 days to be 6500 PSI.
- 17       6. Coat exposed edges of grout with a cure/seal compound recommended by grout
- 18         manufacturer.
- 19    C. Epoxy Bonding Adhesive:
- 20       1. Two component, moisture insensitive adhesive manufactured for the purpose of bonding
- 21         fresh concrete to hardened concrete.

22   **PART 3 - EXECUTION**

23   **3.1 PREPARATION**

- 24    A. Provide and maintain temporary partitions as required in public areas.
- 25       1. Construct partitions of braced plywood in exterior areas.
- 26       2. Adequately braced paneling may be used in interior areas.
- 27    B. Provide and maintain covered passageways where necessary to ensure safe passage of persons in
- 28         or near areas of work.
- 29    C. Provide and maintain substantial barricades and safety lights as required.
- 30    D. Provide and maintain temporary dustproof partitions where indicated or necessary.
- 31       1. Prevent infiltration of dust into occupied areas.
- 32    E. Provide and maintain temporary weather protection as necessary.
- 33    F. Provide adequate temporary bracing to maintain safety, stability and to resist all loads to which
- 34         the structure may be subjected.

35   **3.2 DEMOLITION**

- 36    A. Cutting and Removal:
- 37       1. Remove existing work indicated to be removed, or as necessary for installation of new
- 38         work.
- 39       2. Neatly cut and remove materials, and prepare all openings to receive new work.
- 40       3. Remove masonry or concrete in small sections.
- 41    B. Modification of Existing Concrete:
- 42       1. Where indicated, remove existing concrete and finish remaining.
- 43         a. Make openings by sawing through the existing concrete.
- 44           1) Core drill with 6 IN DIA core at the corners of rectangular openings to avoid
- 45             overcutting at corners.

- 1                   b. Break out concrete after initial saw cuts in the event concrete thickness prevents cutting
- 2                   through.
- 3                   c. Where saw cutting is not possible, make openings by drilling holes around perimeter of
- 4                   opening and then chipping out the concrete.
- 5                   1) Holes shall be sufficient in number to prevent damage to remaining concrete.
- 6                   2. Oversize required openings in existing concrete 1 IN on all sides and build back to required
- 7                   opening size by means of grout epoxy bonded to the existing concrete.
- 8                   3. Where oversized openings cannot be made, remove the concrete to the required opening
- 9                   size and cut back exposed reinforcing 2 IN from face of concrete and fill resulting holes
- 10                  with bonding agent and non-shrink grout.
- 11                  a. At liquid containing structures, coat entire surface with cementitious waterproofing
- 12                  mortar.
- 13                  4. Protect remaining concrete from damage.
- 14                  a. If existing concrete to remain becomes damaged, cease demolition and make
- 15                  corrections as required to avoid further damage.
- 16                  b. Notify Engineer immediately of any damage to remaining concrete.
- 17                  C. Removal of Existing Anchor Bolts or Other Protruding Elements:
- 18                  1. Remove all protruding elements.
- 19                  2. Remove to a depth of 1/4 IN from finished surface.
- 20                  3. Fill void with epoxy patch.
- 21                  D. Matching and Patching:
- 22                  1. Walls, ceilings, floors or partitions:
- 23                  a. Repair abutting walls, ceilings, floors or partitions disturbed by removal.
- 24                  b. Match and patch existing construction disturbed during installation of new work.
- 25                  2. Methods and materials:
- 26                  a. Similar in appearance, and equal in quality to adjacent areas for areas or surfaces being
- 27                  repaired.
- 28                  b. Subject to review of Owner.
- 29                  3. Reinforcing steel that is cut and exposed:
- 30                  a. Remove to a depth of 2 IN.
- 31                  b. Fill void with epoxy patch.
- 32                  E. Salvaged Items:
- 33                  1. Thoroughly dry and clean all metal surfaces.
- 34                  2. Prime all bare metal.
- 35                  3. Clean and lubricate motors and other moving parts.
- 36                  4. Brace motors attached to flexible mountings until reinstallation.
- 37                  5. Dispose of items or materials not designated for Owner's salvage or reuse.
- 38                  a. Promptly remove from site.
- 39                  6. Do not store or sell Contractor salvaged items or materials on-site.
- 40                  7. Carefully remove items to be salvaged and reused or to be delivered to Owner's storage.
- 41                  a. Store and protect items indicated on Drawings or those which have been marked by
- 42                  Owner to be salvaged or to be reused in Work.
- 43                  b. Replace any item damaged through carelessness in removal, storage, or handling with
- 44                  new items of same type.
- 45                  c. Do not reuse materials or equipment not specifically indicated or specified to be reused.
- 46                  8. Preparation of equipment for storage:
- 47                  a. Identify each component with markings or tags to show its position in the assembly and
- 48                  the assembly of which it belongs.
- 49                  b. Place small parts of wooden boxes and clearly mark contents on the outside.
- 50                  c. Remove oil from oil-lubricated bearings and gear boxes and replace with storage oil.
- 51                  d. Grease grease-lubricated bearings.
- 52                  e. Replace any breather plug with solid plug.
- 53                  f. Megger test motor windings: Attach report of the test results to the unit and furnish one
- 54                  (1) copy to the Engineer.

- 1 g. Attach unit to suitable crate bottom.
- 2 h. Enclose unit in polyethylene film and seal all seams and the film to the base of the unit
- 3 with tape.
- 4 i. Construct crate of wooden slats around top and sides of unit.
- 5 j. Attach permanent instruction tag to outside of crate stating "This unit has been prepared
- 6 for storage--replace oil, vent plugs, and lubricant in accordance with manufacturer's
- 7 instructions before start-up."
- 8 F. Clean Up: Transport debris and legally dispose of off-site.

9 **3.3 SCHEDULE**

10 A. Items to be Salvaged to Owner:

11

EQUIPMENT NAME /DESIGNATION	EQUIPMENT LOCATION	DELIVER TO OWNER'S LOCATION

12

13

**END OF SECTION**



1 2017/09/13

2 **SECTION 01 74 13**  
3 **CLEANING**

4 **PART 1 - GENERAL**

5 **1.1 SUMMARY**

- 6 A. Section Includes:
- 7 1. Intermediate and final cleaning of Work not including special cleaning of closed systems
- 8 specified elsewhere.
- 9 B. Related Specification Sections include but are not necessarily limited to:
- 10 1. Division 00 - Procurement and Contracting Requirements.
- 11 2. Division 01 - General Requirements.

12 **1.2 STORAGE AND HANDLING**

- 13 A. Store cleaning products and cleaning wastes in containers specifically designed for those
- 14 materials.

15 **1.3 SCHEDULING**

- 16 A. Schedule cleaning operations so that dust and other contaminants disturbed by cleaning process
- 17 will not fall on newly painted surfaces.

18 **PART 2 - PRODUCTS**

19 **2.1 MATERIALS**

- 20 A. Cleaning Agents:
- 21 1. Compatible with surface being cleaned.
- 22 2. New and uncontaminated.
- 23 3. For Manufactured Surfaces: Material recommended by manufacturer.

24 **PART 3 - EXECUTION**

25 **3.1 CLEANING - GENERAL**

- 26 A. Prevent accumulation of wastes that create hazardous conditions.
- 27 B. Conduct cleaning and disposal operations to comply with laws and safety orders of governing
- 28 authorities.
- 29 C. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary
- 30 drains or sewers.
- 31 D. Dispose of degradable debris at an approved solid waste disposal site.
- 32 E. Dispose of nondegradable debris at an approved solid waste disposal site or in an alternate
- 33 manner approved by Engineer and regulatory agencies.
- 34 F. Handle materials in a controlled manner with as few handlings as possible.
- 35 G. Do not drop or throw materials from heights greater than 4 FT or less than 4 FT if conditions
- 36 warrant greater care.
- 37 H. On completion of work, leave area in a clean, natural looking condition.
- 38 1. Remove all signs of temporary construction and activities incidental to construction of
- 39 required permanent Work.

1 I. Do not burn on-site.

2 **3.2 INTERIOR CLEANING**

3 A. Cleaning During Construction:

- 4 1. Keep work areas clean so as not to hinder health, safety or convenience of personnel in  
5 existing facility operations.  
6 2. At maximum weekly intervals, dispose of waste materials, debris, and rubbish.  
7 3. Vacuum clean interior areas when ready to receive finish painting.  
8 a. Continue vacuum cleaning on an as-needed basis, until substantial completion.  
9 4. Control dust in work areas of existing facilities.  
10 a. Provide protection to existing electrical and mechanical equipment as required to  
11 eliminate detrimental effects due to construction.  
12 b. Weekly check air handling filters in existing units having construction activities.  
13 c. Replace as necessary.  
14 d. At maximum monthly intervals, check interior of existing electric panels and vacuum if  
15 dust accumulation has occurred.  
16 e. At maximum weekly intervals, sweep all floors, including basins, tunnels, platforms,  
17 walkways, and pick up and dispose of all debris.  
18 f. Use dust suppressant sweeping compound in areas open to areas of existing facility  
19 operations.

20 B. Final Cleaning:

- 21 1. Complete immediately prior to Demonstration Period.  
22 2. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign  
23 materials from sight-exposed surfaces.  
24 3. Wipe all lighting fixture reflectors, lenses, lamps and trims clean.  
25 4. Wash and shine glazing and mirrors.  
26 5. Polish glossy surfaces to a clear shine.  
27 6. Ventilating systems:  
28 a. Clean permanent filters and replace disposable filters if units were operated during  
29 construction.  
30 b. Clean ducts, blowers and coils if units were operated without filters during  
31 construction.  
32 7. Replace all burned out lamps.  
33 8. Broom clean process area floors.  
34 9. Mop office and control room floors.

35 **3.3 EXTERIOR (SITE) CLEANING**

36 A. Cleaning During Construction:

- 37 1. Construction debris:  
38 a. Confine in strategically located container(s):  
39 1) Cover to prevent blowing by wind.  
40 2) Haul from site minimum once a week.  
41 b. Remove from work area to container daily.  
42 2. Vegetation: Keep weeds and other vegetation trimmed to 3 IN maximum height.  
43 3. Soils, sand, and gravel deposited on paved areas and walks:  
44 a. Remove as required to prevent muddy or dusty conditions.  
45 b. Do not flush into storm sewer system.

46 B. Final Cleaning:

- 47 1. Remove trash and debris containers from site.  
48 a. Re-seed areas disturbed by location of trash and debris containers.  
49 2. Clean paved roadways.







DIVISION 10  
SPECIALTIES





1 2017/11/14

2

3

**SECTION 10 14 00**  
**IDENTIFICATION DEVICES**

4 **PART 1 - GENERAL**

5 **1.1 SUMMARY**

6 A. Section Includes:

7 1. Tag, tape and stenciling systems for equipment, piping, valves, pumps, ductwork and  
8 similar items, and hazard and safety signs.

9 B. Related Specification Sections include but are not necessarily limited to:

- 10 1. Division 00 - Procurement and Contracting Requirements.  
11 2. Division 01 - General Requirements.

12 **1.2 QUALITY ASSURANCE**

13 A. Referenced Standards:

- 14 1. American Society of Mechanical Engineers (ASME):  
15 a. A13.1, Scheme for the Identification of Piping Systems.  
16 2. The International Society of Automation (ISA).  
17 3. National Electrical Manufacturers Association/American National Standards Institute  
18 (NEMA/ANSI):  
19 a. Z535.1, Safety Color Code.  
20 b. Z535.2, Environmental and Facility Safety Signs.  
21 c. Z535.3, Criteria for Safety Symbols.  
22 d. Z535.4, Product Safety Signs and Labels.  
23 4. National Fire Protection Association (NFPA):  
24 a. 70, National Electrical Code (NEC).  
25 5. Occupational Safety and Health Administration (OSHA):  
26 a. 29 CFR 1910.145, Specification for Accident Prevention Signs and Tags.

27 **1.3 SUBMITTALS**

28 A. Shop Drawings:

- 29 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of  
30 the submittal process.  
31 2. Product technical data including:  
32 a. Catalog information for all identification systems.  
33 b. Acknowledgement that products submitted meet requirements of standards referenced.  
34 3. Identification register, listing all items in PART 3 of this Specification Section to be  
35 identified, type of identification system to be used, lettering, location and color.

36 **PART 2 - PRODUCTS**

37 **2.1 MANUFACTURERS**

38 A. Subject to compliance with the Contract Documents, the following manufacturers are  
39 acceptable:

- 40 1. W.H. Brady Co.  
41 2. Panduit.  
42 3. Seton.  
43 4. National Band and Tag Co.  
44 5. Carlton Industries, Inc.

45 B. Submit request for substitution in accordance with Specification Section 01 25 13.

1 **2.2 MANUFACTURED UNITS**

2 A. Type A1 - Round Metal Tags:

- 3 1. Materials:
- 4 a. Aluminum or stainless steel.
  - 5 b. Stainless steel shall be used in corrosive environments.
- 6 2. Size:
- 7 a. Diameter: 1-1/2 IN minimum.
  - 8 b. Thickness: 0.035 IN (20 GA) minimum.
- 9 3. Fabrication:
- 10 a. 3/16 IN minimum mounting hole.
  - 11 b. Legend: Stamped and filled with black coloring.
- 12 4. Color: Natural.

13 B. Type A2 - Rectangle Metal Tags:

- 14 1. Materials: Stainless steel.
- 15 2. Size:
- 16 a. 3-1/2 IN x 1-1/2 IN minimum.
  - 17 b. Thickness: 0.036 IN (20 GA) minimum.
- 18 3. Fabrication:
- 19 a. 3/16 IN minimum mounting hole.
  - 20 b. Legend: Stamped and filled with black coloring.
- 21 4. Color: Natural.

22 C. Type A3 - Metal Tape Tags:

- 23 1. Materials: Aluminum or stainless steel.
- 24 2. Size:
- 25 a. Width 1/2 IN minimum.
  - 26 b. Length as required by text.
- 27 3. Fabrication:
- 28 a. 3/16 IN minimum mounting hole.
  - 29 b. Legend: Embossed.
- 30 4. Color: Natural.

31 D. Type B1- Square Nonmetallic Tags:

- 32 1. Materials: Fiberglass reinforced plastic.
- 33 2. Size:
- 34 a. Surface: 2 x 2 IN minimum.
  - 35 b. Thickness: 100 mils.
- 36 3. Fabrication:
- 37 a. 3/16 IN mounting hole with metal eyelet.
  - 38 b. Legend: Preprinted and permanently embedded and fade resistant.
- 39 4. Color:
- 40 a. Background: Manufacturer standard or as specified.
  - 41 b. Lettering: Black.

