

DATE: 05-13-2020

HURST-ROSCHE, INC.  
1400 E. Tremont Street  
Hillsboro, Illinois 62049  
217-532-3959

TO: PROSPECTIVE BIDDERS

SUBJECT: ADDENDUM NO. 1 TO THE BIDDING DOCUMENTS FOR

**NEW WELL NO. 7 & WELL HOUSE RENOVATION**  
**VILLAGE OF RAYMOND**  
**RAYMOND, MONTGOMERY COUNTY, ILLINOIS**  
**HR # 170-0868**

This addendum forms a part of the bidding and contract documents and modifies the original bidding documents dated April 17, 2020. Acknowledge receipt of this addendum in the space provided on the Bid Form. **FAILURE TO DO SO MAY SUBJECT BIDDER TO DISQUALIFICATION.**

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Upon receipt of this addendum, please sign below and email to Hurst-Rosche, Inc. at [shunt@hurst-rosche.com](mailto:shunt@hurst-rosche.com) within 24 hours of receipt.

|                     |                                        |
|---------------------|----------------------------------------|
| <b>RECEIVED BY:</b> | _____                                  |
|                     | Company Name/Authorized Representative |
| <b>DATE:</b>        | _____                                  |

**SPECIFICATIONS**

- A. Section 00 11 16 – Invitation to Bid
  - 1. 00 11 16-2, Construction Schedule:
    - i. **DELETE** “30 days” under Bid Package A Alternate Bid work and **REPLACE** with “60 days”.
- B. Section 00 21 14 – Instructions to Bidders
  - 1. 00 21 14-6, Paragraph 1.4.DD.b:
    - i. **DELETE** “30 days” under Bid Package A Alternate Bid work and **REPLACE** with “60 days”.

This addendum consists of 5 pages and 3 attachments consisting of 35 additional pages.

- C. Section 00 52 14 – Agreement Form
  - 1. 00 52 14-1, Paragraph 1.2.C.1:
    - i. **DELETE** this paragraph in its entirety. No liquidated damages are in these contracts.
  - 2. 00 52 14-2, Paragraph 1.2.C – Construction Schedule:
    - i. **DELETE** “30 days” under Bid Package A Alternate Bid work and **REPLACE** with “60 days”.
  
- D. Section 01 50 00 – Temporary Facilities and Controls
  - 1. 01 50 00-1, Paragraph 1.2.A:
    - i. **CLARIFICATION:** Plan Sheet C1.1 refers to Contractor providing temporary power under their base bid. This isn’t intended for the Contractor to provide a separate electrical meter and pay for the electrical costs, it is just stating that we would like the temporary power and pump installed by the Contractor so that the Village can utilize it to flush the well if the original bacteriological samples don’t come back satisfactory. The temporary power can be extended from the existing well house under the Village’s existing meter.
  
- E. Section 08 91 19 – Fixed Louvers
  - 1. **ADD** Attachment No. 1 to Addendum #1 – Fixed Louver specification to the project specifications
  
- F. Section 22 11 00 – Facility Water Distribution
  - 1. **DELETE** this specification section in its entirety and **REPLACE** with Attachment No. 2 to Addendum #1 – Facility Water Distribution specification to the project specifications, in which the 3-inch magnetic flow meter specification was added
  
- G. Section 23 34 13 – Axial HVAC Fans
  - 1. **ADD** Attachment No. 3 to Addendum #1 – Axial HVAC Fans specification to the project specifications
  
- H. Section 33 21 00 – Water Supply Wells
  - 1. 33 21 00-1, Paragraph 1.1.A.1:
    - i. **DELETE** “54 feet” and **REPLACE** with “59 feet”.
  
- I. Section 33 21 00 – Water Supply Wells
  - 1. 33 21 00-2, Paragraph 1.3.A.2:
    - i. **DELETE** “42 feet” and **REPLACE** with “47 feet”.
  
- J. Section 33 21 00 – Water Supply Wells
  - 1. 33 21 00-5, Paragraph 2.3:
    - i. **CLARIFICATION:** Bid Package A Contractor shall supply and install the 150 gpm pump. The pump controller and pressure sensing switch shall be supplied by Bid Package A Contractor, but installed by Bid Package B Contractor.
  
- K. Section 33 21 00 – Water Supply Wells
  - 1. 33 21 00-7, Paragraph 2.5.A:
    - i. **DELETE** “13 feet” and **REPLACE** with “12 feet”.

This addendum consists of 5 pages and 3 attachments consisting of 35 additional pages.

## DRAWINGS – BID PACKAGE A:

- A. Sheet C1.1, Bidding Note #4
- i. **CLARIFICATION:** Plan Sheet C1.1 refers to Contractor providing temporary power under their base bid. This isn't intended for the Contractor to provide a separate electrical meter and pay for the electrical costs, it is just stating that we would like the temporary power and pump installed by the Contractor so that the Village can utilize it to flush the well if the original bacteriological samples don't come back satisfactory. The temporary power can be extended from the existing well house under the Village's existing meter.

## DRAWINGS – BID PACKAGE B:

- A. Sheet A1.1:
- i. **CLARIFICATION:** The foundation and floor slab under the old Well #4 doghouse portion of the building shall be removed in its entirety. The old Well #4 casing and grout in-fill shall be removed to a depth of 6-inches below the proposed finished floor slab.
- B. Sheet M1.2 – Proposed Plan
- i. **ADD** a Greenheck Model SE1-10-440 wall mounted, propeller ventilation fan centered on the north wall of the sodium hypochlorite room, installed at a height of 8' above the finished floor to the center of the unit. Contractor shall verify with the supplier the size of opening required in the masonry wall.
  - ii. **ADD** a 20" x 20" Ruskin Model ELF211D louver centered on the south wall of the sodium hypochlorite room, installed at a height of 8' above the finished floor to the center of the louver. Contractor shall verify with the supplier the size of opening required in the masonry wall.
  - iii. **ADD** a Greenheck Model SE1-10-440 ventilation fan centered between the fluoride and phosphate chemical feed equipment on the north wall of the fluoride and phosphate chemical feed room, installed at a height of 8' above the finished floor to the center of the unit. Contractor shall verify with the supplier the size of opening required in the masonry wall.
  - iv. **ADD** a 20" x 20" Model ELF211D louver centered between the fluoride and phosphate chemical feed equipment on the south wall of the fluoride and phosphate chemical feed equipment, installed at a height of 8' above the finished floor to the center of the louver. Contractor shall verify with the supplier the size of opening required in the masonry wall.
- C. Sheet M1.2 – Section A-A & Proposed Plan:
- i. **DELETE** the 6-inch meter and two 6-inch valves and **REPLACE** with a 3-inch magnetic flow meter and two 3-inch valves.
  - ii. **ADD** two 6-inch x 3-inch reducers on each side of the 3-inch valves. Reducers and valves shall be installed to provide a minimum of 5 pipe diameters (15-inches) of straight pipe run length upstream of the mag meter and 2 pipe diameters (6-inches) of straight pipe run length downstream of the mag meter.
- D. Sheet M2.1 – Section A-A & Proposed Plan:
- i. **DELETE** the 6-inch meter and two 6-inch valves and **REPLACE** with a 3-inch magnetic flow meter and two 3-inch valves.
  - ii. **ADD** two 6-inch x 3-inch reducers on each side of the 3-inch valves. Reducers and valves shall be installed to provide a minimum of 5 pipe diameters (15-inches) of straight pipe run length upstream of the mag meter and 2 pipe diameters (6-inches) of straight pipe run length downstream of the mag meter.

