

1 **SECTION 08221 - FIBERGLASS REINFORCED DOOR AND FRAME SYSTEM**

2 **PART 1 GENERAL**

3 **1.1 SECTION INCLUDES**

- 4 A. Flush Panel FRP Doors.
- 5 B. Aluminum Door Frames.

6 **1.2 RELATED SECTIONS**

- 7 A. Section 06 10 00 - Rough Carpentry [06 10 00] - Rough Carpentry: Hardware
8 installation.
- 9 B. Section 08 71 00 - Door Hardware

10 **1.3 REFERENCES**

- 11 A. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building
12 Materials

13 **1.4 PERFORMANCE REQUIREMENTS**

- 14 A. Performance: Based on minimum single door size tested of 3 feet (91.44 cm) by 7 feet
15 (213.36 cm)
 - 16 1. With door closed and locked, unit tested in accordance with ASTM E 330 at static
17 air pressure difference of 90 pounds per square foot positive pressure and 90
18 pounds per square foot negative pressure.
 - 19 2. At conclusion of test there shall be no glass breakage, permanent damage to
20 fasteners, hardware parts, support arms or actuating mechanism, nor any other
21 damage that would cause the door to be inoperable.

22 **1.5 SUBMITTALS**

- 23 A. Submit under provisions of Section 01 33 00s.
- 24 B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 25 1. Fabrication and hardware mounting details.
 - 26 2. Preparation instructions and recommendations.
 - 27 3. Storage and handling requirements and recommendations.
 - 28 4. Installation instructions.
- 29 C. Shop Drawings: Indicate the following:
 - 30 1. Elevations and details of each door and frame type.
 - 31 2. Schedule of doors and frames.
 - 32 3. Location and installation requirements for hardware.
 - 33 4. Thicknesses of materials, joints.
- 34 D. Color Samples: Minimum size 6 inches (150 mm) by 6 inches (150 mm), representing
35 actual product, color, and of finish for each finish product specified.

1 **1.6 QUALITY ASSURANCE**

- 2 A. Manufacturer Qualifications: Company specializing in manufacturing FRP and aluminum
3 door and aluminum frame systems of the type required for this project, with minimum ten
4 continuous years documented experience.
- 5 B. Installer Qualifications: Company specializing in installation aluminum door and frame
6 systems of the type required for this project, with minimum five continuous years
7 documented experience.

8 **1.7 DELIVERY, STORAGE, AND HANDLING**

- 9 A. Deliver doors and frames palleted, wrapped or individually crated. Protect door sides
10 with surrounding grooved 2 inch (50.8 mm) by 4 inch (101.6 mm) wood frame, covered
11 with 275 pound (124.74 kg) test corrugated cardboard.
- 12 B. Store products under cover in manufacturer's unopened packaging with labels intact until
13 installation.
 - 14 1. Place units on minimum 4 inch (101.6 mm) wood blocking.
 - 15 2. Do not use non-vented plastic or canvas covers.
 - 16 3. Remove packaging immediately if packaging becomes wet.
 - 17 4. Provide 0.25 inch (6.35 mm) air spaces between stacked doors.
- 18 C. Protect materials and finish from damage during handling and installation.

19 **1.8 PROJECT CONDITIONS**

- 20 A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits
21 recommended by manufacturer for optimum results. Do not install products under
22 environmental conditions outside manufacturer's absolute limits.
- 23 B. Verify actual openings by field measurements before fabrication; show recorded
24 measurements on shop drawings.
- 25 C. Coordinate field measurements and fabrication schedule with construction progress to
26 avoid construction delays.

27 **1.9 WARRANTY**

- 28 A. Provide manufacturer's 10 year warranty against defects in workmanship and materials,
29 including warping, rotting, decaying or bowing.
- 30 B. Provide installers 5 year warranty against defects due to workmanship and materials
31 handling.

32 **PART 2 PRODUCTS**

33 **2.1 MANUFACTURERS**

- 34 A. Basis of Design for FRP Door
35 1. Special-Lite inc. or Approved Equal
36