42 E. Type B2 - Nonmetallic Signs:

- 43 1. Materials: Fiberglass reinforced or durable plastic.
- 44 2. Size:
- 45 a. Surface: As required by text.
  - 46 b. Thickness: 60 mils minimum.
- 47 3. Fabrication:
- 48 a. Rounded corners.
  - 49 b. Drilled holes in corners with grommets.
  - 50 c. Legend: Preprinted, permanently embedded and fade resistant for a 10 year minimum
  - 51 outdoor durability.
- 52 4. Color:
- 53 a. Background: Manufacturer standard or as specified.



- 1                   b. Lettering: Black.
- 2                   5. Standards for OSHA signs: NEMA/ANSI Z535.1, NEMA/ANSI Z535.2, NEMA/ANSI
- 3                   Z535.3, NEMA/ANSI Z535.4, OSHA 29 CFR 1910.145.
- 4                   F. Type C - Laminated Name Plates:
- 5                   1. Materials: Phenolic or DR (high impact) acrylic.
- 6                   2. Size:
- 7                   a. Surface: As required by text.
- 8                   b. Thickness: 1/16 IN.
- 9                   3. Fabrication:
- 10                  a. Outdoor rated and UV resistant when installed outdoors.
- 11                  b. Two (2) layers laminated.
- 12                  c. Legend: Engraved through top lamination into bottom lamination.
- 13                  d. Two (2) drilled side holes, for screw mounting.
- 14                  4. Color: Black top surface, white core, unless otherwise indicated.
- 15                  G. Type D - Self-Adhesive Tape Tags and Signs:
- 16                  1. Materials: Vinyl tape or vinyl cloth.
- 17                  2. Size:
- 18                  a. Surface: As required by text.
- 19                  b. Thickness: 5 mils minimum.
- 20                  3. Fabrication:
- 21                  a. Indoor/Outdoor grade.
- 22                  b. Weather and UV resistant inks.
- 23                  c. Permanent adhesive.
- 24                  d. Legend: Preprinted.
- 25                  e. Wire markers to be self-laminating.
- 26                  4. Color: White with black lettering or as specified.
- 27                  5. Standards for OSHA signs: NEMA/ANSI Z535.1, NEMA/ANSI Z535.2, NEMA/ANSI
- 28                  Z535.3, NEMA/ANSI Z535.4, OSHA 29 CFR 1910.145.
- 29                  H. Type E - Heat Shrinkable Tape Tags:
- 30                  1. Materials: Polyolefin.
- 31                  2. Size: As required by text.
- 32                  3. Fabrication:
- 33                  a. Legend: Preprinted.
- 34                  4. Color: White background, black printing.
- 35                  I. Type F - Underground Warning Tape:
- 36                  1. Materials: Polyethylene.
- 37                  2. Size:
- 38                  a. 6 IN wide (minimum).
- 39                  b. Thickness: 3.5 mils.
- 40                  3. Fabrication:
- 41                  a. Legend: Preprinted and permanently imbedded.
- 42                  b. Message continuous printed.
- 43                  c. Tensile strength: 1750 PSI.
- 44                  4. Color: As specified.
- 45                  J. Type G - Stenciling System:
- 46                  1. Materials:
- 47                  a. Exterior type stenciling enamel.
- 48                  b. Either brushing grade or pressurized spray can form and grade.
- 49                  2. Size: As required.
- 50                  3. Fabrication:
- 51                  a. Legend: As required.
- 52                  4. Color: Black or white for best contrast.

1 **2.3 ACCESSORIES**

- 2 A. Fasteners:  
3 1. Bead chain: #6 brass, aluminum or stainless steel.  
4 2. Plastic strap: Nylon, urethane or polypropylene.  
5 3. Screws: Self-tapping, stainless steel.  
6 4. Adhesive, solvent activated.

7 **2.4 MAINTENANCE MATERIALS**

- 8 A. Where stenciled markers are provided, clean and retain stencils after completion and include in  
9 extra stock, along with required stock of paints and applicators.

10 **PART 3 - EXECUTION**

11 **3.1 GENERAL INSTALLATION**

- 12 A. Install identification devices at specified locations.  
13 B. All identification devices to be printed by mechanical process, hand printing is not acceptable.  
14 C. Attach tags to equipment with sufficient surface or body area with solvent activated adhesive  
15 applied to back of each tag.  
16 D. Attach tags with 1/8 IN round or flat head screws to equipment without sufficient surface or  
17 body area, or porous surfaces.  
18 1. Where attachment with screws should not or cannot penetrate substrate, attach with plastic  
19 strap.  
20 E. Single items of equipment enclosed in a housing or compartment to be tagged on outside of  
21 housing.  
22 1. Several items of equipment mounted in housing to be individually tagged inside the  
23 compartment.

24 **3.2 SCHEDULES**

- 25 A. Process Systems:  
26 1. General:  
27 a. Provide arrows and markers on piping.  
28 1) At 20 FT maximum centers along continuous lines.  
29 2) At changes in direction (route) or obstructions.  
30 3) At valves, risers, "T" joints, machinery or equipment.  
31 4) Where pipes pass through floors, walls, ceilings, cladding assemblies and like  
32 obstructions provide markers on both sides.  
33 b. Position markers on both sides of pipe with arrow markers pointing in flow direction.  
34 1) If flow is in both directions use double headed arrow markers.  
35 c. Apply tapes and stenciling in uniform manner parallel to piping.  
36 2. Process equipment (e.g., pumps, pump motors, etc.):  
37 a. Tag type:  
38 1) Type B2 - Nonmetallic Signs.  
39 2) Type D - Self-Adhesive Tape Tags and Signs.  
40 3) Type G - Stenciling System.  
41 b. Fastener:  
42 1) Self.  
43 2) Screws.  
44 3) Adhesive.  
45 c. Legend:  
46 1) Letter height: 1/2 IN minimum.  
47 2) Equipment designation as indicated on the Drawings (e.g., "Primary Sludge Pump  
48 P-xxx").

- 1 3. Piping systems:
- 2 a. Tag type:
- 3 1) Outdoor locations: Type G - Stenciling System.
- 4 2) Indoor locations:
- 5 a) Type D - Self-Adhesive Tape Tags and Signs.
- 6 b) Type G - Stenciling System.
- 7 b. Fastener: Self.
- 8 c. Color: Per ASME A13.1.
- 9 d. Legend:
- 10 1) Letter height: Manufacturers standard for the pipe diameter.
- 11 2) Mark piping in accordance with ASME A13.1.
- 12 3) Use piping designation as indicated on the Drawings.
- 13 4) Arrow: Single arrow.
- 14 4. Equipment that starts automatically:
- 15 a. Tag type:
- 16 1) Type B2 - Nonmetallic Signs.
- 17 2) Type D - Self-Adhesive Tape Tags and Signs.
- 18 b. Fastener:
- 19 1) Type B2 - Screw or adhesive.
- 20 2) Type D - Self.
- 21 c. Size: 5 IN x 7 IN
- 22 d. Location: Equipment name.
- 23 e. Legend:
- 24 1) OSHA Warning Sign.
- 25 2) Description of Warning: "THIS MACHINE STARTS AUTOMATICALLY".
- 26 B. HVAC Systems:
- 27 1. General:
- 28 a. Provide arrows and markers on ducts.
- 29 1) At 20 FT maximum centers along continuous lines.
- 30 2) At changes in direction (route) or obstructions.
- 31 3) At dampers, risers, branches, machinery or equipment.
- 32 4) Where ducts pass through floors, walls, ceilings, cladding assemblies and like
- 33 obstructions provide markers on both sides.
- 34 b. Position markers on both sides of duct with arrow markers pointing in flow direction.
- 35 1) If flow is in both directions use double headed arrow markers.
- 36 c. Apply tapes and stenciling in uniform manner parallel to ducts.
- 37 2. HVAC Equipment (e.g., unit heaters, exhaust fans, air handlers, etc.):
- 38 a. Tag type:
- 39 1) Type B2 - Nonmetallic Signs.
- 40 2) Type C - Phenolic Name Plates.
- 41 b. Fastener: Screws.
- 42 c. Legend:
- 43 1) Letter height: 1 IN minimum.
- 44 2) Equipment designation as indicated on the Drawings (e.g., "EF-xxx").
- 45 3. Ductwork:
- 46 a. Tag type:
- 47 1) Type D - Self-Adhesive Tape Tags and Signs.
- 48 2) Type G - Stenciling System.
- 49 b. Fastener: Self.
- 50 c. Legend:
- 51 1) Letter height: 1 IN minimum.
- 52 2) Description of ductwork, (e.g., "AIR SUPPLY").
- 53 3) Arrows: Single arrow.
- 54 4. Enclosure for instrumentation and control equipment, (e.g., fan control panels, etc.):
- 55 a. Tag type: Type C - Phenolic Name Plates.

- 1           b. Fastener: Screws.
- 2           c. Legend:
- 3             1) Letter height: 1/2 IN minimum.
- 4             2) Equipment designation as indicated on the Drawings (e.g., "FAN CONTROL
- 5                 PANEL FCP-xxx").
- 6       5. Wall mounted thermostats:
- 7           a. Tag type: Type D - Self-Adhesive Tape Tags and Signs.
- 8           b. Fastener: Self.
- 9           c. Legend:
- 10            1) Letter height: 3/16 IN minimum.
- 11            2) Description of equipment controlled (e.g., "UH-xxx" or AHU-xxx").
- 12       6. Components inside equipment enclosure, (e.g., controller's, control relays, contactors, and
- 13           timers):
- 14           a. Tag type: Type D - Self-Adhesive Tape Tags and Signs.
- 15           b. Fastener: Self.
- 16           c. Legend:
- 17             1) Letter height: 3/16 IN minimum.
- 18             2) Description or function of component (e.g., "CR-xxx").
- 19       7. Through enclosure door mounted equipment (e.g., selector switches, controller digital
- 20           displays, etc.):
- 21           a. Tag type: Type C - Phenolic Name Plates.
- 22           b. Fastener: Screws.
- 23           c. Legend:
- 24             1) Letter height: 1/4 IN minimum.
- 25             2) Component tag number as indicated on the Drawings or as defined by Contractor
- 26                 (e.g., "HS-xxx").
- 27       C. Electrical Systems:
- 28           1. Panelboards:
- 29             a. Tag type: Type C - Phenolic Name Plates.
- 30             b. Fastener: Screws.
- 31             c. Legend:
- 32                1) Letter height:
- 33                    a) First line: 3/8 IN minimum.
- 34                    b) Subsequent lines: 3/16 IN minimum.
- 35                2) First line: Equipment name (e.g., "PANELBOARD LPxxx" or "TRANSFORMER
- 36                    Txxx").
- 37                3) Second line (panelboards only): System voltage and phase (e.g., "208/120V,
- 38                    3PH").
- 39                4) Third line:
- 40                    a) Source of power (e.g., "FED FROM MCCxxx LOCATED IN ROOM xxx").
- 41                    b) Include the building name or number if the source is in another building.
- 42                5) Fourth line: Date installed (e.g., "INSTALLED JULY 20xx").
- 43           2. Safety switches, separately mounted circuit breakers and motor starters, VFD's, etc.:
- 44             a. Tag type: Type C - Phenolic Name Plates.
- 45             b. Fastener: Screws.
- 46             c. Legend:
- 47                1) Letter height: 1/4 IN minimum.
- 48                2) First line: Description of load equipment is connected to (e.g., "PUMP Pxxx").
- 49           3. Enclosure for instrumentation and control equipment, (e.g., lighting control panels, etc.):
- 50             a. Tag type: Type C - Phenolic Name Plates.
- 51             b. Fastener: Screws.
- 52             c. Legend:
- 53                1) Letter height: 1/2 IN minimum.
- 54                2) Equipment name (e.g., "LIGHTING CONTROL PANEL LCPxxx").

4. Components inside equipment enclosures (e.g., circuit breakers, fuses, control power transformers, control relays, contactors, timers, etc.):
  - a. Tag type: Type D - Self-Adhesive Tape Tags and Signs.
  - b. Fastener: Self.
  - c. Legend:
    - 1) Letter height: 3/16 IN minimum.
    - 2) Description or function of component (e.g., "M-xxx", "CR-xxx" or "TR-xxx").
5. Through enclosure door mounted equipment (e.g., selector switches, controller digital displays, etc.):
  - a. Tag type: Type C - Phenolic Name Plates.
  - b. Fastener: Screws.
  - c. Legend:
    - 1) Letter height: 1/4 IN minimum.
    - 2) Component tag number as indicated on the Drawings or as defined by contractor (e.g., "HS-xxx").
6. Conductors in control panels and in pull or junction boxes where multiple circuits exist.
  - a. Tag type: Type D - Self-Adhesive Tape Tags.
  - b. Fastener: Self.
  - c. Tag conductor at both ends.
  - d. Legend:
    - 1) Letter height: 1/8 IN minimum.
    - 2) Circuit number or wire number as scheduled on the Drawings or as furnished with the equipment.
7. Grounding conductors associated with grounding electrode system in accordance with the following:
  - a. Tag type: Type D - Self-Adhesive Tape Tags.
  - b. Fastener: Self.
  - c. Legend:
    - 1) Letter height: 1/8 IN minimum.
    - 2) Function of conductor (e.g., "MAIN BONDING JUMPER", "TO GROUND RING", "TO MAIN WATER PIPE").
8. Flash protection for switchboards, panelboards, industrial control panels and motor control centers:
  - a. Tag type: Type D - Self-Adhesive Tape Signs.
  - b. Fastener: Self.
  - c. Legend: Per NFPA 70.
9. Equipment where more than one (1) voltage source is present:
  - a. Tag type:
    - 1) Type B2 - Nonmetallic Signs.
    - 2) Type D - Self-Adhesive Tape Signs.
  - b. Fastener:
    - 1) Screw or adhesive.
    - 2) Self.
  - c. Size: 1-3/4 IN x 2-1/2 IN.
  - d. Location: Exterior face of enclosure or cubical.
  - e. Legend:
    - 1) OSHA Danger Sign.
    - 2) Description of Danger: "MULTIPLE VOLTAGE SOURCES".

### 3.3 HAZARD AND SAFETY SIGNS

- A. Provide 5 Hazard and Safety Signs:
  1. Type B2.
  2. Inscription as directed by Owner.