This addendum consists of 5 pages and 3 attachments consisting of 35 additional pages.

- E. Sheet M2.1 – Keyed Note #2:
- i. **ADD** Contractor shall provide a spare identical pump for both the phosphate and fluoride chemical feed system.
- F. Sheet M2.1 – Keyed Note #8:
- i. **ADD** Contractor shall provide a spare identical pump for the sodium hypochlorite chemical feed system.
- G. Sheets P1.0 & E2.1 - Proposed Plan:
- i. **DELETE** the 6-inch meter and two 6-inch valves and **REPLACE** with a 3-inch magnetic flow meter and two 3-inch valves.
  - ii. **ADD** two 6-inch x 3-inch reducers on each side of the 3-inch valves. Reducers and valves shall be installed to provide a minimum of 5 pipe diameters (15-inches) of straight pipe run length upstream of the mag meter and 2 pipe diameters (6-inches) of straight pipe run length downstream of the mag meter.
- H. Sheets E1.1 – Demolition Note #2:
- i. **ADD** Bid Package B Contractor shall coordinate with the Village and Bid Package A Contractor prior to demolishing the existing electrical service as the temporary electrical service for drilling the new Well #7 will be routed from this service.
- I. Sheets E2.1:
- i. **ADD** Keyed Note #16 – Route 20 Amp electrical circuit from the 3-inch mag meter to Panel WP-7 per NEC Electric Code and Manufacturer recommendations
  - ii. **ADD** Keyed Note #17 – Route 20 Amp electrical circuit from the sodium hypochlorite feed room ventilation fan to WP-7 per NEC Electric Code. Provide connection to Vari-Green transformer for automatic control
  - iii. **ADD** Keyed Note #18 – Route 20 Amp electrical circuit from the fluoride and phosphate chemical feed room ventilation fan to WP-7 per NEC Electric Code. Provide connection to Vari-Green transformer for automatic control
  - iv. **ADD** Keyed Note #19 – Route 20 Amp electrical circuit from the eye-wash hot water heater in the fluoride and phosphate chemical feed room to Panel WP-7 per NEC Electric Code.
  - v. **ADD** Keyed Note #20 – Contractor shall provide control wiring, conduit, necessary control boxes, and connections from the mag meter to all three chemical feed pumps as required to provide flow paced control of the chemical feed pumps.
  - vi. **ADD** Keyed Note #21 – Contractor shall field locate a control wiring box to facilitate the installation of control wiring from the mag meter to all three chemical feed pumps. The control box shall have a 24VDC power supply and one ASI 45111241 analog splitter.
  - vii. **ADD** Keyed Note #22 – Contractor shall route 120 VAC (3 #12's) to the control box and four 2 conductor, twisted pair with shield and foil, 16 AWG from the control box to Panel WP-7, the mag meter and each chemical feed pump. One twisted pair will be routed to the flow meter and the other three will be routed to each of the chemical feed pumps.
  - viii. **ADD** a Vari-Green air quality controller on south wall near entrance for automatic control of exhaust fans. Provide control wiring.
  - ix. **ADD** (2) 150A circuits for instantaneous water heaters. Provide local disconnects and parallel feeds as indicated in WP-7 panel schedule

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- J. Sheets E3.1 – WP-7 Branch Circuit Panelboard Schedule:
- i. **ADD** 20 Amp breaker for the 3-inch mag meter circuit
  - ii. **ADD** 20 Amp breaker for the sodium hypochlorite ventilation fan
  - iii. **ADD** 20 Amp breaker for the fluoride/phosphate ventilation fan
  - iv. **ADD** 20 Amp breaker for the eye wash station circuit
  - v. **ADD** 150 Amp 3PH breaker for the water heater circuit
  - vi. **ADD** 150 Amp 3PH breaker for the water heater circuit
  - vii. **CHANGE** Panel WP-7 from 100A MLO to 400A MLO. Route correct ampacity conductor and properly sized conduit according to NEC Annex tables.

This addendum **DOES NOT** alter the previously published bid date of **Wednesday, May 20, 2020, 2:00 PM**, prevailing time, at **Raymond Village Hall , 305 East Broad Street, Raymond, Illinois 62560**.

Sincerely,

HURST-ROSCHE, INC.



Scott L. Hunt, P.E., Treasurer

cc: All plan holders

## SECTION 089119 - FIXED LOUVERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Fixed **extruded-aluminum** louvers.

#### 1.3 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades (i.e., the axis of the blades are horizontal).
- C. Vertical Louver: Louver with vertical blades (i.e., the axis of the blades are vertical).
- D. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.
- E. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven-rain performance, as determined by testing according to AMCA 500-L.
- F. Windborne-Debris-Impact-Resistant Louver: Louver that provides specified windborne-debris-impact resistance, as determined by testing according to AMCA 540.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
  - 1. Show weep paths, gaskets, flashings, sealants, and other means of preventing water intrusion.

2. Show mullion profiles and locations.
- C. Samples: For each type of metal finish required.
- D. Delegated-Design Submittal: For louvers indicated to comply with structural[ **and seismic**] performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.
- B. Windborne-debris-impact-resistance test reports.
- C. Sample Warranties: For manufacturer's special warranties.

#### 1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
  1. AWS D1.2/D1.2M.
  2. AWS D1.3/D1.3M.
  3. AWS D1.6/D1.6M.

#### 1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

#### 1.8 WARRANTY

- A. Special Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.
  1. Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  2. Warranty Period: **Five** years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Ruskin
- B. Approved equivalent

### 2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
  - 1. Wind Loads: Determine loads based on a uniform pressure of **20 lbf/sq. ft. (957 Pa)**, acting inward or outward.
- B. Windborne-Debris-Impact Resistance: Louvers located within **30 feet (9.1 m)** of grade shall pass **basic** protection, when tested according to AMCA 540.
- C. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
  - 1. Temperature Change (Range): **120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.**
- E. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

### 2.3 FIXED EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal Drainable-Blade Louver
  - 1. Louver Depth: **2 inches**
  - 2. Frame and Blade Nominal Thickness: Not less than **0.060 inch (1.52 mm) for blades and 0.080 inch (2.03 mm) for frames.**
  - 3. Mullion Type: Exposed.
  - 4. Louver Performance Ratings:
    - a. Free Area: Not less than **75 sq. ft. (7 sq. m)** for 120-inch wide by 90-inch high louver.
    - b. Point of Beginning Water Penetration: Not less **1197 fpm**



- c. Air Performance: Not more than **0.10-inch wg (25-Pa)** static pressure drop at **700-fpm (3.6-m/s)** free-area **intake** velocity.
5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

## 2.4 LOUVER SCREENS

- A. General: Provide screen at **each exterior louver**
  1. Screen Location for Fixed Louvers: Interior face.
  2. Screening Type **Insect screening**.
- B. Secure screen frames to louver frames with **machine screws with heads finished to match louver**, spaced a maximum of **6 inches (150 mm)** from each corner and at **12 inches (300 mm)** o.c.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
  1. Metal: Same type and form of metal as indicated for louver to which screens are attached. **Reinforce extruded-aluminum screen frames at corners with clips**.
  2. Finish: **Same finish as louver frames to which louver screens are attached**.
- D. Louver Screening for Aluminum Louvers:
  1. Insect Screening: Aluminum, **18-by-16 (1.4-by-1.6-mm)** mesh, **0.012-inch (0.30-mm)** wire.
  2. Insect Screening: Stainless steel, **18-by-18 (1.4-by-1.4-mm)** mesh, **0.009-inch (0.23-mm)** wire.