1 **2.2 FRP FLUSH DOORS AND ALUMINUM FRAMES**

- 2 A. FRP Flush Doors: Provide FRP Flush Door Series 200BE of the type, size and design
3 indicated on the Drawings.
- 4 1. Minimum Thickness: 1.75-inches (44 mm)
 - 5 2. Construction: 3-ply composite laminate system.
 - 6 3. Door Size: Sizes are nominal; provide standard clearances as follows:
 - 7 a) Hinge and Lock Stiles: 0.125-inch (3.18 mm).
 - 8 b) Between Meeting Stiles: 0.25-inch (6.35 mm).
 - 9 c) At Top Rails: 0.125-inch (3.18 mm).
 - 10 d) Between Door Bottom and Threshold: 0.125-inch (3.18 mm).
- 11 B. Aluminum Frames: Provide Aluminum Door frames of the type, size and design indicated
12 on the Drawings.
- 13 C. Aluminum Members: Provide alloy and temper recommended by manufacturer for
14 strength, corrosion resistance, and application of required finish.
- 15 D. FRP Door Components: Minimum 3 ply composite laminated construction to include:
- 16 1. Facing: 0.120-inch (3.05 mm) composite FRP panel exterior grade, UV-protected
17 fiber reinforced polyester panel on interior and exterior faces. Ultraviolet inhibitors
18 shall be maximum amount formulated within the resin. Exterior and interior FRP
19 panels shall be a Class C Flame Spread: Maximum of 75, and Smoke Developed
20 Rating of 450 or less (ASTM E 84)
 - 21 2. Surface texture shall be pebble embossed with a non-directional pattern.
 - 22 3. All mylar transporter fabrication film must be removed from FRP face sheets prior
23 to door fabrication.
 - 24 4. FRP face panels shall be USDA accepted with minimal porosity.
 - 25 5. Face sheet shall be bonded to core and backup tube from edge to edge of door.
 - 26 6. FRP face sheets shall be a Class C Flame Spread: Maximum of 75 and Smoke
27 Developed rating of 450 or less (ASTM E 84), for both interior and exterior faces of
28 interior and exterior doors
 - 29 7. Core: Organic marine grade honeycomb core with high compression strength of
30 94.8 psi (ASTM C 365), and internal aluminum hardware backup tube.
 - 31 8. Hardware Backup: Minimum of 4.25 inches (107.95 mm) in width, 1.375 inches
32 (34.93 mm) in depth with a wall thickness of 0.125 inches (3.18 mm). Contiguous
33 for the full perimeter of the door to allow for all specified and non specified
34 hardware reinforcement.
 - 35 9. Hardware Preparation: Provide for specified hardware including mortise lock edge
36 prep or cylindrical lock prep; and pairs prepped for flush bolts, if required.
 - 37 10. Bonding Agent: Environmentally friendly adhesive with strength buildup of 350
38 pounds per square inch (24.6 kg/cm²).
 - 39 11. Perimeter Door Trim: Wall thickness of 0.050 inch (1.25 mm) minimum in 6063-T5
40 extruded aluminum alloy conforming to ASTM B 221 with special beveled edge cap
41 design and integral weather stripping on lock stile.
 - 42 12. Replaceable Door Trim: Mechanically fastened to the hardware backup tube,
43 allowing for replacement in the field, if damaged.
 - 44 13. Trim Finish: To have minimum of an AAMA Class I anodized finish.
 - 45 14. Weather stripping: Replaceable wool pile with nylon fabric, polypropylene backing
46 meeting AAMA 701 standards. Applied weather stripping is not acceptable.

- 1 15. Only nonferrous, non-rusting members are acceptable, including tie rods, screws
2 and reinforcement plates.
3 16. All components and agents shall meet EPA standards.
- 4 E. FRP Finish
5 1. Color: Black
- 6 F. Aluminum Frame:
7 1. Frame Components: Extruded channel (tubular) 6063-T5 aluminum alloy
8 conforming to ASTM B 221, minimum wall thickness 0.125 inch (3.18 mm); cut
9 corners square and joinery shall be mechanical with no exposed fasteners.
10 2. Profile:
11 3. Open Back with Applied Stop (OBS), 1.75-inch by 5 inch (44 by 127 mm).
12 4. Hinge and Strike Mounting Plates: Extruded aluminum alloy bar stock, 0.1875 inch
13 (4.75 mm) thick mounted in a concealed integral channel with no exposed
14 fasteners.
15 5. Replaceable Weatherstripping: AAMA 701, wool pile with nylon fabric,
16 polypropylene backing, at head and jambs.
17 6. Door Stop: Snap-in door stop shall be 0.1875-inch (4.76mm) extruded aluminum
18 bar stock. Screw-on stops are not acceptable.
- 19 G. Aluminum Finish
20 1. Finish: Black anodic coating; AA-M12C22A34 Class II mechanical finish, non-
21 specular as fabricated, with medium-matte chemical etch, minimum thickness 0.4-
22 mil (0.01 mm).
23 2. Color: Selected by Architect from manufacturer's full range of available colors.
- 24 H. Accessories
25 1. Fasteners: Aluminum, nonmagnetic stainless steel, or other material warranted by
26 manufacturer as non-corrosive and compatible with aluminum components. Do not
27 use exposed fasteners.
28 2. Brackets and Reinforcements: Manufacturer's high-strength aluminum units where
29 feasible, otherwise, nonferrous stainless steel.
30 3. Bituminous Coating: Cold-applied asphaltic mastic, compounded for 30-mil (0.76
31 mm) thickness per coat.