**END OF SECTION**





DIVISION 11  
EQUIPMENT







1 2018/04/26

2

## SECTION 11 53 13

3

### LABORATORY FUME HOODS AND EXHAUST DEVICES

4

#### **PART 1 - GENERAL**

5

##### **1.1 SUMMARY**

6

A. Furnish labor, materials, tools, equipment, and services for Laboratory Fume Hoods in accordance with provisions of Contract Documents.

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8

B. Completely coordinate with work of other trades.

9

##### **1.2 SECTION INCLUDES**

10

A. Kjeldahl Hood.

11

##### **1.3 DESCRIPTION**

12

A. Provide Kjeldahl hood complete with accessories as described herein, and shown on Drawings.

13

B. Reconnect Kjeldahl hood unit to existing service connections previously connected to demolished Kjeldahl unit. Contractor is to coordinate necessary modifications with manufacturer.

14

15

16

##### **1.4 QUALITY ASSURANCE**

17

A. Manufacturer Qualifications:

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1. Work in this Section, with respect to the specific equipment specified herein, shall be manufactured by a firm having a minimum eight (8) years documented experience, and an established organization and production facilities including all tools, equipment and special machinery necessary for specializing in the fabrication and installation of the type of equipment required with skilled personnel, factory trained workmen and an experienced engineering department. Each shall have the demonstrated knowledge, ability and the proven capability to produce the specified equipment of the required quality and the proven capacity to complete an installation of this size and type within the required time limits. Upon request, manufacturers shall produce evidence of financial stability and bonding capacity required to perform on this project.

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2. Manufacturer shall maintain a factory test facility which provides variable exhaust and make-up air control. Test facility shall contain, as permanent equipment, ANSI/ASHRAE 110 testing equipment as specified for performance testing.

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30

31

B. Installer Qualifications:

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1. Installed by manufacturer or installers approved in writing by fume hood or exhaust device manufacturer for installation of specified products.

33

34

C. American Society of Heating, Refrigeration, and Air conditioning Engineers:

35

1. ASHRAE 110, latest edition, Method of Testing Performance of Fume Hoods.

36

D. Scientific Equipment and Furniture Association:

37

1. SEFA 1 Fume Hoods.

38

2. SEFA 2 Installation.

39

3. SEFA 3 Laboratory Work Surfaces.

40

4. SEFA 7 Fixtures.

41

5. SEFA 8 M Laboratory Grade Metal Casework.

42

E. Occupational Safety and Health Administration:

43

1. Federal Register 29 CFR Part 1910 Occupational Exposures to Hazardous Chemicals in Laboratories.

44

- 1 F. State OSHA regulations, if developed for state of the project location.
- 2 G. American National Standards Institute/American Industrial Hygiene Association:
- 3 1. ANSI/AIHA Z9.5 Standard for Laboratory Ventilation.
- 4 H. National Fire Protection Association:
- 5 1. NFPA 45 Standard on Fire Protection for Laboratories Using Chemicals.
- 6 I. American Conference of Government Industrial Hygienists:
- 7 1. ACGIH Industrial Ventilation.
- 8 J. Provide interface products of style, material, finish, and color in order to produce a homogenous
- 9 installation.
- 10 K. Fume Hoods shall be UL tested and labeled and conform to Class A requirements of ANSI Z9.5
- 11 Laboratory Ventilation.
- 12 1. Fume Hood Testing shall be in accordance with ASHRAE 110.
- 13 2. Fume Hood Testing shall be in accordance with the National Institutes of Health Design
- 14 Requirements Manual.

15 **1.5 SUBMITTALS**

- 16 A. Shop Drawings:
- 17 1. Submit complete shop fabrication and installation drawings, including plans, elevations,
- 18 sections, dimensions, materials and metal gauge sizes, details, fittings, duct connections,
- 19 schedules, and steam table piping and vents from cabinets below where applicable.
- 20 2. Show relationship to adjoining materials and construction.
- 21 3. Identify connection points, locations and sizes to building services and systems. Provide
- 22 clear identification where equipment requirements deviate from the service/utility
- 23 provisions in the Construction Documents.
- 24 4. Coordinate shop drawing submittals of both this Section and existing conditions
- 25 5. Provide piping, wiring, and/or control diagrams, including connection points and sizes to
- 26 building services and systems. Provide flow rates, pressure drops, voltage and amperage,
- 27 etc.
- 28 6. Identify where equipment requirements deviate from service/utility provisions identified in
- 29 the Construction Documents.
- 30 B. Product Data:
- 31 1. Description of hoods and exhaust devices, including construction details, materials, gauges,
- 32 sash lock and release procedure, hardware cut sheets, piping of equipment and description
- 33 of re-lamping procedures.
- 34 2. Statement giving face velocity, operating volume and pressure drop at operating sash
- 35 position for each size hood or exhaust device.
- 36 3. Description of proposed factory dynamic testing procedures.
- 37 4. Submit complete materials list, including catalog data of materials, equipment, fan curves,
- 38 test designs, performance charts, and products for Work specified in this Section.
- 39 C. Samples:
- 40 1. Manufacturer's color charts showing the full range of colors, textures and patterns available
- 41 for each type of finish, for selection or verification by Architect.
- 42 2. Submit two (2) samples of each type of specified finish and color range available, or as
- 43 identified in the Finish Schedule.
- 44 3. Submit two (2) samples of fume hood sash safety label.
- 45 D. Project Information:
- 46 1. As Manufactured (AM) Fume Hood Testing in Manufacturing Facility: Provide
- 47 certification that each type and size of fume hood has achieved an AM performance rating
- 48 equal or better than 0.05 ppm with 4.0 Lpm tracer gas release rate when tested in
- 49 accordance with ASHRAE 110.

- 1           2. Fume Hood Sound Level Certification: Provide certification of fume hood compliance with
- 2           design criteria for maximum allowable noise within laboratories.
- 3           a. Provide test data of octave band analysis verifying fume hood is capable of a 50 NC
- 4           value when connected to a 50 NC HVAC source. Measurements shall be taken 915mm
- 5           36 IN in front of full open sash, 1.524m 60 IN above the floor at the specified face
- 6           velocity.
- 7       E. Contract Closeout Information:
- 8           1. Structural calculations for Laboratory Fume Hoods and Exhaust Devices indicating design
- 9           conforms to specified design criteria, sealed by the Specialty Structural Engineer.
- 10          a. Submit concurrent with Shop Drawings.
- 11          2. Certification: Submit certification by an independent testing company stating that
- 12          equipment is installed per applicable and referenced codes and standards, adjusted and
- 13          balanced for design operations, and is complete and ready for intended function.
- 14          a. Certify that fume hoods will not exceed design maximum at specified operating
- 15          conditions.
- 16          3. Operation and Maintenance data:
- 17           a. Operating and maintenance manuals that describe proper operating procedures.
- 18           b. Maintenance and replacement schedules.
- 19           c. Component parts list.
- 20           d. Wiring diagrams.
- 21           e. Closest factory representative for components and service.
- 22           f. See Section 01 33 04.

## 23   **1.6 PRODUCT HANDLING**

- 24   A. Protect work before, during and after installation including installed work and materials of other
- 25   trades. Maintain protective covering until start-up.
- 26   B. Deliver laboratory equipment after wet operations in building are complete.
- 27   C. Laboratory equipment shall be stored in a ventilated area, protected from weather, with relative
- 28   humidity of 50 PCT or less at 70 DEGF.
- 29   D. Replace, repair and restore damaged work to original condition.
- 30   E. At no time shall worker use the installed equipment as a work bench, scaffolding, or for other
- 31   uses.

## 32   **PART 2 - PRODUCTS**

### 33   **2.1 KJELDAHL HOOD**

- 34   A. Provide Six-Place Hooded Combination Kjeldahl Digestion/Distillation Apparatus.
- 35    1. Acceptable Manufacturers:
- 36    a. Labconco.
- 37    1) Catalog # 2117613.
- 38    2. Provide Kjeldahl flasks; see 23 34 00 for exhaust fans – connect per manufacturer’s
- 39    recommendations for a fully operational system.
- 40    3. Electrical: 208 V, three phase, 60 Hz, 21 amps.

## 41   **PART 3 - EXECUTION**

### 42   **3.1 EXAMINATION**

- 43   A. Prior to installation of the Work of this Section, carefully inspect the installed Work specified in
- 44   other sections and verify that Work is complete to the point where this installation may properly
- 45   commence.

- 1 B. Verify that Work has been installed in complete accordance with the original design, received  
2 submittals, and the manufacturer's recommendations.
- 3 C. In the event of discrepancy, immediately notify the Architect. Do not proceed with installation  
4 in areas of discrepancy until discrepancies have been fully resolved.

5 **3.2 INSTALLATION**

- 6 A. Work in this Section requires close coordination with Work specified in Divisions 23 and 26, as  
7 well as installation by Owner of Owner furnished components. Coordinate Work to ensure an  
8 orderly process in the Project, without removal of previously installed Work, and so as to  
9 prevent damage to finishes and products.
- 10 B. Coordinate location and alignment of hoods and cabinets for proper connection of piping and  
11 duct work.
- 12 C. Install equipment in accordance with manufacturer's written instructions, applicable codes and  
13 regulations, accepted Shop Drawings, and as necessary for a complete operating system.
- 14 D. Install equipment plumb, square, and straight with no distortion and securely anchored, as  
15 required.
- 16 E. Where cup sinks are indicated, coordinate alignment of fume hood cup sink(s) so that sink is  
17 centered below water fitting outlet.
- 18 F. Coordinate with and reconnect existing service connections to new hood.

19 **3.3 ADJUSTING, CLEANING, AND PROTECTION**

- 20 A. Repair or remove and replace defective work as approved by the Architect upon completion of  
21 installation.
- 22 B. Adjust all moving or operating parts to function within their design parameters.
- 23 C. Clean equipment, touch up as required.
- 24 D. Protect all units before, during, and after installation. Damaged materials due to improper  
25 protection shall be cause for rejection.

26

**END OF SECTION**



## DIVISION 23

HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)





2 **SECTION 23 05 93**  
3 HVAC SYSTEMS: BALANCING AND TESTING

4 **PART 1 - GENERAL**

5 **1.1 SUMMARY**

- 6 A. Section Includes:
- 7 1. Adjusting, balancing, and testing of all heating, ventilating and air conditioning (HVAC)
  - 8 systems, including the following systems:
- 9 B. Related Sections include but are not necessarily limited to:
- 10 1. Division 00 - Procurement and Contracting Requirements.
  - 11 2. Division 01 - General Requirements.
  - 12 3. Section 23 34 00 - HVAC: Fans

13 **1.2 QUALITY ASSURANCE**

- 14 A. Referenced Standards:
- 15 1. Associated Air Balance Council (AABC):
  - 16 a. National Standards for Total System Balance.
  - 17 2. American Industrial Hygiene Association (AIHA):
  - 18 a. Z9.5, Laboratory Ventilation.
  - 19 3. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
  - 20 a. HVAC Applications Handbook, Chapter entitled "Laboratories".
  - 21 b. HVAC Systems and Equipment Handbook, Chapter entitled "Testing, Adjusting, and
  - 22 Balancing".
  - 23 4. National Environmental Balancing Bureau (NEBB):
  - 24 a. Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
- 25 B. Qualifications:
- 26 1. Work of this Section to be accomplished by an independent testing and balancing firm
  - 27 certified by one (1) of the following:
  - 28 a. Associated Air Balance Council (AABC).
  - 29 b. National Environmental Balancing Bureau (NEBB).
  - 30 c. Other certification entity approved by Engineer.
  - 31 2. The independent firm shall not be the same firm as the firm installing the HVAC equipment,
  - 32 nor under contract to the firm installing the equipment.

33 **1.3 SUBMITTALS**

- 34 A. Shop Drawings:
- 35 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of
  - 36 the submittal process.
  - 37 2. Certifications:
  - 38 a. Letter stating the name and qualifications of the firm proposed.
  - 39 b. Evidence that relevant subcontractors have been notified of the requirement to
  - 40 coordinate balance and test elements in the work with the testing and balancing firm.
  - 41 3. Report forms:
  - 42 a. Procedures and forms to be used in calibrating of test instruments, balancing systems,
  - 43 and recording and reporting test data.
- 44 B. Informational Submittals:
- 45 1. Completed test reports and data forms upon completion of installation, balance and testing
  - 46 of HVAC systems.
  - 47 a. Insert recorded information on report forms required by specifications and approved for
  - 48 use on project.





1 2018/04/26

2 **SECTION 23 34 00**

3 HVAC: FANS

4 **PART 1 - GENERAL**

5 **1.1 SUMMARY**

- 6 A. Section Includes:
- 7 1. Heating, ventilating, and cooling equipment.
- 8 B. Related Specification Sections include but are not necessarily limited to:
- 9 1. Division 00 - Procurement and Contracting Requirements.
- 10 2. Division 01 - General Requirements.
- 11 3. Section 01 61 03 - Equipment: Basic Requirements.
- 12 4. Section 23 05 93 - HVAC Systems: Balancing and Testing.

13 **1.2 QUALITY ASSURANCE**

- 14 A. Referenced Standards:
- 15 1. Air Movement and Control Association (AMCA).
- 16 a. AMCA Publication 203 "Field Performance Measurement of Fan Systems"
- 17 b. ANSI/AMCA 210 "Laboratory Methods of Testing Fans for Aerodynamic Performance
- 18 Rating".
- 19 2. Air Conditioning and Refrigeration Institute (ARI).
- 20 3. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
- 21 a. HVAC Applications Handbook, Chapter entitled "Sound and Vibration Control."
- 22 b. 20, Methods of Testing for Rating Remote Mechanical-Draft Air-Cooled Refrigerant
- 23 Condensers.
- 24 c. 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal
- 25 Efficiency by Particle Size.
- 26 4. Canadian Standards Association (CSA).
- 27 5. National Electrical Manufacturers Association (NEMA):
- 28 a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
- 29 6. National Fire Protection Association (NFPA):
- 30 a. 70, National Electrical Code (NEC).
- 31 7. National Roofing Contractors Association (NRCA).
- 32 8. Underwriters Laboratories, Inc. (UL):
- 33 a. 507, Standard for Electric Fans.
- 34 9. Building code:
- 35 a. International Code Council (ICC):
- 36 1) International Building Code and associated standards, 2015 Edition including all
- 37 amendments, referred to herein as Building Code.
- 38 B. Miscellaneous:
- 39 1. Gage thickness specified herein shall be manufacturer's standard gage for steel and Brown
- 40 and Sharpe gage for non-ferrous metals.
- 41 2. Corrosion protection of equipment to be as specified herein.