## 2.5 MATERIALS

- A. Aluminum Extrusions: **ASTM B 221 (ASTM B 221M)**, Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: **ASTM B 209 (ASTM B 209M)**, Alloy 3003 or 5005, with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Use types and sizes to suit unit installation conditions.
  1. Use **hex-head or Phillips pan-head** screws for exposed fasteners unless otherwise indicated.
  2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
  3. For fastening galvanized steel, use hot-dip-galvanized-steel or 300 series stainless-steel fasteners.
  4. For fastening stainless steel, use 300 series stainless-steel fasteners.
  5. For color-finished louvers, use fasteners with heads that match color of louvers.
- D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, fabricated from stainless-steel components, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as

determined by testing according to ASTM E 488/E 488M conducted by a qualified testing agency.

- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

## 2.6 FABRICATION

- A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
  - 1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern
  - 2. Horizontal Mullions: Provide horizontal mullions at joints
- C. Maintain equal louver blade spacing, **including separation between blades and frames at head and sill**, to produce uniform appearance.
- D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
- E. Include supports, anchorages, and accessories required for complete assembly.
- F. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer, or **72 inches (1830 mm)** o.c., whichever is less.
  - 1. Fully Recessed Mullions: Where indicated, provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.
  - 2. Semirecessed Mullions: Where indicated, provide mullions partly recessed behind louver blades, so louver blades appear continuous. Where length of louver exceeds fabrication and handling limitations, fabricate with interlocking split mullions and close-fitting blade splices designed to permit expansion and contraction.
  - 3. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.
  - 4. Exterior Corners: Prefabricated corner units with mitered and with **fully recessed** mullions at corners.
- G. Provide **subsills made of same material as louvers or extended sills** for recessed louvers.

- H. Join frame members to each other and to fixed louver blades with fillet welds **concealed from view, threaded fasteners, or both, as standard with louver manufacturer** unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

## 2.7 ALUMINUM FINISHES

- A. Finish louvers after assembly.
- B. Clear Anodic Finish: AAMA 611, **AA-M12C22A41, Class I, 0.018 mm, AA-M12C22A31, Class II, 0.010 mm** or thicker.
- C. Color Anodic Finish: AAMA 611, **AA-M12C22A42/A44, Class I, 0.018 mm, AA-M12C22A32/A34, Class II, 0.010 mm** or thicker.
  - 1. **As selected by Architect from full range of industry colors and color densities.**
- D. Conversion-Coated Finish: AA-C12C42, nonetched, cleaned with inhibited chemicals, and chemical conversion coated with acid chromate-fluoride-phosphate.
- E. Factory-Primed Finish: AA-C12C42R1x with air-dried primer of not less than **2-mil (0.05-mm)** dry film thickness.
- F. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of **1.5 mils (0.04 mm)**. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
  - 1. Color and Gloss: **As selected by Architect from manufacturer's full range**

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

### 3.3 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Protect unpainted galvanized- and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.

#### 3.4 ADJUSTING AND CLEANING

- A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers damaged during installation and construction, so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
  - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 089119

## SECTION 22 11 00 - FACILITY WATER DISTRIBUTION

### PART 1 GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Domestic water piping, above grade.
2. Unions and flanges.
3. Valves.
4. Magnetic flow meters
5. Pipe hangers and supports.
6. Pressure gages.
7. Pressure gage taps.
8. Flow control valves.
9. Water pressure reducing valves.
10. Relief valves.
11. Strainers.
12. Hose bibs.
13. Sample tap faucet.
14. Bedding and cover materials.

##### B. Related Sections:

1. Section 03 30 00 - Cast-In-Place Concrete: Execution requirements for placement of concrete house keeping pads specified by this section.
2. Section 07 84 00 - Firestopping: Product requirements for firestopping for placement by this section.
3. Section 09 90 00 - Painting and Coating: Product and execution requirements for painting specified by this section.
4. Section 22 05 53 - Identification for Plumbing Piping and Equipment: Product requirements for pipe identification and valve tags for placement by this section.
5. Section 22 07 00 - Plumbing Insulation: Product and execution requirements for pipe insulation.
6. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections to equipment specified by this section.
7. Section 31 05 13 - Soils for Earthwork: Soils for backfill in trenches.
8. Section 31 05 16 - Aggregates for Earthwork: Aggregate for backfill in trenches.
9. Section 31 23 16 - Excavation: Product and execution requirements for excavation and backfill required by this section.
10. Section 31 23 17 - Trenching: Execution requirements for trenching required by this section.
11. Section 31 23 23 - Fill: Requirements for backfill to be placed by this section.
12. Section 33 13 00 - Disinfecting of Water Utility Distribution: Product and execution requirements for disinfection of domestic water piping beyond 5 feet (1500 mm) of building.

## 1.2 REFERENCES

### A. American National Standards Institute:

1. ANSI Z21.22 - Relief Valves for Hot Water Supply Systems.

### B. American Society of Mechanical Engineers:

1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
3. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
4. ASME B31.9 - Building Services Piping.
5. ASME B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element.
6. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.
7. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

### C. American Society of Sanitary Engineering:

1. ASSE 1010 - Performance Requirements for Water Hammer Arresters.
2. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers.
3. ASSE 1012 - Performance Requirements for Backflow Preventer with Intermediate Atmospheric Vent.
4. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers.
5. ASSE 1019 - Performance Requirements for Vacuum Breaker Wall Hydrants, Freeze Resistant, Automatic Draining Type.
6. ASSE 5013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers (RP) and Reduced Pressure Fire Protection Principle Backflow Preventers (RFP).
7. ASSE 5015 - Performance Requirements for Testing Double Check Backflow Prevention Assemblies (DC) and Double Check Fire Protection Backflow Prevention Assemblies (RPDF).