32 2.3 FABRICATION

- 33 A. FRP Flush Door: Fabricate Doors of the type, size and design indicated on the
34 Drawings.
35 1. Thickness: 1.75-inches (44 mm), 5-ply composite laminate system.
36 2. Door Size: Sizes are nominal; provide standard clearances as follows:
37 a) Hinge and Lock Stiles: 0.125-inch (3.18 mm).
38 b) Between Meeting Stiles: 0.25-inch (6.35 mm).
39 c) At Top Rails: 0.125-inch (3.18 mm).
40 d) Between Door Bottom and Threshold: 0.125-inch (3.18 mm).
41

- 1 B. Aluminum Frames: Fabricate doors frames of the type, size and design indicated on the
- 2 Drawings.
- 3 1. Cut corners square.
- 4 2. Reinforce and secure mechanically.
- 5 3. No exposed fasteners.

6 **PART 3 EXECUTION**

7 **3.1 EXAMINATION**

- 8 A. Do not begin installation until substrates have been properly prepared.
- 9 B. Verify that wall surfaces and openings are ready to receive frames and are within
- 10 tolerances specified in manufacturer's instructions.
- 11 C. Verify frames installed by other trades for installation of doors of this section are in strict
- 12 accordance with the manufacturer's instructions.
- 13 D. If preparation is the responsibility of another installer, notify Architect of unsatisfactory
- 14 preparation before proceeding.

15 **3.2 PREPARATION**

- 16 A. Clean surfaces thoroughly prior to installation.
- 17 B. Prepare surfaces using the methods recommended by the manufacturer for achieving
- 18 the best result for the substrate under the project conditions.

19 **3.3 INSTALLATION**

- 20 A. Install frames in accordance with manufacturer's instructions and approved shop
- 21 drawings; set frames plumb, square, level, and aligned to receive doors.
- 22 B. Perform cutting, fitting, forming, drilling, and grinding of frames as required for project
- 23 conditions; do not damage sight-exposed finishes.
- 24 C. Anchor frames to adjacent construction within tolerances specified in manufacturer's
- 25 instructions.
- 26 D. Seal metal-to-metal joints between framing members using good quality elastomeric
- 27 sealant.
- 28 E. Hang doors with required clearances as follows:
- 29 1. Hinge and Lock Stiles: 0.125 inch (3.18 mm).
- 30 2. Between Meeting Stiles: 0.250 inch (6.35 mm).
- 31 3. At Top Rails: 0.125 inch (3.18 mm).
- 32 4. Between Door Bottom and Threshold: 0.125 inch (3.18 mm).
- 33 F. Adjust doors and hardware to operate properly.
- 34 G. Installation of door hardware is specified in Section 08 71 00 - Door Hardware.
- 35

1 **3.4 CLEANING**

- 2 A. Upon completion of installation, thoroughly clean door and frame surfaces in accordance
3 with AAMA 609.
- 4 B. Do not use abrasive, caustic or acid cleaning agents.

5 **3.5 PROTECTION**

- 6 A. Protect products of this section from damage caused by subsequent construction until
7 substantial completion.
- 8 B. Repair damaged or defective products to original specified condition in accordance with
9 manufacturer's recommendations.
- 10 C. Replace damaged or defective products that cannot be repaired to Architect's
11 acceptance.

12
13 **END OF SECTION 08 02 21**

1 **SECTION 22 00 00 - PLUMBING**

2
3
4 **PART 1 - GENERAL**

5
6 **1.01 DESCRIPTION**

7
8 A. Work Included: Provide plumbing where shown on the Drawings, as specified herein, and as
9 needed for a complete and proper installation including, but not necessarily limited to:

- 10
11 1. Domestic Hot and Cold Water Piping.
12 2. Drain, Waste, and Vent Systems.
13 3. Plumbing Fixtures and Trim.
14 4. Lake Water Filter Piping.
15

16 B. Related Work:

- 17
18 1. Documents affecting work of this Section include, but are not necessarily limited to,
19 General Conditions, Supplementary Conditions, and Sections in Division 1 of these
20 Specifications.
21 2. Demolition and deactivation of plumbing systems in existing facilities as noted on the Site
22 Drawings.
23