42 **1.3 SUBMITTALS**

- 43 A. Shop Drawings:
- 44 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of
- 45 the submittal process.
- 46 2. Product technical data including:
- 47 a. Acknowledgement that products submitted meet requirements of standards referenced.
- 48 b. Manufacturer's installation instructions.

- 1 c. Wiring diagrams.
- 2 d. Control diagrams.
- 3 e. Manufacturer's catalog cuts and technical data.
- 4 f. Corrosion-protection information.
- 5 g. Fan curves.
- 6 h. Sound data.
- 7 i. Vibration isolation.
- 8 j. Performance data on all equipment.
- 9 3. Certifications:
  - 10 a. Provide certification of thickness of corrosion-protection coating.
  - 11 b. Fan systems have been tested in accordance with AMCA Standard 210 or 260, and are
  - 12 licensed to bear the AMCA Certified Ratings Seal.
- 13 B. Factory Performance test for any fan having a flow rate greater than 1,000 CUFTM and/or a
- 14 total static pressure rating equal to or greater than 1.5 IN WC.
  - 15 1. Pursuant to AMCA Publication 203 or 210 with no plus tolerances on Power and no minus
  - 16 tolerances on flow or pressure.
- 17 C. Contract Closeout Information:
  - 18 1. Operation and Maintenance Data:
    - 19 a. See Specification Section 01 33 04 for requirements for the mechanics, administration,
    - 20 and the content of Operation and Maintenance Manual submittals.

## 21 **PART 2 - PRODUCTS**

### 22 **2.1 MANUFACTURERS**

- 23 A. Subject to compliance with the Contract Documents, the following manufacturers are
- 24 acceptable:
  - 25 1. High-Plume Dilution Laboratory Exhaust Fans.
  - 26 a. MK Plastics.
  - 27 b. Strobic Air.
  - 28 c. Plasticair.
- 29 B. Submit request for substitution in accordance with Specification Section 01 25 13.

### 30 **2.2 GENERAL**

- 31 A. All Manufactured Units:
  - 32 1. Comply with Specification Section 01 61 03.
  - 33 2. Factory wired and assembled.
  - 34 3. Use fasteners made of same material as unit.
  - 35 4. Fabricate motor assemblies and unit housings with vibration isolation assemblies:
    - 36 a. Type: As per ASHRAE HVAC Applications Handbook.

### 37 **2.3 MANUFACTURED UNITS**

- 38 A. High-Plume Dilution Laboratory Exhaust Fans:
  - 39 1. General:
    - 40 a. Base fan performance at standard conditions (density 0.075 LB/FT<sup>3</sup>).
    - 41 b. Each fan shall be belt driven in AMCA arrangement 1, 9 or 10, according to drawings.
    - 42 c. Fans to be equipped with lifting lugs.
    - 43 d. Fan stand shall be coated steel with a minimum of 4 - 6 MIL electrostatically applied
    - 44 Plastifer™ baked Polyester powder coating.
    - 45 e. Fasteners to be 316 stainless steel.
    - 46 f. All components shall be resistant to H<sub>2</sub>S, HCl, and H<sub>2</sub>SO<sub>4</sub>

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2. Fan Housing and Outlet:
    - a. Fan housing to be aerodynamically designed with high-efficiency inlet, engineered to reduce incoming air turbulence. Casings to be smooth exterior and resin rich interior.
    - b. Fan housing shall be manufactured in specifically formulated resins, for maximum corrosion resistance, and reinforced with fiberglass for structural strength. Fastening bolts holding the casing to the support plate are to be encapsulated in FRP. No uncoated metal fan parts in the corrosive air stream will be tolerated.
    - c. A bifurcated fiberglass reinforced plastic (FRP) discharge nozzle shall be supplied by the fan manufacturer and be designed to efficiently handle an outlet velocity of up to 7,000 FPM. The discharge shall include a venturi and fiberglass wind band to induce ambient air.
    - d. All fiberglass parts shall include UV inhibitors in the resins to prevent chalking from the sunlight. Flame retardancy of 25 or less.
    - e. A graphite liner and grounding strap shall be included to remove any possible build up of static electricity.
    - f. An integral fan housing drain shall be used to drain rainwater when the fan is de-energized.
    - g. A bolted housing access door shall be supplied for impeller inspection.
    - h. Hub seal to be neoprene or Teflon.
  3. Fan Impeller:
    - a. Impellers shall be solid, molded FRP with backward inclined blades. A metal backplate integral to the FRP impeller and encapsulated in resin shall have the hub extending to the outside of the fan housing. A tight fitting removable FRP cap shall cover the impeller end of the shaft. Impellers manufactured in coated steel are not acceptable.
  4. Fan Inlet Elbow/Plenum:
    - a. The elbow/plenum shall be equipped with a bypass air damper(s) and fiberglass reinforced plastic (FRP) weather cowl and birdscreen, for introducing outside air at roof level upstream of the fan. As standard, the plenum shall be constructed of double wall, thermally and acoustically insulated, 1 IN thick K-Kore™ fiberglass panels, bonded, reinforced and sealed together to prevent noise and air leakage.
    - b. Bypass plenum shall be mounted on an insulated curb.
    - c. Inlet Plenum to be attached to the fan inlet by a flexible FPVC connector, provided by the fan manufacturer.
    - d. Bypass air damper(s) shall be opposed-blade, airfoil design, constructed of either fiberglass reinforced plastic (FRP), or extruded aluminum with a clear anodized finish, (as indicated on the equipment schedule and project drawings), with linkage hardware installed in the side frame. Each bypass damper shall be housed inside a fiberglass reinforced plastic (FRP) weather cowl and birdscreen, to prevent the possibility of rainwater entrainment.
    - e. Fan isolation damper(s) shall be parallel-blade, airfoil design, constructed of either fiberglass reinforced plastic (FRP), or extruded aluminum with a clear anodized finish, (as indicated on the equipment schedule and project drawings), with linkage hardware installed in the side frame. Each isolation damper shall be housed inside a fiberglass reinforced plastic (FRP) damper enclosure, bolted to the bypass air plenum with a round slip connection at one end for fan inlet attachment.
    - f. All dampers shall have an extended control shaft for electronic, pneumatic or manual control actuation.
  5. Fan Motor and Drive:
    - a. Motors to be premium efficiency, standard NEMA frame, 1800 RPM, TEFC with a 1.15 service factor. A factory mounted NEMA 4X disconnect switch shall be provided for each fan. Motor maintenance shall be accomplished without fan impeller removal or requiring maintenance personnel to access the contaminated exhaust components.
    - b. Drive belts and sheaves shall be sized for 150 PCT of the fan operating brake horsepower, and shall be readily and easily accessible for service, if required.

- 1 c. Motor sheaves shall be cast iron, variable pitch.
- 2 d. Shaft 316 stainless steel shafts.
- 3 e. Bearings shall be heavy duty, grease lubricated, spherical roller or adapter mounted
- 4 anti-friction ball, self-aligning, pillow block type and selected for a minimum average
- 5 bearing life (AFBMA L-10) in excess of 200,000 HRS at the maximum fan RPM.

6 **PART 3 - EXECUTION**

7 **3.1 INSTALLATION**

- 8 A. Install in accordance with Specification Section 01 61 03.
- 9 B. Install FPVC flexible connections with stainless steel straps, provided by the fan manufacturer,
- 10 between fan inlet and bypass plenum. Insure that the flexible connection is at least 6 inches
- 11 wide.
- 12 C. Install fans in accordance with manufacturer's instructions, applicable specification and code
- 13 requirements.
- 14 D. Install fixed pitched drive sheave after sheave has been sized based on accepted test and balance
- 15 report.
- 16 E. Do not operate fans for any purpose until ductwork is clean, filters are in place, bearings
- 17 lubricated and fan has been test run under observation.

18 **3.2 FIELD QUALITY CONTROL**

- 19 A. Comply with Specification Section 23 05 93.

20

**END OF SECTION**



DIVISION 26  
ELECTRICAL





1 2018/02/09

2

## SECTION 26 05 00

3

### ELECTRICAL: BASIC REQUIREMENTS

#### 4 PART 1 - GENERAL

##### 5 1.1 SUMMARY

6

A. Section Includes: Basic requirements for electrical systems.

7

B. Related Specification Sections include but are not necessarily limited to:

8

1. Division 00 - Procurement and Contracting Requirements.

9

2. Division 01 - General Requirements.

10

3. Section 01 61 03 - Equipment: Basic Requirements.

11

4. Section 05 50 00 - Metal Fabrications.

12

5. Section 10 14 00 - Identification Devices.

13

6. Section 26 05 19 - Wire and Cable - 600 Volt and Below.

14

7. Section 26 05 33 - Raceways and Boxes.

15

##### 1.2 QUALITY ASSURANCE

16

A. Referenced Standards:

17

1. Aluminum Association (AA):

18

a. ADM, Aluminum Design Manual.

19

2. American Iron and Steel Institute (AISI):

20

a. 325, Manual of Steel Construction.

21

3. ASTM International (ASTM):

22

a. A36, Standard Specification for Carbon Structural Steel.

23

b. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

24

c. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

25

26

4. ETL Testing Laboratories (ETL).

27

5. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

28

a. C2, National Electrical Safety Code (NESC).

29

6. National Electrical Manufacturers Association (NEMA):

30

a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).

31

7. National Fire Protection Association (NFPA):

32

a. 70, National Electrical Code (NEC).

33

8. Underwriters Laboratories, Inc. (UL).

34

35

B. Where UL test procedures have been established for the product type, use UL or ETL approved electrical equipment and provide with the UL or ETL label.

36

37

##### 1.3 DEFINITIONS

38

A. For the purposes of providing materials and installing electrical work the following definitions shall be used.

39

1. Outdoor area: Exterior locations where the equipment is normally exposed to the weather and including below grade structures, such as vaults, manholes, handholes and in-ground pump stations.

40

41

2. Non-architecturally finished interior area: Pump, chemical, mechanical, electrical rooms and other similar process type rooms.

42

43

3. Shop fabricated: Manufactured or assembled equipment for which a UL test procedure has not been established.

44

45

46

- 1 B. Execution of this Contract will involve replacement of existing equipment.  
2 1. The Contractor is responsible for coordinating with the Engineer and the Owner those items  
3 which shall remain in service, or which shall have a limited downtime, and to schedule his  
4 work accordingly.

#### 5 **1.4 SUBMITTALS**

- 6 A. Shop Drawings:  
7 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of  
8 submittal process.  
9 2. See Specification Section 01 61 03 and individual specification sections for submittal  
10 requirements for products defined as equipment.  
11 3. General requirements:  
12 a. Provide manufacturer's technical information on products to be used, including product  
13 descriptive bulletin.  
14 b. Include data sheets that include manufacturer's name and product model number.  
15 1) Clearly identify all optional accessories.  
16 c. Acknowledgement that products are UL or ETL listed or are constructed utilizing UL  
17 or ETL recognized components.  
18 d. Manufacturer's delivery, storage, handling and installation instructions.  
19 e. Product installation details.  
20 f. See individual specification sections for any additional requirements.
- 21 B. Operation and Maintenance Manuals:  
22 1. See Specification Section 01 33 04 for requirements for:  
23 a. The mechanics and administration of the submittal process.  
24 b. The content process of Operation and Maintenance Manuals.
- 25 C. When a Specification Section includes products specified in another Specification Section, each  
26 Specification Section shall have the required Shop Drawing transmittal form per Specification  
27 Section 01 33 00 and all Specification Sections shall be submitted simultaneously.

#### 28 **1.5 DELIVERY, STORAGE, AND HANDLING**

- 29 A. See Specification Section 01 65 50.  
30 B. Protect nameplates on electrical equipment to prevent defacing.

#### 31 **1.6 AREA DESIGNATIONS**

- 32 A. Designation of an area will determine the NEMA rating of the electrical equipment enclosures,  
33 types of conduits and installation methods to be used in that area.  
34 1. Outdoor areas:  
35 a. Wet.  
36 2. Indoor areas:  
37 a. Dry.

### 38 **PART 2 - PRODUCTS**

#### 39 **2.1 MANUFACTURERS**

- 40 A. Subject to compliance with the Contract Documents, refer to specific Electrical Specification  
41 Sections and specific material paragraphs below for acceptable manufacturers.  
42 B. Submit request for substitution in accordance with Specification Section 01 25 13.  
43 C. Provide all components of a similar type by one (1) manufacturer.



1 **2.2 MATERIALS**

- 2 A. Electrical Equipment Support Pedestals and/or Racks:  
3 1. Approved manufacturers:  
4 a. Modular strut:  
5 1) Unistrut Building Systems.  
6 2) Eaton B-Line.  
7 3) Globe Strut.  
8 4) Thomas & Betts Superstrut.  
9 2. Material requirements:  
10 a. Modular strut:  
11 1) Galvanized steel: ASTM A123/123M or ASTM A153/A153M.  
12 2) Stainless steel: AISI Type 316.  
13 3) Aluminum: AA Type 6063-T6.  
14 b. Structural members (e.g., I beams, L and C channels):  
15 1) Galvanized steel: ASTM A36 steel with galvanizing per ASTM A123/A123M.  
16 2) Aluminum: AA Type 6061-T6 or 6063-T6.  
17 c. Mounting plates:  
18 1) Galvanized steel: ASTM A36 steel with galvanizing per ASTM A123/A123M.  
19 2) Aluminum: AA Type 6063-T6.  
20 d. Mounting hardware:  
21 1) Galvanized steel.  
22 2) Stainless steel.  
23 e. Anchorage per Specification Section 05 50 00.  
24 B. Field touch-up of galvanized surfaces.  
25 1. Zinc-rich primer.  
26 a. One (1) coat, 3.0 mils, ZRC by ZRC Products.

27 **PART 3 - EXECUTION**

28 **3.1 INSTALLATION**

- 29 A. Install and wire all equipment, including prepurchased equipment, and perform all tests  
30 necessary to assure conformance to the Drawings and Specification Sections and ensure that  
31 equipment is ready and safe for energization.  
32 B. Install equipment in accordance with the requirements of:  
33 1. NFPA 70.  
34 2. IEEE C2.  
35 3. The manufacturer's instructions.  
36 C. In general, conduit routing is not shown on the Drawings.  
37 1. The Contractor is responsible for routing all conduits including those shown on one-line and  
38 control block diagrams and home runs shown on floor plans.  
39 2. Conduit routings and stub-up locations that are shown are approximate; exact routing to be  
40 as required for equipment furnished and field conditions.  
41 D. When complete branch circuiting is not shown on the Drawings:  
42 1. A homerun indicating panelboard name and circuit number will be shown and the circuit  
43 number will be shown adjacent to the additional devices (e.g., light fixture and receptacles)  
44 on the same circuit.  
45 2. The Contractor is to furnish and install all conduit and conductors required for proper  
46 operation of the circuit.  
47 3. The indicated home run conduit and conductor size shall be used for the entire branch  
48 circuit.  
49 4. See Specification Section 26 05 19 for combining multiple branch circuits in a common  
50 conduit.