### D. ASTM International:

1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
3. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
4. ASTM A536 - Standard Specification for Ductile Iron Castings.
5. ASTM B32 - Standard Specification for Solder Metal.
6. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.
7. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
8. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric).
9. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.
10. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80, and 120.
11. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

12. ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameters.
13. ASTM D2241 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
14. ASTM D2447 - Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter.
15. ASTM D2464 - Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
16. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
17. ASTM D2467 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
18. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
19. ASTM D2609 - Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe.
20. ASTM D2661 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings.
21. ASTM D2846/D2846M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems.
22. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
23. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
24. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
25. ASTM D 3311 - Standard Specification for Drain, Waste, and Vent (DWV) Plastic Fittings Patterns.
26. ASTM E1 - Standard Specification for ASTM Thermometers.
27. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers.
28. ASTM F437 - Standard Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
29. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
30. ASTM F439 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
31. ASTM F441/F441M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
32. ASTM F442/F442M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR).
33. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
34. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
35. ASTM F 891 - Standard Specification for Coextruded Poly(Vinyl Chloride) (PVC) Plastic Pipe With a Cellular Core.
36. ASTM F1281 - Standard Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe.

37. ASTM F1282 - Standard Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe.
38. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

E. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

F. American Water Works Association:

1. AWWA C104 - American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. AWWA C105 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.
4. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
6. AWWA C651 - Disinfecting Water Mains.
7. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
8. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.
9. AWWA C702 - Cold-Water Meters - Compound Type.
10. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
11. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution.
12. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. through 3 in., for Water Service.
13. AWWA C950 - Fiberglass Pressure Pipe.
14. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

G. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 67 - Butterfly Valves.
3. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
4. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
5. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
6. MSS SP 78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
7. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
8. MSS SP 85 - Cast Iron Globe & Angle Valves, Flanged and Threaded.
9. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
10. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

H. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).



I. Plumbing and Drainage Institute:

1. PDI WH201 - Water Hammer Arrester Standard.

J. Underwriters Laboratories Inc.:

1. UL 393 - Indicating Pressure Gauges for Fire-Protection Service.
2. UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data:

1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturer's catalog information.
2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
3. Hangers and Supports: Submit manufacturers catalog information including load capacity.
4. Domestic Water Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.
5. Pumps: Submit pump type, capacity, certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Submit installation instructions for pumps, valves and accessories.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of valves and equipment.

C. Operation and Maintenance Data: Submit spare parts list, exploded assembly views and recommended maintenance intervals.

1.5 QUALITY ASSURANCE

A. For drinking water service, provide valves complying with NSF 61.

B. Perform Work in accordance with Illinois Plumbing Code, current edition.

C. Maintain one copy of each document on site.

## 1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

## 1.7 PRE-INSTALLATION MEETINGS

- A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
- B. Accept valves and equipment on site in shipping containers with labeling in place. Inspect for damage.
- C. Provide temporary protective coating on cast iron and steel valves.
- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

## 1.9 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements.
- B. Do not install underground piping when bedding is wet or frozen.

## 1.10 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

## 1.11 WARRANTY

- A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish manufacturer's standard warranty for domestic water piping.

## 1.12 EXTRA MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish two packing kits for each size valve and two loose keys for outside hose bibs.

## PART 2 PRODUCTS

### 2.1 DOMESTIC WATER PIPING, ABOVE GRADE (Suppling Hose Bibs & Sample Taps)

#### A. Copper Tubing: ASTM B88 (ASTM B88M), Type L or K, drawn.

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
2. Joints: ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, lead free solder.

#### B. Copper Tubing: ASTM B88 (ASTM B88M), Type L or K, drawn, rolled grooved ends.

1. Fittings: ASME B16.18 cast copper alloy, or ASME B16.22 wrought copper and bronze grooved ends.
2. Joints: Grooved mechanical couplings meeting ASTM F1476.
  - A. Housing Clamps: ASTM A395/A395M and ASTM A536 ductile iron, enamel coated, compatible with copper tubing sizes, to engage and lock designed to permit some angular deflection, contraction, and expansion.
  - B. Gasket: Elastomer composition for operating temperature range from -30 degrees F (-34 degrees C) to 230 degrees F (110 degrees C).
  - C. Accessories: Stainless steel bolts, nuts, and washers.

### 2.2 WELL PIPING (Large diameter, to/from Wellhouse)

#### A. Ductile Iron Pipe: AWWA C151, Pressure Class 250 psi (350 for 12-inch and smaller):

1. Fittings: Ductile Iron, standard thickness, AWWA C110.
2. Joints: AWWA C111, flanged with rubber gasket
3. Lining: AWWA C104, cement-mortar lining.

#### B. All ductile iron pipe and fittings shall be the product of a UNITED STATES OF AMERICA manufacturer.

### 2.3 UNIONS AND FLANGES

#### A. Unions for Pipe 2 inches (50 mm) and Smaller:

1. Ferrous Piping: Class 150, malleable iron, threaded.
2. Copper Piping: Class 150, bronze unions with soldered.
3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
4. PVC Piping: PVC.
5. CPVC Piping: CPVC.

#### B. Flanges for Pipe 2-1/2 inches (65 mm) and Larger:

1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
2. Copper Piping: Class 150, slip-on bronze flanges.
3. PVC Piping: PVC flanges.
4. CPVC Piping: CPVC flanges.
5. Gaskets: 1/16 inch (1.6 mm) thick preformed neoprene gaskets.

- C. PVC Pipe Materials: For connections to equipment and valves with threaded connections, furnish solvent-weld socket to screwed joint adapters and unions, or ASTM D2464, Schedule 80, threaded, PVC pipe.

## 2.4 GATE VALVES

### A. Manufacturers:

1. Crane.
2. Hammond Valve.
3. Milwaukee Valve Co.
4. NIBCO, Inc.
5. Stockham.
6. Substitutions: Section 01 60 00 - Product Requirements.

- B. 2-1/2 inches (65 mm) and Larger: MSS SP 70, Class 125, cast iron body, bronze trim, bolted bonnet, non-rising stem, hand-wheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged ends. Furnish chain-wheel operators for valves 6 inches (150 mm) and larger mounted over 8 feet (2400 mm) above floor.

## 2.5 GLOBE VALVES

### A. Manufacturers:

1. Hammond Valve.
2. Milwaukee Valve Co.
3. NIBCO, Inc.
4. Substitutions: Section 01 60 00 - Product Requirements.

- B. 2 inches (50 mm) and Smaller: MSS SP 80, Class 125, bronze body, bronze trim, threaded or union bonnet, hand wheel, Buna-N composition disc, solder or threaded ends.

## 2.6 BALL VALVES

### A. Manufacturers:

1. Crane.
2. Hammond Valve.
3. Jenkins Valves.
4. Milwaukee Valve Co.
5. NIBCO, Inc.
6. Stockham.
7. Substitutions: Section 01 60 00 - Product Requirements.

- B. 2 inches (50 mm) and Smaller: MSS SP 110, Class 150, bronze, two piece body, chrome plated bronze ball, full port, teflon seats, blow-out proof stem, solder or threaded ends with union at locations required, lever handle or locking lever handle at locations required, with balancing stops at required locations.

- C. 2 inches (50 mm) and Smaller: 150 psi (1035 kPa) at 73 degrees F (55 degrees C) water temperature, maximum service temperature: 140 degrees F (60 degrees C) ASTM D1785

PVC body and ball, double lever handle, fluorocarbon seals, teflon seats, full port, single or double union type with socket or threaded ends.