24 C. Work of Other Sections:

- 25
26 1. Openings for new Plumbing work in new construction walls, floors, roof, ceiling, etc. shall
27 be provided by the General Contractor. Location and size of these openings shall be the
28 responsibility of the Plumbing Contractor.
29 2. Electrical line voltage wiring (110 volts and greater) by the Electrical Contractor. Wiring
30 diagrams shall be furnished to the Electrical Contractor by the Plumbing Contractor.
31 3. Roofing, exterior wall and related exterior openings shall be caulked, sealed and patched
32 by the General Contractor.
33 4. Exterior site utilities by the Site Contractor - refer to Division 33 requirements.
34

35 **1.02 GENERAL PROVISIONS**

36
37 A. This specification Section is a general description of the work requirements. The particular
38 descriptions are not intended to be all-inclusive. Bidders shall also refer to the Drawings.
39

40 B. Prior to submitting a bid, the Contractor shall call the Engineer's attention (in writing only) to any
41 materials or items of work believed to be inadequate. Bidders are required to visit the premises,
42 take measurements, inspect existing conditions and limitations, and obtain first-hand information
43 necessary to submit a bid. The intent of the Contract is to obtain complete system installations,
44 tested, ready for operation. No extras will be allowed because Contractor's misunderstanding of
45 the scope work involved.
46

47 C. Everything essential for the completion of the work implied to be covered by these Specifications
48 to make the system ready for normal and proper operation must be furnished and installed by this
49 Contractor. Accordingly, any omission from either the plans or the Specifications, or both of
50 details necessary for the proper installation and operation of the system shall not relieve this
51 Contractor from furnishing such detail in full and proper manner.
52

53 D. The Drawings show various details indicating the general arrangement of the plumbing work,
54 sizes and locations of piping, equipment, etc. The said Drawings with figures, lettering, etc., shall
55 be considered a part of these Specifications and no charge or alternation shall be made in any
56 case unless ordered by the Engineer.
57

- 1 E. In addition to the Plumbing work, refer to the Plumbing work shown on the general Construction
2 Drawings of the building as being part of this Contract, unless specified to be done by other
3 contractors.
4

5 **1.03 QUALITY ASSURANCE**
6

- 7 A. Use adequate number of skilled workmen who are thoroughly trained and experienced in the
8 necessary crafts and who are completely familiar with the specified requirements and the
9 methods needed for proper performance of the work of this Section.
10
11 B. Without additional cost to the Owner, provide such other labor and materials as required to be
12 complete the work of the Section in accordance, with the requirements of governmental agencies
13 having jurisdiction, regardless of whether such materials and associated labor are called for
14 elsewhere in the Contract Documents.
15
16 C. In acceptance or rejection of installed work, the Architect or Engineer shall make no allowance for
17 lack of skill on the part of the Workmen.
18
19 D. For the actual field fabrication, installation and testing of the Plumbing work, use only thoroughly
20 trained and experienced workmen complete familiar with the items required and manufacturer's
21 current recommended methods of installation.
22

23 E. Reference Standards:
24

25	ANSI	American National Standards Institute
26	ASME	American Society of Mechanical Engineers
27	ASSE	American Society of Sanitary Engineering
28	ASTM	American Society of Testing and Material
29	AWWA	American Waterworks Association
30	CISPI	Cast Iron Soil Pipe Institute
31	FM	Factory Mutual
32	MCA	Mechanical Contractors Association
33	NEC	National Electric Code
34	NEMA	National Electrical Manufacturers Association
35	NFPA	National Fire Protection Association
36	NSF	National Sanitation Foundation
37	WQA	Water Quality Association

38
39 **1.04 CODES AND PERMITS**
40

- 41 A. This contractor must comply with building codes and other ordinances in force where the building
42 is located as far as same apply to his work.
43
44 B. Plumbing work shall meet all Federal, State, Local Codes, ordinances and utility regulations.
45
46 1. In the event of conflict between or among specified requirements and pertinent
47 regulations, the more stringent requirement will govern when so directed by the Engineer.
48
49 C. Plumbing Contractor must secure permits from proper offices and pay all legal fees as may be
50 necessary for fulfilling the requirements of these specifications.
51
52 D. Submit one (1) copy of all permits to the Owner.
53

54 **1.05 COORDINATION**
55

- 56 A. Cooperate and coordinate with other trades to assure that all systems pertaining to the Plumbing
57 work shall be installed in the best feasible arrangement. Coordinate as required with all other
58 trades to share space in common areas and to provide the maximum of access to each system.