- 1 E. Do not use equipment that exceed dimensions or reduce clearances indicated on the Drawings or  
2 as required by the NFPA 70.
- 3 F. Install equipment plumb, square and true with construction features and securely fastened.
- 4 G. Install electrical equipment, including pull and junction boxes, minimum of 6 IN from process,  
5 gas, air and water piping and equipment.
- 6 H. Install equipment so it is readily accessible for operation and maintenance, is not blocked or  
7 concealed and does not interfere with normal operation and maintenance requirements of other  
8 equipment.
- 9 I. Device Mounting Schedule:  
10 1. Unless indicated otherwise on the Drawings, mounting heights are as indicated below:  
11 a. Safety switch (to center of operating handle): 54 IN.
- 12 J. Avoid interference of electrical equipment operation and maintenance with structural members,  
13 building features and equipment of other trades.  
14 1. When it is necessary to adjust the intended location of electrical equipment, unless  
15 specifically dimensioned or detailed, the Contractor may make adjustments of up to 6 IN in  
16 equipment location with the Engineer's approval.  
17 a. Changes in equipment location exceeding those defined above require the Engineer's  
18 approval.
- 19 K. Provide electrical equipment support system per the following area designations:  
20 1. Dry areas:  
21 a. Galvanized system consisting of galvanized steel channels and fittings, nuts and  
22 hardware.  
23 b. Field touch-up cut ends and scratches of galvanized components with the specified  
24 primer during the installation, before rust appears.  
25 2. Wet areas:  
26 a. Aluminum system consisting of aluminum channels and fittings with stainless steel nuts  
27 and hardware.  
28 b. Field touch-up cut ends and scratches of galvanized components with the specified  
29 primer during the installation, before rust appears.
- 30 L. Provide all necessary anchoring devices and supports rated for the equipment load based on  
31 dimensions and weights verified from approved submittals, or as recommended by the  
32 manufacturer.  
33 1. See Specification Section 05 50 00.  
34 2. Do not cut, or weld to, building structural members.  
35 3. Do not mount safety switches or other equipment to equipment enclosures, unless enclosure  
36 mounting surface is properly braced to accept mounting of external equipment.
- 37 M. Provide corrosion resistant spacers to maintain 1/4 IN separation between metallic equipment  
38 and/or metallic equipment supports and mounting surface in wet areas, on below grade walls and  
39 on walls of liquid containment or processing areas such as Basins, Clarifiers, Digesters,  
40 Reservoirs, etc.
- 41 N. Do not place equipment fabricated from aluminum in direct contact with earth or concrete.
- 42 O. Screen or seal all openings into equipment mounted outdoors to prevent the entrance of rodents  
43 and insects.
- 44 P. Do not use materials that may cause the walls or roof of a building to discolor or rust.
- 45 Q. Identify electrical equipment and components in accordance with Specification Section 10 14  
46 00.
- 47 R. Provide field markings and/or documentation of available short-circuit current (available fault  
48 current) and related information for equipment as required by the National Electrical Code and  
49 other applicable codes.

- 1 S. Provide equipment or control panels with Short Circuit Current Rating (SCCR) labeling as  
2 required by NFPA 70 and other applicable codes.
- 3 1. Determine the SCCR rating by one of the following methods:
  - 4 a. Method 1: SCCR rating meets or exceeds the available fault current of the source  
5 equipment when indicated on the Drawings.
  - 6 b. Method 2: SCCR rating meets or exceeds the source equipment's Amp Interrupting  
7 Current (AIC) rating as indicated on the Drawings.
  - 8 c. Method 3: SCCR rating meets or exceeds the calculated available short circuit current  
9 at the control panel.
- 10 2. The source equipment is the switchboard, panelboard, motor control center or similar  
11 equipment where the equipment or control panel circuit originates.
- 12 3. For Method 3, provide calculations justifying the SCCR rating. Utilize source equipment  
13 available fault current or AIC rating as indicated on the Drawings.

14 **3.2 FIELD QUALITY CONTROL**

- 15 A. Verify exact rough-in location and dimensions for connection to electrified equipment, provided  
16 by others.
  - 17 1. See Specification Section 01 73 20 for openings and penetrations in structures.
- 18 B. Replace equipment and systems found inoperative or defective and re-test.
- 19 C. Cleaning: See Specification Section 01 74 13.
- 20 D. The protective coating integrity of support structures and equipment enclosures shall be  
21 maintained.
  - 22 1. Repair galvanized components utilizing a zinc rich paint.
  - 23 2. Repair painted components utilizing touch up paint provided by or approved by the  
24 manufacturer.
  - 25 3. Repair surfaces which will be inaccessible after installation prior to installation.
  - 26 4. See Specification Section 26 05 33 for requirements for conduits and associated accessories.
- 27 E. Replace nameplates damaged during installation.

28 **END OF SECTION**



**SECTION 26 05 00**  
**ELECTRICAL: BASIC REQUIREMENTS**

4 **PART 1 - GENERAL**

5 **1.1 SUMMARY**

- 6 A. Section Includes: Basic requirements for electrical systems.
- 7 B. Related Specification Sections include but are not necessarily limited to:
- 8 1. Division 00 - Procurement and Contracting Requirements.
- 9 2. Division 01 - General Requirements.
- 10 3. Section 01 61 03 - Equipment: Basic Requirements.
- 11 4. Section 10 14 00 - Identification Devices.
- 12 5. Section 26 05 19 - Wire and Cable - 600 Volt and Below.
- 13 6. Section 26 05 33 - Raceways and Boxes.

14 **1.2 QUALITY ASSURANCE**

- 15 A. Referenced Standards:
- 16 1. Aluminum Association (AA):
- 17 a. ADM, Aluminum Design Manual.
- 18 2. American Iron and Steel Institute (AISI):
- 19 a. 325, Manual of Steel Construction.
- 20 3. ASTM International (ASTM):
- 21 a. A36, Standard Specification for Carbon Structural Steel.
- 22 b. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron
- 23 and Steel Products.
- 24 c. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel
- 25 Hardware.
- 26 4. ETL Testing Laboratories (ETL).
- 27 5. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
- 28 a. C2, National Electrical Safety Code (NESC).
- 29 6. National Electrical Manufacturers Association (NEMA):
- 30 a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
- 31 7. National Fire Protection Association (NFPA):
- 32 a. 70, National Electrical Code (NEC).
- 33 8. Underwriters Laboratories, Inc. (UL).
- 34 B. Where UL test procedures have been established for the product type, use UL or ETL approved
- 35 electrical equipment and provide with the UL or ETL label.

36 **1.3 DEFINITIONS**

- 37 A. For the purposes of providing materials and installing electrical work the following definitions
- 38 shall be used.
- 39 1. Outdoor area: Exterior locations where the equipment is normally exposed to the weather
- 40 and including below grade structures, such as vaults, manholes, handholes and in-ground
- 41 pump stations.
- 42 2. Non-architecturally finished interior area: Pump, chemical, mechanical, electrical rooms
- 43 and other similar process type rooms.
- 44 3. Shop fabricated: Manufactured or assembled equipment for which a UL test procedure has
- 45 not been established.

- 1 B. Execution of this Contract will involve replacement of existing equipment.  
2 1. The Contractor is responsible for coordinating with the Engineer and the Owner those items  
3 which shall remain in service, or which shall have a limited downtime, and to schedule his  
4 work accordingly.

#### 5 **1.4 SUBMITTALS**

- 6 A. Shop Drawings:  
7 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of  
8 submittal process.  
9 2. See Specification Section 01 61 03 and individual specification sections for submittal  
10 requirements for products defined as equipment.  
11 3. General requirements:  
12 a. Provide manufacturer's technical information on products to be used, including product  
13 descriptive bulletin.  
14 b. Include data sheets that include manufacturer's name and product model number.  
15 1) Clearly identify all optional accessories.  
16 c. Acknowledgement that products are UL or ETL listed or are constructed utilizing UL  
17 or ETL recognized components.  
18 d. Manufacturer's delivery, storage, handling and installation instructions.  
19 e. Product installation details.  
20 f. See individual specification sections for any additional requirements.
- 21 B. Operation and Maintenance Manuals:  
22 1. See Specification Section 01 33 04 for requirements for:  
23 a. The mechanics and administration of the submittal process.  
24 b. The content process of Operation and Maintenance Manuals.
- 25 C. When a Specification Section includes products specified in another Specification Section, each  
26 Specification Section shall have the required Shop Drawing transmittal form per Specification  
27 Section 01 33 00 and all Specification Sections shall be submitted simultaneously.

#### 28 **1.5 DELIVERY, STORAGE, AND HANDLING**

- 29 A. See Specification Section 01 65 50.  
30 B. Protect nameplates on electrical equipment to prevent defacing.

#### 31 **1.6 AREA DESIGNATIONS**

- 32 A. Designation of an area will determine the NEMA rating of the electrical equipment enclosures,  
33 types of conduits and installation methods to be used in that area.  
34 1. Outdoor areas:  
35 a. Wet.  
36 2. Indoor areas:  
37 a. Dry.

### 38 **PART 2 - PRODUCTS**

#### 39 **2.1 MANUFACTURERS**

- 40 A. Subject to compliance with the Contract Documents, refer to specific Electrical Specification  
41 Sections and specific material paragraphs below for acceptable manufacturers.  
42 B. Submit request for substitution in accordance with Specification Section 01 25 13.  
43 C. Provide all components of a similar type by one (1) manufacturer.

1 **2.2 MATERIALS**

- 2 A. Electrical Equipment Support Pedestals and/or Racks:
- 3 1. Approved manufacturers:
- 4 a. Modular strut:
- 5 1) Unistrut Building Systems.
- 6 2) Eaton B-Line.
- 7 3) Globe Strut.
- 8 4) Thomas & Betts Superstrut.
- 9 2. Material requirements:
- 10 a. Modular strut:
- 11 1) Galvanized steel: ASTM A123/123M or ASTM A153/A153M.
- 12 2) Stainless steel: AISI Type 316.
- 13 3) Aluminum: AA Type 6063-T6.
- 14 b. Structural members (e.g., I beams, L and C channels):
- 15 1) Galvanized steel: ASTM A36 steel with galvanizing per ASTM A123/A123M.
- 16 2) Aluminum: AA Type 6061-T6 or 6063-T6.
- 17 c. Mounting plates:
- 18 1) Galvanized steel: ASTM A36 steel with galvanizing per ASTM A123/A123M.
- 19 2) Aluminum: AA Type 6063-T6.
- 20 d. Mounting hardware:
- 21 1) Galvanized steel.
- 22 2) Stainless steel.
- 23 B. Field touch-up of galvanized surfaces.
- 24 1. Zinc-rich primer.
- 25 a. One (1) coat, 3.0 mils, ZRC by ZRC Products.

26 **PART 3 - EXECUTION**

27 **3.1 INSTALLATION**

- 28 A. Install and wire all equipment, including prepurchased equipment, and perform all tests
- 29 necessary to assure conformance to the Drawings and Specification Sections and ensure that
- 30 equipment is ready and safe for energization.
- 31 B. Install equipment in accordance with the requirements of:
- 32 1. NFPA 70.
- 33 2. IEEE C2.
- 34 3. The manufacturer's instructions.
- 35 C. In general, conduit routing is not shown on the Drawings.
- 36 1. The Contractor is responsible for routing all conduits including those shown on one-line and
- 37 control block diagrams and home runs shown on floor plans.
- 38 2. Conduit routings and stub-up locations that are shown are approximate; exact routing to be
- 39 as required for equipment furnished and field conditions.
- 40 D. When complete branch circuiting is not shown on the Drawings:
- 41 1. A homerun indicating panelboard name and circuit number will be shown and the circuit
- 42 number will be shown adjacent to the additional devices (e.g., light fixture and receptacles)
- 43 on the same circuit.
- 44 2. The Contractor is to furnish and install all conduit and conductors required for proper
- 45 operation of the circuit.
- 46 3. The indicated home run conduit and conductor size shall be used for the entire branch
- 47 circuit.
- 48 4. See Specification Section 26 05 19 for combining multiple branch circuits in a common
- 49 conduit.

- 1 E. Do not use equipment that exceed dimensions or reduce clearances indicated on the Drawings or  
2 as required by the NFPA 70.
- 3 F. Install equipment plumb, square and true with construction features and securely fastened.
- 4 G. Install electrical equipment, including pull and junction boxes, minimum of 6 IN from process,  
5 gas, air and water piping and equipment.
- 6 H. Install equipment so it is readily accessible for operation and maintenance, is not blocked or  
7 concealed and does not interfere with normal operation and maintenance requirements of other  
8 equipment.
- 9 I. Device Mounting Schedule:  
10 1. Unless indicated otherwise on the Drawings, mounting heights are as indicated below:  
11 a. Safety switch (to center of operating handle): 54 IN.
- 12 J. Avoid interference of electrical equipment operation and maintenance with structural members,  
13 building features and equipment of other trades.  
14 1. When it is necessary to adjust the intended location of electrical equipment, unless  
15 specifically dimensioned or detailed, the Contractor may make adjustments of up to 6 IN in  
16 equipment location with the Engineer's approval.  
17 a. Changes in equipment location exceeding those defined above require the Engineer's  
18 approval.
- 19 K. Provide electrical equipment support system per the following area designations:  
20 1. Dry areas:  
21 a. Galvanized system consisting of galvanized steel channels and fittings, nuts and  
22 hardware.  
23 b. Field touch-up cut ends and scratches of galvanized components with the specified  
24 primer during the installation, before rust appears.  
25 2. Wet areas:  
26 a. Aluminum system consisting of aluminum channels and fittings with stainless steel nuts  
27 and hardware.  
28 b. Field touch-up cut ends and scratches of galvanized components with the specified  
29 primer during the installation, before rust appears.
- 30 L. Provide all necessary anchoring devices and supports rated for the equipment load based on  
31 dimensions and weights verified from approved submittals, or as recommended by the  
32 manufacturer.  
33 1. Do not cut, or weld to, building structural members.  
34 2. Do not mount safety switches or other equipment to equipment enclosures, unless enclosure  
35 mounting surface is properly braced to accept mounting of external equipment.
- 36 M. Provide corrosion resistant spacers to maintain 1/4 IN separation between metallic equipment  
37 and/or metallic equipment supports and mounting surface in wet areas, on below grade walls and  
38 on walls of liquid containment or processing areas such as Basins, Clarifiers, Digesters,  
39 Reservoirs, etc.
- 40 N. Do not place equipment fabricated from aluminum in direct contact with earth or concrete.
- 41 O. Screen or seal all openings into equipment mounted outdoors to prevent the entrance of rodents  
42 and insects.
- 43 P. Do not use materials that may cause the walls or roof of a building to discolor or rust.
- 44 Q. Identify electrical equipment and components in accordance with Specification Section 10 14  
45 00.
- 46 R. Provide field markings and/or documentation of available short-circuit current (available fault  
47 current) and related information for equipment as required by the National Electrical Code and  
48 other applicable codes.