- D. 2 inches (50 mm) and Smaller: 150 psi (1035 kPa) at 73 degrees F (55 degrees C) water temperature, maximum service temperature: 210 degrees F (100 degrees C), ASTM D1785 CPVC body and ball, double lever handle, fluorocarbon seals, teflon seats, full port, single or double union type with socket or threaded ends.

## 2.7 BUTTERFLY VALVES

### A. Manufacturers:

1. Crane.
2. Hammond Valve.
3. Milwaukee Valve Co.
4. NIBCO, Inc.
5. Stockham.
6. Substitutions: Section 01 60 00 - Product Requirements.

### B. 2-1/2 inches (65 mm) and Larger: MSS SP 67, Class 150 or Class 200.

1. Body: Cast or ductile iron, lug or grooved ends, stainless steel stem, extended neck.
2. Disc: Nickel-plated ductile iron, Elastomer coated ductile iron, or Chrome plated ductile iron.
3. Seat: Resilient replaceable Buna N.
4. Handle and Operator: 10 position lever handle. Furnish gear operators for valves 8 inches (200 mm) and larger, and chain-wheel operators for valves mounted over 8 feet (2400 mm) above floor.
- 5.

## 2.8 CHECK VALVES

### A. Horizontal Swing Check Valves:

1. Manufacturers:
  - A. Crane Valve, North America.
  - B. Hammond Valve.
  - C. Milwaukee Valve Company.
  - D. NIBCO, Inc.
  - E. Stockham Valves & Fittings.
  - F. Substitutions: Not Permitted.
2. 2 inches and Smaller: MSS SP 80, Class 150, bronze body and cap, bronze seat, Buna-N disc, solder or threaded ends.
3. 2-1/2 inches and Larger: MSS SP 71, Class 125, cast iron body, bolted cap, bronze or cast iron disc, renewable disc seal and seat, flanged ends.

### B. Spring Loaded Check Valves:

1. Manufacturers:
  - A. Crane Valve, North America.

- B. Hammond Valve.
  - C. Milwaukee Valve Company.
  - D. NIBCO, Inc.
  - E. Stockham Valves & Fittings.
  - F. Substitutions: Not Permitted.
2. 2 inches and Smaller: MSS SP 80, Class 250, bronze body, in-line spring lift check, silent closing, Buna-N disc, integral seat, solder or threaded ends.
  3. 2-1/2 inches and Larger: MSS SP 71, Class 125, wafer or globe style, cast iron body, bronze seat, center guided bronze disc, stainless steel spring and screws, flanged ends.

## 2.9 MAGNETIC LIQUID FLOW METERS

- A. Manufacturers:
  1. Toshiba.
  2. MJK
  3. Substitutions: Not Permitted.
- B. INSTRUMENT
  1. There shall be furnished an electromagnetic flow meter suitable for fixed-site measurement of bi-directional flow in a full pipe. The flow meter shall consist of a flow tube and a flow transmitter, which shall indicate, totalize and transmit flow. The flow tube shall use a spool piece configuration with field-interchangeable coils and electrodes.
  2. The flow meter shall be Engineer pre-approved. Under no circumstances shall an approved meter be relieved from conforming to the entire technical specification and specified warranties. Any cost associated with modifying standard products to conform to the technical specification shall be the responsibility of the contractor and or meter supplier.
- C. SPOOL PIECE FLOW TUBE AND SENSORS
  1. Nominal Flow Tube Diameter – as shown on drawings”
  2. The spool piece flow tube shall be made of carbon steel and shall be epoxy enamel painted (flow tube shall have rubber membrane for lime sludge mag meter). Sensor electrode seals shall be made of Viton, and Sensor Gaskets shall be made of Elastomer. The flow tube shall not require an insulating liner and accuracy shall not be affected by cuts or scratches in the flow tube.
    - A. The flow tube shall be supplied with steel flanges to ANSI/AWWA standards
  3. Each flow sensor shall contain a coil, a pair of sensing electrodes and an integral grounding electrode (stainless steel electrodes for the lime sludge mag meter). External grounding rings and straps shall not be necessary. The sensors shall use solid-state design, with the coils, electrodes, and other sensor components encapsulated in polyurethane that conforms to National Sanitation Foundation Standard NSF61 and AWWA C213 for nominal diameters of 16 in. (400 mm) and above. The sensors shall be field-replaceable and field-interchangeable without the need for recalibration. The electrodes shall be made of AISI Type 316 stainless steel.

4. The flow tube shall use pulsed AC coil excitation to create the magnetic field, with typical magnetizing current of not less than 1 A base to peak, and frequency of not less than 2/3 of power supply frequency (40 Hz for a 60 Hz power supply frequency), to ensure a high signal-to-media noise ratio.
5. The minimum media conductivity shall be 0.5 microS/cm.
6. The maximum media temperature shall be 175 degrees F (80 degrees C).
7. The flow meter shall include multiple sensors to measure mean velocity in full pipes.
  - A. The mean velocity measurement range shall be from 0 to 2 feet per second (0 to 0.6 meters per second) to 0 to 50 feet per second (0 to 15 meters per second).
  - B. The minimum detectable mean velocity shall be 0.02 feet per second (0.006 meters per second).
  - C. The mean velocity shall be measured with a maximum error of +/-0.005 feet per second (+/- 0.0015 meters per second) over a range of less than 1 foot per second (0.3 meters per second), and +/-0.5% of flow rate over a range of 1 to 50 feet per second (0.3 to 15 meters per second). A mean velocity of 0.1 foot per second (0.03 meters per second) shall be measured with a maximum error of +/-5% of reading. Accuracy shall be traceable to the US National Institute of Standards and Technology (NIST), and shall be guaranteed on-site for applications such as drinking water, raw sewage, and similar media, even with a permanent coating of raw sewage or similar on the electrodes, provided that specification parameters and installation recommendations are met. A NIST traceable calibration certificate shall be provided with each flow meter.
  - D. The temperature coefficient shall be less than 0.05% per 10 degrees F (0.09% per 10 degrees C).
  - E. A non-full pipe condition shall be indicated by a user-supplied signal into one of the contact inputs on the flow transmitter.
  - F. Maximum pressure shall be 150 psi (10 bar).
8. The wiring from the flow transmitter to the sensors shall be 2 separate 2-conductor cables, 18 gauge (0.75 mm<sup>2</sup>), twisted and shielded
9. The flow tube and sensors shall exceed the NEMA 6P (IP68) submersibility standard, and shall be submersible to 33 feet (10 m)

D. FLOW TRANSMITTER

1. The flow transmitter shall be microprocessor-based, and shall contain a keypad and a 2 line, 32 character, backlit alphanumeric liquid crystal display (LCD) with characters 0.3 in. (8 mm) high and 0.2 in. (5 mm) wide. The LCD shall visually prompt the user through the programming sequence, and the flow transmitter shall include a built-in help system. The LCD shall display flow rate and/or total flow in user-selectable units of measure. The flow transmitter shall be capable of displaying forward, reverse, net and grand total flows, and the totalizers shall be resettable or non-resettable.
2. The flow transmitter shall have an input impedance of 1012 ohms.
3. The flow transmitter shall include 2 isolated contact inputs, activated by contact closure or transistor, programmable to acknowledge alarms, reset totalizers, select the current flow rate range in forward flow/multi range mode, or indicate non-full pipe condition, rated 25 volts DC, 15 mA.