- 1
2 B. Arrange plumbing work in neat, well organized manner with piping and similar services running
3 with primary lines of building construction, and with minimum of 8 foot overhead clearance, where
4 possible.
5
6 C. Locate equipment properly to provide easy access, and arrange entire plumbing work with
7 adequate access for operation and maintenance.
8
9 D. Give right-of-way to piping, which must slope for drainage.
10
11 E. Where Plumbing work is to connect to existing, the Contractor must field verify all connection
12 points before beginning any rough-in work. Verify gravity flow lines and proper invert elevations
13 required prior to starting piping installation.
14

15 **1.06 ELECTRICAL PROVISIONS OF PLUMBING WORK**
16

- 17 A. Line Voltage Wiring: The Electrical Contractor is to make all line voltage (100 volts and greater)
18 electrical wiring connections for hookup of the units and systems.
19
20 B. Low Voltage Control Wiring: Exposed low voltage (less than 100 volts) temperature control wiring
21 in connection with the Plumbing systems shall be in EMT conduit by the Plumbing Contractor in
22 strict accordance with the applicable sections of the Electrical Specifications. *Concealed low-*
23 *voltage control* wiring may be routed to equipment without conduit, unless subject to physical
24 damage.
25
26 C. The Plumbing Contractor shall consult with the Electrical Contractor before ordering electrical
27 motors, to ascertain correct electrical current characteristics. Plumbing Contractor shall furnish
28 complete list and location of equipment requiring electrical connections and necessary wiring
29 diagrams to the Electrical Contractor.
30
31 D. Motors: Where not otherwise indicated, comply with applicable provisions of the National
32 Electrical Code, NEMA Standards, and sections of Division 16 of Specifications.
33
34 1. Phases and Current: 1/6 HP and smaller is Contractor's option; up to 1/3 HP, capacitor-
35 start, 120 volt, 60 cycle single-phase; 1/2 HP and larger, squirrel-cage induction NEMA
36 rated 200 volt, three-phase, 60 cycle. Provide 2 separate windings on 2 speed three-
37 phase motors. Coordinate with actual current characteristics; refer to Division 16 of
38 Specifications.
39 2. High Efficiency Motors: All motors 1 HP and larger shall be high efficiency motors
40 meeting or exceeding values tested in accordance with IEEE Standards 112, Method B
41 procedures as stated in NEMA MG 1-12.53a.
42 3. Temperature Rating: Class B insulation for 70 degree C temperature rise.
43 4. Service Factor: 1.15 for three-phase; 1.35 for single-phase.
44 5. Construction: General purpose, continuous duty.
45 6. Frames: NEMA Standard for horsepower specified.
46 7. Overload Protection: Built-in thermal, with internal sensing device for stopping motor,
47 and for signaling where indicated.
48 8. Bearings: Permanently lubricated and sealed ball bearings.
49
50 E. Motor Starter & Disconnect Switches: Where motor starters and disconnect switches are
51 indicated to be an integral part of equipment furnished by Plumbing Contractor, they shall meet
52 requirements of Division 16 and shall be connected by the Electrical installer.
53
54 1. Field assembled motor starters and disconnect switches are to be the responsibility of the
55 Electrical Contractor, unless indicated otherwise.
56
57 F. Wiring Connections: Wired connections in flexible conduit, except where plug-in electrical cords
58 are indicated and permitted by governing regulations.

- 1
2 G. General Wiring: Comply with applicable provisions of Division 16 Section.
3
4 H. Drip Pans: Furnish drain pans below piping which passes directly above electrical work.
5 Install drain piping and drain valve.
6

7 **1.07 PAINTING PLUMBING WORK**
8

- 9 A. General: All field painting of plumbing equipment shall be done by the General Contractor,
10 unless equipment is specified otherwise or is to be furnished with factory-applied finish coats.
11
12 B. All equipment shall be provided with factory-applied prime and final coat paint finish, unless
13 otherwise specified.
14
15 C. If factory-applied paint finish in any Plumbing equipment furnished by the Plumbing Contractor is
16 damaged in shipment or during construction of the building, the equipment shall be refinished by
17 the Plumbing Contractor to the satisfaction of the Architect or Engineer.
18
19 D. Prime paint all field-fabricated metal work under plumbing work, comply with applicable provisions
20 of Division 9.
21