- 1 S. Provide equipment or control panels with Short Circuit Current Rating (SCCR) labeling as  
2 required by NFPA 70 and other applicable codes.
- 3 1. Determine the SCCR rating by one of the following methods:  
4 a. Method 1: SCCR rating meets or exceeds the available fault current of the source  
5 equipment when indicated on the Drawings.  
6 b. Method 2: SCCR rating meets or exceeds the source equipment's Amp Interrupting  
7 Current (AIC) rating as indicated on the Drawings.  
8 c. Method 3: SCCR rating meets or exceeds the calculated available short circuit current  
9 at the control panel.
- 10 2. The source equipment is the switchboard, panelboard, motor control center or similar  
11 equipment where the equipment or control panel circuit originates.
- 12 3. For Method 3, provide calculations justifying the SCCR rating. Utilize source equipment  
13 available fault current or AIC rating as indicated on the Drawings.

14 **3.2 FIELD QUALITY CONTROL**

- 15 A. Verify exact rough-in location and dimensions for connection to electrified equipment, provided  
16 by others.  
17 1. See Specification Section 01 73 20 for openings and penetrations in structures.
- 18 B. Replace equipment and systems found inoperative or defective and re-test.
- 19 C. Cleaning: See Specification Section 01 74 13.
- 20 D. The protective coating integrity of support structures and equipment enclosures shall be  
21 maintained.  
22 1. Repair galvanized components utilizing a zinc rich paint.  
23 2. Repair painted components utilizing touch up paint provided by or approved by the  
24 manufacturer.  
25 3. Repair surfaces which will be inaccessible after installation prior to installation.  
26 4. See Specification Section 26 05 33 for requirements for conduits and associated accessories.
- 27 E. Replace nameplates damaged during installation.

28 **END OF SECTION**

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1 2018/04/26

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3

**SECTION 26 05 33**  
**RACEWAYS AND BOXES**

4 **PART 1 - GENERAL**

5 **1.1 SUMMARY**

6

A. Section Includes:

7

1. Material and installation requirements for:

8

a. Conduits.

9

b. Conduit fittings.

10

c. Conduit supports.

11

d. Wireways.

12

e. Outlet boxes.

13

f. Pull and junction boxes.

14

B. Related Specification Sections include but are not necessarily limited to:

15

1. Division 00 - Procurement and Contracting Requirements.

16

2. Division 01 - General Requirements.

17

3. Section 26 05 00 - Electrical: Basic Requirements.

18

**1.2 QUALITY ASSURANCE**

19

A. Referenced Standards:

20

1. Aluminum Association (AA).

21

2. American Iron and Steel Institute (AISI).

22

3. ASTM International (ASTM):

23

a. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

24

b. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

25

26

4. National Electrical Manufacturers Association (NEMA):

27

a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).

28

5. National Electrical Manufacturers Association/American National Standards Institute (NEMA/ANSI):

29

a. C80.1, Electric Rigid Steel Conduit (ERSC).

30

b. C80.3, Steel Electrical Metallic Tubing (EMT).

31

c. C80.5, Electrical Aluminum Rigid Conduit.

32

d. OS 1, Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

33

6. National Fire Protection Association (NFPA):

34

a. 70, National Electrical Code (NEC).

35

7. Underwriters Laboratories, Inc. (UL):

36

a. 1, Standard for Flexible Metal Conduit.

37

b. 6, Standard for Electrical Rigid Metal Conduit - Steel.

38

c. 50, Enclosures for Electrical Equipment, Non-Environmental Considerations.

39

d. 360, Standard for Liquid-Tight Flexible Steel Conduit.

40

e. 467, Grounding and Bonding Equipment.

41

f. 514A, Metallic Outlet Boxes.

42

g. 514B, Conduit, Tubing, and Cable Fittings.

43

h. 797, Electrical Metallic Tubing - Steel.

44

i. 870, Standard for Wireways, Auxiliary Gutters, and Associated Fittings.

45

1 **1.3 SUBMITTALS**

2 A. Shop Drawings:

- 3 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of  
4 the submittal process.  
5 2. Product technical data:  
6 a. Provide submittal data for all products specified in PART 2 of this Specification  
7 Section except:  
8 1) Conduit fittings.  
9 2) Support systems.  
10 b. See Specification Section 26 05 00 for additional requirements.

11 **1.4 DELIVERY, STORAGE, AND HANDLING**

- 12 A. See Specification Section 26 05 00.

13 **PART 2 - PRODUCTS**

14 **2.1 MANUFACTURERS**

- 15 A. Subject to compliance with the Contract Documents, the following manufacturers are  
16 acceptable:

- 17 1. Rigid metal conduits and electrical metallic tubing:  
18 a. Allied Tube and Conduit Corporation.  
19 b. Triangle PWC Inc.  
20 c. Western Tube and Conduit Corporation.  
21 d. Wheatland Tube Company.  
22 e. EASCO Aluminum.  
23 f. Indalex.  
24 g. VAW of American, Inc.  
25 2. Flexible conduit:  
26 a. AFC Cable Systems.  
27 b. Anamet, Inc.  
28 c. Electri-Flex.  
29 d. International Metal Hose Company.  
30 e. Southwire Company.  
31 3. Wireway:  
32 a. Hoffman Engineering Company.  
33 b. Wiegmann.  
34 c. Square D.  
35 4. Conduit fittings and accessories:  
36 a. Appleton Electric Co.  
37 b. Carlon.  
38 c. Cantex.  
39 d. Crouse-Hinds.  
40 e. Killark.  
41 f. Osburn Associates.  
42 g. OZ Gedney Company.  
43 h. RACO.  
44 i. Steel City.  
45 j. Thomas & Betts.  
46 5. Support systems:  
47 a. Unistrut Building Systems.  
48 b. Eaton B-Line.  
49 c. Kindorf.  
50 d. Minerallac Fastening Systems.  
51 e. Caddy.

- 1 f. Thomas & Betts Superstrut.
  - 2 6. Outlet, pull and junction boxes:
  - 3 a. Appleton Electric Co.
  - 4 b. Eaton Crouse-Hinds.
  - 5 c. Killark.
  - 6 d. O-Z/Gedney.
  - 7 e. Thomas & Betts Steel City.
  - 8 f. Raco.
  - 9 g. Bell.
  - 10 h. Hoffman Engineering Co.
  - 11 i. Wiegmann.
  - 12 j. Eaton B-Line.
  - 13 k. Adalet.
  - 14 l. Rittal.
  - 15 m. Stahlin.
- 16 B. Submit request for substitution in accordance with Specification Section 01 25 13.

## 17 **2.2 RIGID METAL CONDUITS**

- 18 A. Rigid Aluminum Conduit (RAC):
- 19 1. AA Type 6063 aluminum alloy, T-1 temper.
- 20 2. Maximum copper content of 0.10 PCT.
- 21 3. Extruded, seamless.
- 22 4. Standards: NFPA 70 Type RMC, NEMA/ANSI C80.5, UL 6.
- 23 B. Electrical Metallic Tubing (EMT)
- 24 1. Mild steel with continuous welded seam.
- 25 2. Metallic zinc applied by hot-dip galvanizing or electro-galvanizing.
- 26 3. Internal coating: Baked lacquer, varnish, or enamel for a smooth surface.
- 27 4. Standards: NFPA 70 Type EMT, NEMA/ANSI C80.3, UL 797.

## 28 **2.3 FLEXIBLE CONDUIT**

- 29 A. PVC-Coated Flexible Galvanized Steel (liquid-tight) Conduit (FLEX-LT):
- 30 1. Core formed of continuous, spiral wound, hot-dip galvanized steel strip with successive
- 31 convolutions securely interlocked.
- 32 2. Extruded PVC outer jacket positively locked to the steel core.
- 33 3. Liquid and vaportight.
- 34 4. Standard: NFPA 70 Type LFMC, UL 360.

## 35 **2.4 WIREWAY**

- 36 A. General:
- 37 1. Suitable for lay-in conductors.
- 38 2. Designed for continuous grounding.
- 39 3. Covers:
- 40 a. Hinged or removable in accessible areas.
- 41 b. Non-removable when passing through partitions.
- 42 4. Finish: Rust inhibiting primer and manufacturers standard paint inside and out except for
- 43 stainless steel type.
- 44 5. Standards: UL 870, NEMA 250.
- 45 B. Watertight (NEMA 4X rated) Wireway:
- 46 1. 14 GA Type 304 or 316 stainless steel bodies and covers without knockouts and 10 GA
- 47 stainless steel flanges.
- 48 2. Cover: Fully gasketed and held in place with captive clamp type latches.
- 49 3. Flanges: Fully gasketed and bolted.

- 1 C. Dusttight (NEMA 12 rated) Wireway:
- 2 1. 14 GA steel bodies and covers without knockouts and 10 GA steel flanges.
- 3 2. Cover: Fully gasketed and held in place with captive clamp type latches.
- 4 3. Flanges: Fully gasketed and bolted.

## 5 2.5 CONDUIT FITTINGS AND ACCESSORIES

### 6 A. Fittings for Use with RGS and RAC:

- 7 1. General:
- 8 2. Locknuts:
  - 9 a. Threaded steel or malleable iron.
  - 10 b. Gasketed or non-gasketed.
  - 11 c. Grounding or non-grounding type.
- 12 3. Bushings:
  - 13 a. Threaded, insulated metallic.
  - 14 b. Grounding or non-grounding type.
- 15 4. Hubs: Threaded, insulated and gasketed metallic for raintight connection.
- 16 5. Couplings:
  - 17 a. Threaded straight type: Same material and finish as the conduit with which they are
  - 18 used on.
  - 19 b. Threadless type: Gland compression or self-threading type, concrete tight.
- 20 6. Unions: Threaded galvanized steel or zinc plated malleable iron.
- 21 7. Conduit bodies (ells and tees):
  - 22 a. Body: Zinc plated cast iron or cast copper free aluminum with threaded hubs.
  - 23 b. Standard and mogul size.
  - 24 c. Cover:
    - 25 1) Clip-on type with stainless steel screws.
    - 26 2) Gasketed or non-gasketed galvanized steel, zinc plated cast iron or cast copper free
    - 27 aluminum.
- 28 8. Expansion couplings:
  - 29 a. 2 IN nominal straight-line conduit movement in either direction.
  - 30 b. Galvanized steel with insulated bushing.
  - 31 c. Gasketed for wet locations.
  - 32 d. Internally or externally grounded.
- 33 9. Expansion/deflection couplings:
  - 34 a. 3/4 IN nominal straight-line conduit movement in either direction.
  - 35 b. 30-degree nominal deflection from the normal in all directions.
  - 36 c. Metallic hubs, neoprene outer jacket and stainless steel jacket clamps.
  - 37 d. Internally or externally grounded.
  - 38 e. Watertight, raintight and concrete tight.
- 39 10. Standards: UL 467, UL 514B, UL 886.

### 40 B. Fittings for Use with EMT:

- 41 1. Connectors:
  - 42 a. Straight, angle and offset types furnished with locknuts.
  - 43 b. Zinc plated steel.
  - 44 c. Insulated gland compression type.
  - 45 d. Concrete and raintight.
- 46 2. Couplings:
  - 47 a. Zinc plated steel.
  - 48 b. Gland compression type.
  - 49 c. Concrete and raintight.
- 50 3. Conduit bodies (ells and tees):
  - 51 a. Body: Copper free aluminum with threaded hubs.
  - 52 b. Standard and mogul size.
  - 53 c. Cover:
    - 54 1) Screw down type with steel screws.

- 1                   2) Gasketed or non-gasketed galvanized steel or copper free aluminum.  
2                   4. Standard: UL 514B.
- 3                   C. Fittings for Use with FLEX-LT:  
4                   1. Connector:  
5                   a. Straight or angle type.  
6                   b. Metal construction, insulated and gasketed.  
7                   c. Composed of locknut, grounding ferrule and gland compression nut.  
8                   d. Liquid tight.  
9                   2. Standards: UL 467, UL 514B.
- 10                  D. Weather and Corrosion Protection Tape:  
11                  1. PVC based tape, 10 mils thick.  
12                  2. Protection against moisture, acids, alkalis, salts and sewage and suitable for direct bury.  
13                  3. Used with appropriate pipe primer.

## 14   **2.6 ALL RACEWAY AND FITTINGS**

- 15                  A. Mark Products:  
16                  1. Identify the nominal trade size on the product.  
17                  2. Stamp with the name or trademark of the manufacturer.

## 18   **2.7 OUTLET BOXES**

- 19                  A. Cast Outlet Boxes:  
20                  1. Die-cast copper free aluminum with manufacturers standard finish.  
21                  2. Threaded hubs and grounding screw.  
22                  3. Styles:  
23                  a. "FS" or "FD".  
24                  b. "Bell".  
25                  c. Single or multiple gang and tandem.  
26                  d. "EDS" or "EFS" for hazardous locations.  
27                  4. Accessories: 40 MIL PVC exterior coating and 2 MIL urethane interior coating.  
28                  5. Standards: UL 514A, UL 886.