4. The flow transmitter shall include an isolated, internally powered 4 to 20 mA output into a maximum of 500 ohms. The 4 to 20 mA output shall be programmable to operate in either forward flow rate, forward flow rate/multi range, bidirectional flow rate, or bidirectional flow rate/split range mode.
  - A. In forward flow rate mode, 4 mA shall represent zero flow rate, and 20 mA shall represent the programmable maximum forward flow rate.
  - B. In forward flow rate/multi range mode, up to 3 different flow rate ranges shall be programmable, with the current range selected by user-supplied signals applied to the contact inputs.
  - C. In bidirectional flow rate mode, independent maximum forward and reverse flow rates shall be programmable, with flow direction indicated by a relay output.
  - D. In bidirectional flow rate/split range mode, 4 mA shall represent the programmable maximum reverse flow rate, 12 mA shall represent zero flow rate, and 20 mA shall represent the programmable maximum forward flow rate.
5. The flow transmitter shall include a 2-wire solid-state pulse output, internally powered, and rated 25 volts DC, 80 mA. The pulse output shall be programmable to operate in either scaled or frequency mode.
  - A. Scaled mode shall be used for totalizing, with a programmable maximum frequency of 5, 10 or 100 Hz and a corresponding pulse width of 100, 50 or 5 ms, respectively.
  - B. Frequency mode shall be used for rate indication, with a square wave output programmable from 0 to 1,000 Hz to 0 to 10,000 Hz.
6. The flow transmitter shall include 2 isolated, normally open relay contacts, activated based on reverse flow, high or low flow rate, total flow, or diagnostic errors, rated 60 volts DC, 30 volts AC RMS, 3 A resistive.
7. The flow transmitter shall be Factory Mutual (FM) Approved for use in ordinary locations. The flow transmitter shall be CE Marked.
8. The flow transmitter shall operate on 120 VAC, 50/60 Hz line power. Typical power consumption shall be 10 W, including the sensors.
9. The flow transmitter shall be housed in a rugged, watertight, dust-tight, corrosion resistant (NEMA 4X and IP65) cast aluminum, epoxy painted enclosure suitable for conduit connections. The enclosure shall include a polycarbonate window for viewing the LCD without opening the enclosure

## 2.10 PIPE HANGERS AND SUPPORTS

### A. Manufacturers:

1. Carpenter & Paterson Inc.
2. Empire Industries, Inc.
3. ERICO International Corp.
4. Globe Pipe Hanger Products Inc.
5. NIBCO, Inc.
6. PHD Manufacturing, Inc.
7. Substitutions: Not Permitted.

B. Plumbing Piping: Conform to ASME B31.9, ASTM F708, MSS SP 58, MSS SP 69, MSS SP 89.



- C. Hangers for Pipe Sizes 1/2 to 1-1/2 inch (15 to 40 mm): Malleable iron or Carbon steel, adjustable swivel, split ring.
- D. Hangers for Cold Pipe Sizes 2 inches (50 mm) and Larger: Carbon steel, adjustable, clevis.
- E. Hangers for Hot Pipe, Sizes 2 to 4 inches (50 to 100 mm): Carbon steel, adjustable, clevis.
- F. Hangers for Hot Pipe, Sizes 6 inches (150 mm) and Larger: Adjustable steel yoke, cast iron pipe roll and double hanger.
- G. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.
- H. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 inches (150 mm) and Larger: Steel channels with welded supports or spacers and hanger rods, cast iron roll.
- I. Wall Support for Pipe Sizes 3 inches (80 mm) and Smaller: Cast iron hooks.
- J. Wall Support for Pipe Sizes 4 inches (100 mm) and Larger: Welded steel bracket and wrought steel clamps.
- K. Wall Support for Hot Pipe Sizes 6 inches (150 mm) and Larger: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron pipe roll.
- L. Vertical Support: Steel riser clamp.
- M. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- N. Floor Support for Hot Pipe Sizes 4 inches (100 mm) and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- O. Floor Support for Hot Pipe Sizes 6 inches (150 mm) and Larger: Adjustable cast iron pipe roll and stand, steel screws, and concrete pier or steel support.
- P. Copper Pipe Support: Carbon steel ring, adjustable, copper plate.

## 2.11 PRESSURE GAGES

### A. Manufacturers:

1. Hayward.
2. Watts.
3. Zurn.
4. Substitutions: Section 01 60 00 - Product Requirements.

### B. Gage: ASME B40.1, UL 393 or UL 404 with bourdon tube, rotary brass movement, brass socket, front calibration adjustment, black scale on white background.

1. Case: Stainless steel.
2. Bourdon Tube: Brass.
3. Dial Size: 3-1/2 inch diameter.

4. Mid-Scale Accuracy: One percent.
5. Scale: Both psi and kPa.

## 2.12 PRESSURE GAGE TAPS

- A. Needle Valve: Brass or Stainless Steel, 1/4 inch NPT for minimum 300 psi.
- B. Ball Valve: Brass or Stainless Steel, 1/4 inch NPT] for 250 psi.
- C. Pulsation Damper: Pressure snubber, brass with 1/4 inch NPT connections.

## 2.13 WATER PRESSURE REDUCING VALVES

### A. Manufacturers:

1. Zurn.
2. Substitutions: Section 01 60 00 - Product Requirements.

B. 2 inches and Smaller: MSS SP 80, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, and single union ends.

C. 2 inches and Larger: MSS SP 85, cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flanged.

## 2.14 RELIEF VALVES

### A. Manufacturers:

1. Flomatic.
2. Hayward.
3. Watts.
4. Zurn
5. Substitutions: Section 01 60 00 - Product Requirements.

### B. Pressure Relief:

1. ANSI Z21.22 certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.

### C. Temperature and Pressure Relief:

1. ANSI Z21.22 certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME certified and labeled.

## 2.15 STRAINERS

### A. Manufacturers:

1. Flomatic.
2. Hayward.
3. NIBCO, Inc.
4. Zurn.
5. Substitutions: Section 01 60 00 - Product Requirements.

- B. 2 inch and Smaller: Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
- C. 1-1/2 inch to 4 inch: Class 125, flanged iron body, Y pattern with 1/16-inch stainless steel perforated screen.
- D. 5 inch and Larger: Class 125, flanged iron body, basket pattern with 1/8 inch stainless steel perforated screen.

#### 2.16 HOSE BIBS (HB-1)

##### A. Manufacturers:

1. Zurn, Model Z1341.
2. Woodford, Model 24.
3. Watts, Model MHB-RC.
4. Substitutions: Not Permitted.

B. Interior: Rough Bronze with integral mounting flange, replaceable hexagonal disc, hose thread spout, with hand wheel, integral vacuum breaker in conformance with ASSE 1011.