22 **1.08 PLUMBING SYSTEM IDENTIFICATION**
23

- 24 A. General: Provide adequate marking of plumbing system and control equipment to allow
25 identification and coordination of maintenance activities and maintenance manuals.
26
27 1. Furnish and install adequate marking, tagging and labeling of all *accessible and exposed*
28 Plumbing equipment, piping and control devices, per ANSI A13.1-1981. Accessible
29 locations shall include all ceiling spaces above accessible ceilings.
30
31 B. Equipment: Identify all major Plumbing equipment with plastic-laminate signs of 2" high painted
32 stencils and contrasting background. Provide test of sufficient clarity and lettering to convey
33 adequate information at each location and mount permanently. Identify control equipment by 1-
34 1/2" x 4" plastic laminate nameplates with 1/4" high lettering.
35
36 C. Piping: Identify piping once every 30 feet at each branch, at termination of lines, and near valve
37 or equipment connections. Place flow directional arrows at each piping system for identification
38 of flow direction. Provide lettering of the appropriate size to convey information on wrap-around
39 signage, adhesive-backed or paint stenciled labels.
40
41 D. Valves: Identify all valves with 1-1/2" diameter polished brass tags with stamp-engraved labels or
42 plastic laminate tags. Prefix or color-code tags for each generic piping service. Prepare and
43 submit valve tag schedule, listing location, service and tag description, and incorporate in
44 Instruction Operations Manual.
45
46 E. Operational Labels: *Where* needed for proper or adequate information on operation and
47 maintenance of Plumbing systems, provide tags or labels of plastic or laminated card stock,
48 typewritten to convey the message.
49

50 **1.09 FLOOR, WALL, ROOF AND CEILING OPENINGS**
51

- 52 A. The General Contractor will be required to leave openings in ceiling, floors, walls, roof, partitions,
53 etc., as required to install the Plumbing work specified or shown on the Drawings. The Plumbing
54 Contractor is responsible for correct size and location of his openings. Where penetrations
55 through existing construction are required, they shall be the responsibility of the Plumbing
56 Contractor.
57
58 1. Pipe Sleeves: Schedule 40 black steel pipe, 1" larger than carrier pipe.

- 1
2 B. The Plumbing Contractor shall set sleeves and anchors for all equipment, etc., and shall provide
3 watertight seals on pipes through exterior walls, floors and roof and where noted on the
4 Drawings.
5
6 C. Pack annular space between sleeves and pipe with fiberglass insulation and seal with approved
7 caulking materials. Where penetrations occur through fire-rated walls or floors, fill space with fire-
8 resistive insulation similar to high-temperature mineral wool, US Gypsum Thermafiber batts or
9 Cera-blanket FS insulation by Tremco. Seal openings with UL approved fire-resistive fire stop
10 caulk/sealant or assembly.
11
12 1. Fireproof plastic piping through fire-rated construction per approved UL listed assembly.
13
14 D. Provisions for openings, holes and clearances through walls, floors, ceilings and partitions to be
15 made in advance of construction of such parts of the building.
16
17 E. If the Plumbing Contractor should neglect to inform the General Contractor of his opening
18 requirements and that portion of the building construction has been completed, the Plumbing
19 Contractor shall pay the General Contractor for providing such openings.
20
21 F. Make arrangements with various other contractors for all special framing, spacing and chases.
22 Mason will leave chases in mason work, but Plumbing Contractor is responsible for correct size and
23 location.

24 **1.10 CUTTING AND PATCHING**

- 25
26 A. General: Refer to Division 1 General Requirements.
27
28 B. Perform all cutting and patching required for complete installation of the HVAC systems, unless
29 specifically noted otherwise. Provide all materials required for patching unless otherwise noted.
30
31 1. All cutting and patching necessary of structural members to install any Plumbing work
32 shall not be done without permission, and then only carefully done under the direction of
33 the Architect and General Contractor.
34
35 C. The Contractor shall not endanger any work of other trades by demolition, cutting, digging or
36 otherwise. Any cost caused by defective or ill-timed cutting and patching work shall be borne by
37 the contractor responsible. Each contractor requiring cutting and patching shall hire men skilled
38 in such cutting and patching to do the work.
39
40 1. All patching work in existing areas shall match existing work and restore the finish to
41 its original condition in material, quality, texture, finish and color unless specifically noted
42 or scheduled otherwise.
43

44 **1.11 TESTS AND INSPECTIONS:**

- 45
46 A. All plumbing tests shall be conducted in the presence of and to the satisfaction of the Governing
47 Authorities, Architect/ Engineer, and Owner or his authorized representative.
48
49 B. The Plumbing Contractor shall be responsible for applying tests and ordering inspections as
50 required by Federal, State and local Code and Inspection authorities.
51
52 1. All work shall remain exposed until it has been tested, inspected and approved.
53

54 **1.12 TEMPORARY SERVICES**

- 55
56 A. Provide temporary services for all plumbing services to the existing facility to maintain function of
57 sanitary, storm, natural gas and water services during the construction period.