## 29   **2.8 PULL AND JUNCTION BOXES**

- 30                  A. NEMA 4X Rated (metallic):  
31                  1. Body and cover: 14 GA Type 304 or 316 stainless steel.  
32                  2. Seams continuously welded and ground smooth.  
33                  3. No knockouts.  
34                  4. External mounting flanges.  
35                  5. Hinged door and stainless steel screws and clamps.  
36                  6. Door with oil-resistant gasket.
- 37                  B. NEMA 12 Rated:  
38                  1. Body and cover:  
39                  a. 14 GA steel finished with rust inhibiting primer and manufacturers standard paint inside  
40                  and out.  
41                  b. Type 5052 H-32 aluminum, unpainted.  
42                  2. Seams continuously welded and ground smooth.  
43                  3. No knockouts.  
44                  4. External mounting flanges.  
45                  5. Non-hinged cover held closed with captivated cover screws threaded into sealed wells or  
46                  hinged cover held closed with stainless steel screws and clamps.  
47                  6. Flat door with oil resistant gasket.
- 48                  C. Miscellaneous Accessories:  
49                  1. Rigid handles for covers larger than 9 SQFT or heavier than 25 LBS.  
50                  2. Split covers when heavier than 25 LBS.

- 1           3. Weldnuts for mounting optional panels and terminal kits.
- 2           4. Terminal blocks: Screw-post barrier-type, rated 600 volt and 20 ampere minimum.
- 3           D. Standards: NEMA 250, UL 50.

4   **2.9 SUPPORT SYSTEMS**

- 5           A. Multi-conduit Surface or Trapeze Type Support and Pull or Junction Box Supports:
  - 6           1. Material requirements.
    - 7           a. Galvanized steel: ASTM A123/A123M or ASTM A153/A153M.
    - 8           b. Stainless steel: AISI Type 316.
    - 9           c. Aluminum: AA Type 6063-T6.
- 10          B. Single Conduit and Outlet Box Support Fasteners:
  - 11          1. Material requirements:
    - 12          a. Zinc plated steel.
    - 13          b. Stainless steel.
    - 14          c. Malleable iron.
    - 15          d. PVC coat malleable iron or steel: 20 MIL PVC coating.
    - 16          e. Steel protected with zinc phosphate and oil finish.

17   **2.10 OPENINGS AND PENETRATIONS IN WALLS AND FLOORS**

- 18          A. Sleeves, smoke and fire stop fitting through walls and floors:
  - 19          1. See Specification Section 01 73 20.

20   **PART 3 - EXECUTION**

21   **3.1 RACEWAY INSTALLATION - GENERAL**

- 22          A. Shall be in accordance with the requirements of:
  - 23          1. NFPA 70.
  - 24          2. Manufacturer instructions.
- 25          B. Size of Raceways:
  - 26          1. Raceway sizes are shown on the Drawings, if not shown on the Drawings, then size in
  - 27          accordance with NFPA 70.
  - 28          2. Unless specifically indicated otherwise, the minimum raceway size shall be:
    - 29          a. Conduit: 3/4 IN.
    - 30          b. Wireway: 2-1/2 IN x 2-1/2 IN.
- 31          C. Field Bending and Cutting of Conduits:
  - 32          1. Utilize tools and equipment recommended by the manufacturer of the conduit, designed for
  - 33          the purpose and the conduit material to make all field bends and cuts.
  - 34          2. Do not reduce the internal diameter of the conduit when making conduit bends.
  - 35          3. Prepare tools and equipment to prevent damage to the PVC coating.
  - 36          4. Degrease threads after threading and apply a zinc rich paint.
  - 37          5. Debur interior and exterior after cutting.
- 38          D. Male threads of conduit systems shall be coated with an electrically conductive anti-seize
- 39          compound.
- 40          E. The protective coating integrity of conduits, fittings, outlet, pull and junction boxes and
- 41          accessories shall be maintained.
  - 42          1. Repair galvanized components utilizing a zinc rich paint.
  - 43          2. Repair painted components utilizing touch up paint provided by or approved by the
  - 44          manufacturer.
  - 45          3. Repair surfaces which will be inaccessible after installation prior to installation.



- 1 F. Remove moisture and debris from conduit before wire is pulled into place.
- 2 1. Pull mandrel with diameter nominally 1/4 IN smaller than the interior of the conduit, to
- 3 remove obstructions.
- 4 2. Swab conduit by pulling a clean, tight-fitting rag through the conduit.
- 5 3. Tightly plug ends of conduit with tapered wood plugs or plastic inserts until wire is pulled.
- 6 G. Only nylon or polyethylene rope shall be used to pull wire and cable in conduit systems.
- 7 H. Where portions of a raceway are subject to different temperatures and where condensation is
- 8 known to be a problem, as in cold storage areas of buildings or where passing from the interior
- 9 to the exterior of a building, the raceway shall be sealed to prevent circulation of warm air to
- 10 colder section of the raceway.
- 11 I. Fill openings in walls, floors, and ceilings and finish flush with surface.
- 12 1. See Specification Section 01 73 20.

### 13 3.2 RACEWAY ROUTING

- 14 A. Raceways shall be routed in the field unless otherwise indicated.
- 15 1. Conduit and fittings shall be installed, as required, for a complete system that has a neat
- 16 appearance and is in compliance with all applicable codes.
- 17 2. Run in straight lines parallel to or at right angles to building lines.
- 18 3. Do not route conduits:
- 19 a. Through areas of high ambient temperature or radiant heat.
- 20 b. In suspended concrete slabs.
- 21 c. In concrete members including slabs, slabs on grade, beams, walls, and columns unless
- 22 specifically located and detailed on structural Drawings.
- 23 4. Locate sleeves or conduits penetrating floors, walls, and beams so as not to significantly
- 24 impair the strength of the construction. Do not place conduit penetrations in columns.
- 25 5. Conduit shall not interfere with, or prevent access to, piping, valves, ductwork, or other
- 26 equipment for operation, maintenance and repair.
- 27 6. Provide pull boxes or conduit bodies as needed so that there is a maximum of 360 DEG of
- 28 bends in the conduit run or in long straight runs to limit pulling tensions.
- 29 B. All conduits within a structure shall be installed exposed except as follows:
- 30 1. As indicated on the Drawings.
- 31 2. Concealed above gypsum wall board or acoustical tile suspended ceilings.
- 32 C. Maintain minimum spacing between parallel conduit and piping runs in accordance with the
- 33 following when the runs are greater than 30 FT:
- 34 1. Between process, gas, air and water pipes: 6 IN.
- 35 D. Conduits shall be installed to eliminate moisture pockets.
- 36 1. Where water cannot drain to openings, provide drain fittings in the low spots of the conduit
- 37 run.
- 38 E. Conduit shall not be routed on the exterior of structures except as specifically indicated on the
- 39 Drawings.
- 40 F. Where sufficient room exists within the housing of roof-mounted equipment, the conduit shall
- 41 be stubbed up inside the housing.
- 42 G. Provide all required openings in walls, floors, and ceilings for conduit penetration.
- 43 1. See Specification Section 01 73 20.

### 44 3.3 RACEWAY APPLICATIONS

- 45 A. Permitted Raceway Types Per Wire or Cable Types:
- 46 1. Power wire or cables: All raceway types.
- 47 2. Telecommunication cables: All raceway types.
- 48 B. Permitted Raceway Types Per Area Designations:

1. Dry areas:
    - a. RGS.
    - b. RAC.
  2. Wet areas:
    - a. RAC.
- C. Permitted Raceway Types Per Routing Locations:
1. In stud framed walls:
    - a. EMT.
  2. Above acoustical tile ceilings:
    - a. EMT.
- D. FLEX-LT conduits shall be install as the final conduit connection to light fixtures, dry type transformers, motors, electrically operated valves, instrumentation primary elements, and other electrical equipment that is liable to vibrate.
1. The maximum length shall not exceed:
    - a. 6 FT to light fixtures.
    - b. 3 FT to motors.
    - c. 2 FT to all other equipment.
- E. NEMA 4X Rated Wireway:
1. Surface mounted in areas designated as wet.
- F. NEMA 12 Rated Wireway:
1. Surface mounted in areas designated as dry in architecturally and non-architecturally finished areas.

### 3.4 CONDUIT FITTINGS AND ACCESSORIES

- A. Rigid nonmetallic conduit and fittings shall be joined utilizing solvent cement.
1. Immediately after installation of conduit and fitting, the fitting or conduit shall be rotated 1/4 turn to provide uniform contact.
- B. Install Expansion/Deflection Fittings:
1. Where conduits enter a structure.
  2. Where conduits span structural expansions joints.
  3. Elsewhere as identified on the Drawings.
- C. Threaded connections shall be made wrench-tight.
- D. Conduit joints shall be watertight:
1. Where subjected to possible submersion.
  2. In areas classified as wet.
  3. Underground.
- E. Terminate Conduits:
1. In metallic outlet boxes:
    - a. RGS and RAC:
      - 1) Conduit hub and locknut.
      - 2) Insulated bushing and two (2) locknuts.
      - 3) Use grounding type locknut or bushing when required by NFPA 70.
    - b. EMT: Compression type connector and locknut.
  2. In NEMA 12 rated enclosures:
    - a. Watertight, insulated and gasketed hub and locknut.
    - b. Use grounding type locknut or bushing when required by NFPA 70.
  3. In NEMA NEMA 4X rated enclosures:
    - a. Watertight, insulated and gasketed hub and locknut.
  4. When stubbed up through the floor into floor mount equipment:
    - a. With an insulated grounding bushing on metallic conduits.
    - b. With end bells on nonmetallic conduits.

- 1 F. Threadless couplings shall only be used to join new conduit to existing conduit when the  
2 existing conduit end is not threaded and it is not practical or possible to cut threads on the  
3 existing conduit with a pipe threader.

### 4 3.5 CONDUIT SUPPORT

- 5 A. Permitted multi-conduit surface or trapeze type support system per area designations and conduit  
6 types:

- 7 1. Dry or wet areas:  
8 a. Galvanized system consisting of: Galvanized steel channels and fittings, nuts and  
9 hardware and conduit clamps.  
10 b. Aluminum system consisting of: Aluminum channels, fittings and conduit clamps with  
11 stainless steel nuts and hardware.  
12 2. Conduit type shall be compatible with the support system material.  
13 a. Galvanized steel system may be used with RGS and EMT.  
14 b. Stainless steel system may be used with RGS and RAC.  
15 c. Aluminum system may be used with RAC.

- 16 B. Permitted single conduit support fasteners per area designations and conduit types:

- 17 1. Dry or wet areas:  
18 a. Material: Zinc plated steel, stainless steel and malleable iron.  
19 b. Types of fasteners: Straps, hangers with bolts, clamps with bolts and bolt on beam  
20 clamps.  
21 2. Conduit type shall be compatible with the support fastener material.  
22 a. Zinc plated steel, steel protected with zinc phosphate and oil finish and malleable iron  
23 fasteners may be used with RGS and EMT.  
24 b. Stainless steel system may be used with RGS and RAC.

- 25 C. Conduit Support General Requirements:

- 26 1. Maximum spacing between conduit supports per NFPA 70.  
27 2. Support conduit from the building structure.  
28 3. Do not support conduit from process, gas, air or water piping; or from other conduits.  
29 4. Provide hangers and brackets to limit the maximum uniform load on a single support to  
30 25 LBS or to the maximum uniform load recommended by the manufacturer if the support  
31 is rated less than 25 LBS.  
32 a. Do not exceed maximum concentrated load recommended by the manufacturer on any  
33 support.  
34 b. Conduit hangers:  
35 1) Continuous threaded rods combined with struts or conduit clamps: Do not use  
36 perforated strap hangers and iron bailing wire.  
37 c. Do not use suspended ceiling support systems to support raceways.  
38 d. Hangers in metal roof decks:  
39 1) Utilize fender washers.  
40 2) Not extend above top of ribs.  
41 3) Not interfere with vapor barrier, insulation, or roofing.  
42 5. Conduit support system fasteners:  
43 a. Use sleeve-type expansion anchors as fasteners in masonry wall construction.  
44 b. Do not use concrete nails and powder-driven fasteners.

### 45 3.6 OUTLET, PULL AND JUNCTION BOX INSTALLATION

- 46 A. General:

- 47 1. Install products in accordance with manufacturer's instructions.  
48 2. See Specification Section 26 05 00 and the Drawings for area classifications.  
49 3. Fill unused punched-out, tapped, or threaded hub openings with insert plugs.  
50 4. Size boxes to accommodate quantity of conductors enclosed and quantity of conduits  
51 connected to the box.

- 1 B. Outlet Boxes:
- 2 1. Permitted uses of cast outlet boxes:
- 3 a. Housing of wiring devices surface mounted in non-architecturally finished dry areas.
- 4 b. Pull and junction box surface mounted in non-architecturally finished dry areas.
- 5 2. Mount device outlet boxes where indicated on the Drawings and at heights as scheduled in
- 6 Specification Section 26 05 00.
- 7 3. Set device outlet boxes plumb and vertical to the floor.
- 8 4. Outlet boxes recessed in walls:
- 9 a. Install with appropriate stud wall support brackets or adjustable bar hangers so that they
- 10 are flush with the face of the wall.
- 11 5. Place barriers between switches in boxes with 277 V switches on opposite phases.
- 12 6. Back-to-back are not permitted.
- 13 C. Pull and Junction Boxes:
- 14 1. Install pull or junction boxes in conduit runs where indicated or required to facilitate pulling
- 15 of wires or making connections.
- 16 a. Make covers of boxes accessible.
- 17 2. Permitted uses of NEMA 4X metallic enclosure:
- 18 a. Pull or junction box surface mounted in areas designated as wet.
- 19 3. Permitted uses of NEMA 12 enclosure:
- 20 a. Pull or junction box surface mounted in areas designated as dry.

21

**END OF SECTION**

1 2018/02/09

2

## SECTION 26 24 19

3

### MOTOR CONTROL EQUIPMENT

#### 4 PART 1 - GENERAL

##### 5 1.1 SUMMARY

6

###### A. Section Includes:

7

1. Separately mounted motor starters (including those supplied with equipment).

8

###### B. Related Specification Sections include but are not necessarily limited to:

9

1. Division 00 - Procurement and Contracting Requirements.

10

2. Division 01 - General Requirements.

11

3. Section 26 05 00 - Electrical: Basic Requirements.

12

4. Section 26 28 00 - Overcurrent and Short Circuit Protective Devices.

13

##### 1.2 QUALITY ASSURANCE

14

###### A. Referenced Standards:

15

1. International Electrotechnical Commission (IEC).

16

2. National Electrical Manufacturers Association (NEMA):

17

- a. 250, Enclosures for Electrical Equipment (1000 Volt Maximum).

18

- b. ICS 2, Controllers, Contactors and Overload Relays Rated 600 V.

19

3. Underwriters Laboratories, Inc. (UL):

20

- a. 508, Standard for Industrial Control Equipment.