#### 2.17 SAMPLE TAPS (ST-1)

##### A. Manufacturers:

1. American Granby, HHB Series.
2. Legend, Model T-532.
3. Matco Norca, FY-690 Series.
4. Substitutions: Not Permitted.

B. Interior: Chrome-plated or rough brass with integral 1/2" MNPT inlet connection, lead-free, rebuildable valve packing, tee handle, smooth-nosed spout.

#### 2.18 BEDDING AND COVER MATERIALS

A. Bedding: Fill Type as specified in Section 31 05 16.

B. Cover: Fill Type, as specified in Section 31 05 16.

C. Soil Backfill from Above Pipe to Finish Grade: Soil Type, as specified in Section 31 05 13. Subsoil with no rocks over 6 inches in diameter, frozen earth or foreign matter.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify excavations are to required grade, dry, and not over-excavated.

### 3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.

### 3.3 INSTALLATION - METERS

- A. Install positive displacement meters in accordance with AWWA M6, with isolating valves on inlet and outlet. Provide full line size bypass with globe valve for liquid service meters.

### 3.4 INSTALLATION - THERMOMETERS AND GAGES

- A. Install one pressure gage for each pump, locate taps before strainers and on suction and discharge of pump; pipe to gage.
- B. Install gage taps in piping.
- C. Install pressure gages with pulsation dampers. Provide needle valve or ball valve to isolate each gage.
- D. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches for installation of thermometer sockets. Allow clearance from insulation.
- E. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- F. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- G. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

### 3.5 INSTALLATION - HANGERS AND SUPPORTS

#### A. Inserts:

- 1. Provide inserts for placement in concrete forms.
- 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.
- 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.

#### B. Pipe Hangers and Supports:

- 1. Install in accordance with ASME B31.9, ASTM F708, and MSS SP 89.
- 2. Support horizontal piping as schedule.
- 3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
- 4. Place hangers within 12 inches of each horizontal elbow.

5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every [other] floor. Support riser piping independently of connected horizontal piping.
7. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
8. Provide copper plated hangers and supports for copper piping.
9. Prime coat exposed steel hangers and supports. Refer to Section 09 90 00. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
10. Provide hangers adjacent to motor driven equipment with vibration isolation; refer to Section 21 05 48.

### 3.6 INSTALLATION - BURIED PIPING SYSTEMS

- A. Establish elevations of buried piping with not less than 3.5ft of cover.
- B. Establish minimum separation of domestic water piping from sanitary and storm sewer piping in accordance with code.
- C. Remove scale and dirt on inside of piping before assembly.
- D. Excavate pipe trench in accordance with Section 31 23 16, 31 23 17.
- E. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches compacted depth; compact to 95 percent maximum density.
- F. Install pipe on prepared bedding.
- G. Route pipe in straight line.
- H. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- I. Install shutoff and drain valves at locations indicated on Drawings in accordance with this Section.
- J. Install plastic ribbon tape continuous over top of pipe, buried 6 inches below finish grade, above pipe line; coordinate with Section 31 23 23, 31 23 17. Refer to Section 22 05 53.
- K. Install trace wire continuous with pipe. Trace wire shall have soldered water tight joints and shall be looped into valve boxes. Coordinate with Section 31 23 23, 31 23 17. Refer to Section 22 05 53.
- L. Pipe Cover and Backfilling:
  1. Backfill trench in accordance with Section 31 23 23.
  2. Maintain optimum moisture content of fill material to attain required compaction density.

3. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 4 inches compacted layers to 6 inches minimum cover over top of jacket. Compact to 95 percent maximum density.
4. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
5. Do not use wheeled or tracked vehicles for tamping.

### 3.7 INSTALLATION - ABOVE GROUND PIPING

- A. Install non-conducting dielectric connections wherever jointing dissimilar metals.
- B. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- C. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.
- D. Group piping whenever practical at common elevations.
- E. Slope piping and arrange systems to drain at low points.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 21 05 16.
- G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 00.
- H. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Section 08 31 13.
- I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- J. Provide support for utility meters in accordance with requirements of utility companies.
- K. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 90 00.
- L. Install domestic water piping in accordance with ASME B31.9.
- M. Sleeve pipes passing through partitions, walls and floors. Refer to Section 22 05 29.
- N. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Section 07 84 00.
- O. Install unions downstream of valves and at equipment or apparatus connections.
- P. Install valves with stems upright or horizontal, not inverted.
- Q. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

- R. Install ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- S. Install globe or butterfly valves for throttling, bypass, or manual flow control services.
- T. Provide lug end butterfly valves adjacent to equipment when functioning to isolate equipment.
- U. Provide spring loaded check valves on discharge of water pumps.
- V. Provide flow controls in water circulating systems as required.
- W. Install potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibs.
- X. Pipe relief from valves, back-flow preventers and drains to nearest floor drain.
- Y. Test backflow preventers in accordance with ASSE 5013, 5015.
- Z. Install air chambers on hot and cold water supply piping to each fixture. Fabricate same size as supply pipe or 3/4 inch minimum, and minimum 18 inches long.

### 3.8 INSTALLATION - PUMPS

- A. Provide pumps to operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
- B. Install long radius reducing elbows or reducers between pump and piping. Support piping adjacent to pump so no weight is carried on pump casings. For close coupled or base mounted pumps, install supports under elbows on pump suction and discharge line sizes 4 inches and over.
- C. Install pumps on vibration isolators.
- D. Install flexible connectors at or near pumps where piping configuration does not absorb vibration.
- E. Provide line sized shut-off valve and strainer on pump suction, and line sized soft seat check valve, balancing valve, and shut-off valve on pump discharge.
- F. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump so no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4 inches and larger.
- G. Provide air cock and drain connection on horizontal pump casings.
- H. Provide drains for bases and seals.
- I. Check, align, and certify alignment of base mounted pumps prior to start-up.

J. Install close coupled and base mounted pumps on concrete housekeeping base, with anchor bolts, set and level, and grout in place. Refer to Section 03 30 00.

K. Lubricate pumps before start-up.

### 3.9 INSTALLATION - SERVICE CONNECTIONS

A. Provide new water service complete with water meter with strainer, meter by-pass assembly, shut-off valves, and pressure reducing valve (as required). Install meter per manufacturer's installation instructions.

### 3.10 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Test domestic water piping system in accordance with Illinois Plumbing Code.

### 3.11 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.

B. Prior to starting work, verify system is complete, flushed and clean.

C. Verify pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

D. Inject disinfectant, free chlorine in liquid, powder and tablet or gas form, throughout system to obtain residual from 50 to 80 mg/L.