1
2 **1.13 TRENCHING AND BACKFILLING**
3

- 4 A. Trench, excavate and tunnel to place all piping and other related work necessary at the
5 elevations indicated or required, as shown on the Drawings.
6
7 1. Cut bottom of trench to grade, make trench 12" wider than the widest
8 dimension of the pipe.
9 2. All pipes shall be laid on a compacted bed of sand 6" deep. Do not lay
10 piping on large stones, rocks or bricks.
11
12 B. Backfill in layers and compact sufficiently to prevent settlement. Backfill with damp sand and fine
13 gravel mixture.
14
15 1. Exterior locations shall be backfilled to 12" of grade with sand and fine
16 gravel mixture and the remainder with native compacted topsoil.
17 2. Do not start backfill operations until plumbing work has been properly inspected and
18 approved.

19 **1.14 CONCRETE FOR PLUMBING WORK**
20

- 21 A. General: Comply with pertinent provisions of Division 1 and Division 3.
22
23 B. All concrete work for equipment pads by the Plumbing Contractor.
24
25 C. Concrete Equipment Pads: For each piece of floor or ground mounted HVAC equipment as
26 indicated on the Drawings, provide a 4" concrete housekeeping pad at a minimum of 4 inches
27 wider than the full size of the respective equipment's base. Equipment pads are required for the
28 following equipment:
29
30 1. Water Heaters.
31 2. Water Softeners and Brine Tanks.
32

33 **1.15 EQUIPMENT ACCESS**
34

- 35 A. General: All valves, equipment and accessories shall be installed to permit access to equipment
36 for maintenance, servicing or repairs. Relocation of piping, or equipment to accomplish
37 equipment access shall be completed by this Contractor at no additional cost.
38
39 B. Location: Provide access doors where equipment is located in chases or inaccessible locations.
40 Access panels shall be furnished by this Contractor and installed by the specific trade responsible
41 for the material in which the access panels are installed.
42
43 C. Construction: Access doors in fire-rated construction must have UL label. Access doors shall be
44 of size to provide adequate access to equipment concealed in wall, ceiling and furred-in spaces.
45 Milcor or approved equal, 14-gauge steel frame and door, prime-coated, except stainless steel in
46 areas subject to excessive moisture.

47 **1.16 EQUIPMENT SUPPORTS**
48

- 49 A. General: Provide all supporting steel and related materials not indicated on structural drawings
50 as required for the installation of equipment and materials, including angles, channels, beams
51 and hangers.
52
53 1. Prime coat paint all metal supports.

1 **1.17 EQUIPMENT GUARDS**

2
3 A. General: Provide equipment guards over belt-driven assemblies, pump shafts, exposed fans
4 and related elsewhere, as indicated in this specification or required by Code.

5
6 1. All belt guards shall be OSHA-approved types.
7

8 **1.18 GUARANTEE**

9
10 A. All material and workmanship must be new and first class in every respect; the plumbing
11 equipment must be turned over to the owner in complete working order and free from mechanical
12 or performance defects.

13
14 B. The Plumbing Contractor must guarantee all labor and materials for one (1) year from the
15 completion of the plumbing system. Maintain and repair plumbing equipment for the above
16 period, unless such defects are clearly the result of bad management after plumbing system is
17 turned over to the Owner.
18

19 C. Before final acceptance of the plumbing work, the Plumbing Contractor shall have the entire
20 apparatus and system in complete and satisfactory operation and shall maintain same in
21 satisfactory and continuous operation for a period of ten days prior to the date of acceptance; fuel
22 to be furnished by Owner.
23

24 D. The Plumbing Contractor shall submit to the Engineer in triplicate, at the completion of his work, a
25 certified statement, signed by a principal of the firm, stating that the system has been fully installed
26 and is operating within the intent of the Drawings and Specifications and that all system components
27 have been tested and adjusted. This statement shall be submitted before the system is presented to
28 the Owner for final inspection.
29

30 **1.19 SUBMITTALS**

31
32 A. Refer to Division 1 for additional submittal requirements.
33

34 B. The Plumbing Contractor will be held responsible for correction of work deemed necessary by the
35 Engineer due to proceeding with the work without shop drawings that have the
36 Architect/Engineers final approval.
37

38 C. Shop drawings shall include data on physical dimensions, gauges, materials of construction and
39 capacities.
40

41 1. Incomplete drawings will be disapproved.
42

43 D. This Contractor will be responsible for all figures and dimensions shown on the shop drawings.
44 Approval of shop drawings describing equipment that cannot fit in the space allotted does not
45 relieve this Contractor from providing equipment that will meet the space requirements.
46

47 E. Submit six (6) copies of shop drawings to the Architect/Engineer for approval, with complete
48 detail for all equipment, materials, etc., to be furnished and installed for this project as follows:
49

- 50 1. Valves.
 - 51 2. Pipe and piping specialties.
 - 52 3. Insulation systems.
 - 53 4. Plumbing fixtures.
 - 54 5. Instructions and O&M manuals (2 copies).
 - 55 6. As-built Drawings (1 copy).
- 56

57 **1.20 HOUSEKEEPING AND CLEANUP**

- 1 A. Periodically as work progress and/or as directed by the Architect/Engineer, the Contractor shall
2 remove waste materials from the building and leave the area of the work room clean. Upon
3 completion of work remove all tools, scaffolding, broken and waste materials, etc., from the site.
4

5 **1.21 LUBRICATION**

6

- 7 A. Upon completion of the work and before turning over to the Owner, clean and lubricate all
8 bearings except sealed and permanently lubricated bearings. Use only lubricant recommended
9 by the manufacturer.