21

###### B. Miscellaneous:

22

1. Verify motor horsepower loads, other equipment loads, and controls from approved shop drawings and notify Engineer of any discrepancies.

23

2. Verify the required instrumentation and control wiring for a complete system and notify Engineer of any discrepancies.

24

25

26

##### 1.3 SUBMITTALS

27

###### A. Shop Drawings:

28

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

29

2. Product technical data:

30

- a. Provide submittal data for all products specified in PART 2 of this Specification Section.

31

- b. See Specification Section 26 05 00 for additional requirements.

32

33

3. Fabrication and/or layout drawings:

34

- a. Separately mounted combination starters:

35

- 1) Unit ladder logic wiring for each unit depicting electrical wiring and identification of terminals where field devices or remote control signals are to be terminated as indicated on the Drawings and/or loop descriptions.

36

37

38

39

###### B. Contract Closeout Information:

40

1. Operation and Maintenance Data:

41

- a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

42

- b. Fabrication and/or layout drawings updated with as-built conditions.

43

44

###### C. Informational Submittals:

45

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

46

2. Service equipment marking and documentation.

47

1 **PART 2 - PRODUCTS**

2 **2.1 MANUFACTURERS**

- 3 A. Subject to compliance with the Contract Documents, the following manufacturers are  
4 acceptable:  
5 1. Allen-Bradley.  
6 2. Eaton.  
7 3. General Electric Company.  
8 4. Square D Company.  
9 5. Siemens.
- 10 B. Submit request for substitution in accordance with Specification Section 01 25 13.

11 **2.2 SEPARATELY MOUNTED COMBINATION STARTERS**

- 12 A. Standards:  
13 1. NEMA 250, NEMA ICS 2.  
14 2. UL 508.
- 15 B. Enclosure:  
16 1. NEMA 12 rated:  
17 a. Body and cover: Sheet steel finished with rust inhibiting primer and manufacturer's  
18 standard paint inside and out.  
19 b. No knockouts, external mounting flanges, hinged and gasketed door.
- 20 C. Operating Handle:  
21 1. With the door closed the handle mechanism allows complete ON/OFF control of the unit  
22 disconnect and clear indication of the disconnect status.  
23 2. Circuit breaker and MCP operators includes a separate TRIPPED position.  
24 3. Mechanical interlock to prevent to prevent the opening of the door when the disconnect is in  
25 the ON position with a defeater mechanism for use by authorized personnel.  
26 4. Mechanical interlock to prevent the placement of the disconnect in the ON position with the  
27 door open with a defeater mechanism for use by authorized personnel.  
28 5. Padlockable in the OFF position.  
29 6. Exceptions: NEMA 7 and NEMA 9 enclosures.
- 30 D. External mounted overload relay pushbutton.
- 31 E. Control Devices:  
32 1. Provide control devices as indicated on the Drawings.  
33 2. Devices will be accessible with the door closed.
- 34 F. Fault Current Withstand Rating: Equal to the rating of the electrical gear from which it is fed.
- 35 G. Motor Starters: See requirements within this Specification Section.
- 36 H. Disconnect Switch, Overcurrent and Short Circuit Protective Devices:  
37 1. Motor circuit protector.  
38 2. See Specification Section 26 28 00 for overcurrent and short circuit protective device  
39 requirements.  
40 3. Factory installed.

41 **2.3 MOTOR STARTERS**

- 42 A. Standards:  
43 1. NEMA ICS 2.  
44 2. UL 508.
- 45 B. Full Voltage Non-Reversing (FVNR) Magnetic Starters:  
46 1. NEMA full size rated contactor.  
47 a. NEMA half sizes and IEC contactors are not permitted.







2 **SECTION 26 28 00**  
3 **OVERCURRENT AND SHORT CIRCUIT PROTECTIVE DEVICES**

4 **PART 1 - GENERAL**

5 **1.1 SUMMARY**

- 6 A. Section Includes:
- 7 1. Low voltage circuit breakers.
  - 8 2. Low voltage fuses.
- 9 B. Related Specification Sections include but are not necessarily limited to:
- 10 1. Division 00 - Procurement and Contracting Requirements.
  - 11 2. Division 01 - General Requirements.
  - 12 3. Section 26 05 00 - Electrical: Basic Requirements.

13 **1.2 QUALITY ASSURANCE**

- 14 A. Referenced Standards:
- 15 1. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
    - 16 a. C37.16, Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors -
    - 17 Preferred Ratings, Related Requirements, and Application Recommendations.
    - 18 b. C37.17, Trip Devices for AC and General Purpose DC Low Voltage Power Circuit
    - 19 Breakers.
  - 20 2. National Fire Protection Association (NFPA):
    - 21 a. 70, National Electrical Code (NEC).
  - 22 3. Underwriters Laboratories, Inc. (UL):
    - 23 a. 248-12, Low-Voltage Fuses - Part 12: Class R Fuses.
    - 24 b. 489, Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches, and
    - 25 Circuit-Breaker Enclosures.
    - 26 c. 943, Standard for Safety for Ground-Fault Circuit-Interruption.
    - 27 d. 1066, Standard for Low-Voltage AC and DC Power Circuit Breakers Used in
    - 28 Enclosures.

29 **1.3 SUBMITTALS**

- 30 A. Shop Drawings:
- 31 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of
  - 32 the submittal process.
  - 33 2. Product technical data including:
    - 34 a. Provide submittal data for all products specified in PART 2 of this Specification
    - 35 Section.
    - 36 b. See Specification Section 26 05 00 for additional requirements.
- 37 B. Contract Closeout Information:
- 38 1. Operation and Maintenance Data:
    - 39 a. See Specification Section 01 33 04 for requirements for the mechanics, administration,
    - 40 and the content of Operation and Maintenance Manual submittals.

1 **PART 2 - PRODUCTS**

2 **2.1 MANUFACTURERS**

- 3 A. Subject to compliance with the Contract Documents, the following manufacturers are  
4 acceptable:
- 5 1. Circuit breakers:
    - 6 a. Match existing equipment.
    - 7 2. Fuses:
      - 8 a. Eaton Bussmann, Inc.
      - 9 b. Littelfuse, Inc.
      - 10 c. Mersen
  - 11 B. Submit request for substitution in accordance with Specification Section 01 25 13.

12 **2.2 CIRCUIT BREAKERS**

- 13 A. Molded Case Type:
- 14 1. General:
    - 15 a. Standards: UL 489.
    - 16 b. Unit construction.
    - 17 c. Over-center, toggle handle operated.
    - 18 d. Quick-make, quick-break, independent of toggle handle operation.
    - 19 e. Manual and automatic operation.
    - 20 f. All poles open and close simultaneously.
    - 21 g. Three (3) position handle: On, off and tripped.
    - 22 h. Molded-in ON and OFF markings on breaker cover.
    - 23 i. One-, two- or three-pole as indicated on the Drawings.
    - 24 j. Current and interrupting ratings as indicated on the Drawings.
    - 25 k. Bolt on type.
  - 26 2. Thermal magnetic type:
    - 27 a. Inverse time overload and instantaneous short circuit protection by means of a thermal  
28 magnetic element.
    - 29 b. Frame size 150 amp and below:
      - 30 1) Non-interchangeable, non-adjustable thermal magnetic trip units.
      - 31 c. Frame sizes 225 to 400 amp (trip settings less than 400A):
        - 32 1) Interchangeable and adjustable instantaneous thermal magnetic trip units.
        - 33 d. Ground Fault Circuit Interrupter (GFCI) Listed:
          - 34 1) Standard: UL 943.
          - 35 2) One- or two-pole as indicated on the Drawings.
          - 36 3) Class A ground fault circuit.
          - 37 4) Trip on 5 mA ground fault (4-6 mA range).

38 **2.3 FUSES**

- 39 A. UL Class RK-1 fuses:
- 40 1. Standard: UL 248-1 and UL 248-12.
  - 41 2. Single-element fast-acting and current limiting rejection type.
  - 42 3. Dual-element time-delay and current limiting rejection type.
  - 43 4. Ratings: 250 and 600 V, 1/10-600 amps and 200,000 RMS AIC symmetrical.

44 **PART 3 - EXECUTION**

45 **3.1 INSTALLATION**

- 46 A. Current and interrupting ratings as indicated on the Drawings.
- 47 B. Series rated systems not acceptable.
- 48 C. Devices shall be ambient temperature compensated.

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D. Circuit Breakers:

1. Molded case circuit breakers shall incorporate the following, unless indicated otherwise on the Drawings:
  - a. Frame sizes 400 amp and less with trip setting less than 400A shall be thermal magnetic type.

E. Fuses:

1. UL Class RK-1 (fast acting): Use where indicated.
2. UL Class RK-1 (dual element): Use for motor feeder and branch circuit devices.

**END OF SECTION**



1 2018/02/09

2 **SECTION 26 28 16**  
3 **SAFETY SWITCHES**

4 **PART 1 - GENERAL**

5 **1.1 SUMMARY**

- 6 A. Section Includes:
- 7 1. Safety switches.
  - 8 2. Manual motor starters.
- 9 B. Related Specification Sections include but are not necessarily limited to:
- 10 1. Division 00 - Procurement and Contracting Requirements.
  - 11 2. Division 01 - General Requirements.
  - 12 3. Section 26 05 00 - Electrical: Basic Requirements.
  - 13 4. Section 26 28 00 - Overcurrent and Short Circuit Protective Devices.

14 **1.2 QUALITY ASSURANCE**

- 15 A. Referenced Standards:
- 16 1. National Electrical Manufacturers Association (NEMA):
    - 17 a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
    - 18 b. KS 1, Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts  
19 Maximum).
    - 20 c. ICS 2, Controllers, Contactors and Overload Relays Rated 600 V.
  - 21 2. Underwriters Laboratories, Inc. (UL):
    - 22 a. 98, Enclosed and Dead-Front Switches.
    - 23 b. 508, Standard for Industrial Control Equipment.

24 **1.3 SUBMITTALS**

- 25 A. Shop Drawings:
- 26 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of  
27 the submittal process.
  - 28 2. Product technical data:
    - 29 a. Provide submittal data for all products specified in PART 2 of this Specification  
30 Section.
    - 31 b. Provide a Summary Table or use Exhibit A that associates the safety switch features  
32 with connected equipment tag number. Exhibit A indicates minimum data required.
    - 33 c. See Specification Section 26 05 00 for additional requirements.

34 **PART 2 - PRODUCTS**

35 **2.1 MANUFACTURERS**

- 36 A. Subject to compliance with the Contract Documents, the following safety switch manufacturers  
37 are acceptable:
- 38 1. Eaton
  - 39 2. General Electric Company.
  - 40 3. Square D Company.
  - 41 4. Siemens.
  - 42 5. Appleton Electric Company.
  - 43 6. Crouse-Hinds.
  - 44 7. Killark.

1 **2.2 SAFETY SWITCHES**

2 A. General:

- 3 1. Non-fusible or fusible as indicated on the Drawings.
- 4 2. Suitable for service entrance when required.
- 5 3. NEMA Type HD heavy-duty construction.
- 6 4. Switch blades will be fully visible in the OFF position with the enclosure door open.
- 7 5. Quick-make/quick-break operating mechanism.
- 8 6. Deionizing arc chutes.
- 9 7. Manufacture double-break rotary action shaft and switchblade as one (1) common
- 10 component.
- 11 8. Clear line shields to prevent accidental contact with line terminals.
- 12 9. Operating handle:
  - 13 a. Red and easily recognizable.
  - 14 b. Padlockable in the OFF position.
  - 15 c. Interlocked to prevent door from opening when the switch is in the ON position with a
  - 16 defeater mechanism.

17 B. Ratings:

- 18 1. Horsepower rated of connected motor.
- 19 2. Voltage and amperage: As indicated on the Drawings.
- 20 3. Short circuit withstand:
  - 21 a. Non-fused: 10,000A.
  - 22 b. Fused: 200,000A.

23 C. Accessories, when indicated in PART 3 of this Specification Section or on the Drawings:

- 24 1. Neutral kits.
- 25 2. Ground lug kits.

26 D. Enclosures:

- 27 1. NEMA 4X rated (metallic):
  - 28 a. Body and cover: Type 304 or 316 stainless steel.
  - 29 b. No knockouts, external mounting flanges, hinged and gasketed door.
- 30 2. NEMA 12 rated:
  - 31 a. Body and cover: Sheet steel finished with rust inhibiting primer and manufacturers
  - 32 standard paint inside and out.
  - 33 b. No knockouts, external mounting flanges, hinged and gasketed door.

34 E. Overcurrent and short circuit protective devices:

- 35 1. Fuses.
- 36 2. See Specification Section 26 28 00 for overcurrent and short circuit protective device
- 37 requirements.

38 F. Standards: NEMA KS 1, UL 98.

39 **2.3 MANUAL MOTOR STARTERS**

40 A. Standards:

- 41 1. NEMA 250, NEMA ICS 2.
- 42 2. UL 508.

43 B. Quick-make, quick-break toggle mechanism that is lockable in the OFF position.

44 C. Types:

- 45 1. Horsepower rated, for ON/OFF control.
- 46 2. Horsepower rated, for ON/OFF control and thermal overload protection.
  - 47 a. Switch to clearly indicate ON, OFF, and TRIPPED position.

48 D. Voltage and current ratings and number of poles as required for the connected motor.

- 1 E. Enclosures:
- 2 1. NEMA 4X rated:
- 3 a. Type 304 or 316 stainless steel.
- 4 b. No knockouts, external mounting flanges.
- 5 2. NEMA 12 rated:
- 6 a. Body and cover: Sheet steel finished with rust inhibiting primer and manufacturer's
- 7 standard paint inside and out.
- 8 b. No knockouts, external mounting flanges.

9 **PART 3 - EXECUTION**

10 **3.1 INSTALLATION**

- 11 A. Install as indicated and in accordance with manufacturer's instructions and recommendations.
- 12 B. Install switches adjacent to the equipment they are intended to serve unless otherwise indicated
- 13 on the Drawings.
- 14 C. Permitted uses of NEMA 4X nonmetallic enclosure:
- 15 1. Surface mounted in exterior areas.
- 16 D. Permitted uses of NEMA 12 enclosure:
- 17 1. Surface mounted in areas designated as dry.
- 18 E. Manual Starter Enclosures:
- 19 1. Permitted uses of NEMA 4X enclosure:
- 20 a. Surface mounted in areas designated as wet.
- 21 2. Permitted uses of NEMA 12 enclosure:
- 22 a. Surface mounted in areas designated as dry.

23 **END OF SECTION**

24

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