E. Bleed water from outlets to obtain distribution and test for disinfectant residual at minimum 15 percent of outlets.

F. Maintain disinfectant in system for 24 hours.

G. When final disinfectant residual tests less than 25 mg/L, repeat treatment.

H. Flush disinfectant from system until residual concentration is equal to incoming water or 1.0 mg/L.

I. Take samples no sooner than 24 hours after flushing, from 5 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

### 3.12 SCHEDULES

A. Pipe Hanger Spacing:



| PIPE MATERIAL                         | MAXIMUM HANGER SPACING<br>Feet | HANGER ROD DIAMETER<br>Inches |
|---------------------------------------|--------------------------------|-------------------------------|
| Copper Tube, 1-1/4 inches and smaller | 6                              | 1/2                           |
| Copper Tube, 1-1/2 inches and larger  | 10                             | 1/2                           |
| CPVC, 1 inch and smaller              | 3                              | 1/2                           |
| CPVC, 1-1/4 inches and larger         | 4                              | 1/2                           |
| Polybutylene                          | 2.67                           | 3/8                           |
| PVC (All Sizes)                       | 4                              | 3/8                           |
| Steel, 3 inches and smaller           | 12                             | 1/2                           |
| Steel, 4 inches and larger            | 12                             | 5/8                           |

END OF SECTION

## SECTION 233413 - AXIAL HVAC FANS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

1. Tubeaxial fans.
2. Vaneaxial fans.
3. Mixed-flow fans.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Include rated capacities, furnished specialties, and accessories for each fan.
2. Certified fan performance curves with system operating conditions indicated.
3. Certified fan sound-power ratings.
4. Motor ratings and electrical characteristics, plus motor and electrical accessories.
5. Material thickness and finishes, including color charts.
6. Dampers, including housings, linkages, and operators.
7. Fan speed controllers.

- B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
5. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show fan room layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.
- B. Seismic Qualification Data: Certificates, for fans, accessories, and components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fans, include the following:
  - 1. Operation in normal and emergency modes.
  - 2. Operation and maintenance manuals.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of unit components.
- C. ASHRAE Compliance:
  - 1. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- E. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design vibration isolation, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

## 2.2 CAPACITIES AND CHARACTERISTICS

- A. Airflow: 707 **cfm**
- B. External Static Pressure: 0.25 **inches wg**
- C. Fan Diameter: 10 **inches**
- D. Brake Horsepower: 0.098
- E. Drive Type: **Direct**
- F. Fan Rpm: 300-1725
- G. Motor:
  - 1. Motor Enclosure **Totally enclosed, air over.**
  - 2. Enclosure Materials: **Rolled steel.**
  - 3. Electrical Characteristics:
    - a. Motor Size: 1/12
    - b. Motor Rpm: .
    - c. Volts: **120 V.**
    - d. Phase: **Single**
    - e. Hertz: 60 Hz.
- H. Vibration Isolators: **Restrained spring** isolators with a static deflection of **1 (25) inch(es) (mm).**
- I. Spark Resistance:
  - 1. **Class A**

## 2.3 VANEAXIAL FANS

- A. Source Limitations: Obtain vaneaxial fans from single manufacturer.
- B. Description: Fan wheel and housing, straightening vane section, factory-mounted motor with belt or direct drive, an inlet cone section, and accessories.
  - 1. Variable-Pitch Fans: Internally mounted **electronic** actuator, externally mounted positive positioner, and mechanical-blade-pitch indicator.
- C. Housings: **Stainless steel.**
  - 1. Inlet and Outlet Connections: Flanges.
  - 2. Guide Vane Section: Integral guide vanes downstream from fan wheel designed to straighten airflow.

- D. Wheel Assemblies: Cast aluminum with airfoil-shaped blades mounted on cast-iron wheel plate keyed to shaft with solid-steel key.
- E. Wheel Assemblies: Fiberglass-reinforced plastic cured under pressure with airfoil-shaped blades keyed to stainless-steel shaft.
- F. Wheel Assemblies: Cast-aluminum hub assembly, machined and fitted with threaded bearing wells to receive blade-bearing assemblies with replaceable, cast-aluminum blades; factory mounted and balanced.
  - a. .
- G. Accessories:
  - 1. Horizontal Support: Pair of supports bolted to fan housing, of same material as housing.
  - 2. Vertical Support: Short duct section with welded brackets bolted to fan housing, of same material as housing.
  - 3. Outlet Screen: On unducted fan outlet - wire-mesh screen, of same material as housing.
  - 4. Backdraft Dampers: Butterfly style, for mounting with flexible connection to fan discharge or direct mounted to discharge diffuser section, of same material as housing.
  - 5. Shaft Seal: Elastomeric seal and PTFE wear plate, suitable for up to 300 deg F (148 deg C).
  - 6. Motor Cover: Cover with side vents to dissipate motor heat, of same material as housing.
  - 7. Inlet Bell: Curved inlet for when fan is not attached to duct, of same material as housing.
  - 8. Inlet Cone: Round-to-round transition, of same material as housing.
  - 9. Outlet Cone: Round-to-round transition, of same material as housing.
  - 10. Direct-Driven Units: Encase motor in housing outside of airstream. Extend lubrication lines to outside of casing and terminate with grease fittings.
- H. Factory Finishes:
  - 1. Sheet Metal Parts: Prime coat before final assembly.
  - 2. Exterior Surfaces: Baked-enamel finish coat after assembly.

## 2.4 SOURCE QUALITY CONTROL

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. AMCA Compliance:
  - 1. Comply with AMCA performance requirements and bear the AMCA-Certified Ratings Seal.
- C. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans in accordance with AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- D. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings in accordance with AMCA 210/ASHRAE 51, "Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating."

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install axial fans level and plumb.
- B. Disassemble and reassemble units, as required for moving to the final location, in accordance with manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.
- D. Equipment Mounting:
  - 1. Install fans on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
  - 2. Comply with requirements for vibration isolation and seismic-control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
  - 3. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."
- E. Install units with adequate clearances for service and maintenance.
- F. Label fans in accordance with requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."
- G. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

### 3.2 ELECTRICAL CONNECTIONS

- A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.
- D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
  - 1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
  - 2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least **1/2 inch (13 mm)** high.

### 3.3 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

### 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- D. Perform tests and inspections
  - 1. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Fans and components will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.

### 3.5 STARTUP SERVICE:

- A. **Perform** startup service.
  - 1. Complete installation and startup checks in accordance with manufacturer's written instructions.
  - 2. Verify that shipping, blocking, and bracing are removed.
  - 3. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
  - 4. Verify that cleaning and adjusting are complete.
  - 5. For direct-drive fans, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation.
  - 6. For belt-drive fans, disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
  - 7. Adjust belt tension.
  - 8. Adjust damper linkages for proper damper operation.
  - 9. Verify lubrication for bearings and other moving parts.
  - 10. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.

11. Disable automatic temperature-control operators, energize motor and confirm proper motor rotation and unit operation, adjust fan to indicated rpm, and measure and record motor voltage and amperage.
12. Shut unit down and reconnect automatic temperature-control operators.
13. Remove and replace malfunctioning units and retest as specified above.

### 3.6 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Lubricate bearings.
- D. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

### 3.7 CLEANING

- A. After completing system installation and testing, adjusting, and balancing and after completing startup service, clean fans internally to remove foreign material and construction dirt and dust.

### 3.8 DEMONSTRATION

- A. **Train** Owner's maintenance personnel to adjust, operate, and maintain axial HVAC fans.

END OF SECTION