- 10
11 1. The Contractor is responsible for maintaining lubrication of all mechanical equipment
12 under his contract until work is accepted by the Owner.
13

- 14 B. Furnish a chart with each piece of equipment listed, itemizing location for lubricant required and
15 recommended periods of lubrication. Incorporate chart in Instruction Manual.
16

17 **1.22 INSTRUCTIONS AND MANUALS**

18

- 19 A. Upon completion of the installation, but before final acceptance of the system, the Plumbing
20 Contractor shall instruct the Owner on the care and operation of all parts of the Plumbing system.
21

- 22 B. Assemble two (2) complete sets of manufacturer's printed operating and maintenance
23 instructions for all mechanical equipment and installed under this contract. Prepare in bound
24 copies complete with index tabs. Information must include parts lists, equipment warranties, and
25 wiring diagrams. Submit bound copies to Architect for disbursement.
26

27 **1.23 AS-BUILT DRAWINGS**

28

- 29 A. During construction maintain a set of prints showing installed as-built work for the project.
30

- 31 B. Upon completion of construction before final acceptance, provide a set of as-built drawings to the
32 Architect/Engineer.
33
34

35 **PART 2 - PRODUCTS**

36

37 **2.01 DOMESTIC WATER PIPE SCHEDULE**

38

- 39 A. Above Ground Piping:
40

- 41 1. Type 'L' copper water tube, H (hard drawn) temper, ASTM B88; with cast copper fittings,
42 ANSI B16.18; wrought copper fittings, ANSI B16.22; lead-free (less than 0.2%) solder,
43 ASTM B32; flux ASTM B813.
44 2. PEXa tubing approved for potable water piping: Crosslinked Polyethylene, ASTM F876
45 & ASTM F877. Fittings: Insert type fittings with cold flaring memory type fittings equal to
46 Uponor. Crimp or compression ring fittings will not be allowed.
47 3. Copper mechanical grooved fittings and couplings on roll grooved pipe(pro-press) may
48 be used in lieu of soldered fittings.
49

- 50 B. Below Ground: 2-1/2" and Smaller:
51

- 52 1. Type 'K' copper water tube, O(annealed-soft) temper, ASTM B88; with cast copper
53 fittings, ANSI B16.18; wrought copper fittings, ANSI B16.22; lead-free (less than 0.2%)
54 solder, ASTM B32; flux ASTM B813; or cast copper flared pressure fittings, ANSI B16.26.
55 2. PEXa tubing approved for potable water piping: Crosslinked Polyethylene, ASTM F876 &
56 ASTM F877. Fittings: Insert type fittings with cold flaring memory type fittings equal to
57 Uponor. Crimp or compression ring fittings will not be allowed.
58

1 **2.02 DRAIN, WASTE AND VENT PIPE SCHEDULE**

2
3 A. Interior Above Ground:

- 4
5 1. Cast iron soil pipe and fittings, hub and spigot, service weight, ASTM A74; with gasketed
6 neoprene joints.
7 2. Hubless cast iron soil pipe and fittings, CISPI 301; with no-hub couplings, CISPI 310.
8 3. PVC plastic pipe, Schedule 40, Class 12454-B (PVC 112), ASTM D1785; PVC plastic
9 drain, waste and vent pipe and fittings, ASTM D2665; socket fitting patterns, ASTM
10 D3311; primer, ASTM F656; solvent cement, ASTM D2564.
11 4. Galvanized steel vent pipe, Schedule 40, zinc-coated, ASTM 120 or 53 Grade B;
12 malleable iron threaded fittings, zinc-coated.
13 5. Type "DWV" copper water tube, H (hard drawn) temper, ASTM B88; with cast copper
14 drainage fittings (DWV), ANSI B16.23; wrought copper drainage fittings (DWV), ANSI
15 B16.29; lead-free (less than 0.2%) solder, ASTM B32; flux, ASTM B813.
16

17 B. Interior Below Ground:

- 18
19 1. Cast iron soil pipe and fittings, hub and spigot, service weight, ASTM A74; with gasketed
20 neoprene joints.
21 2. PVC plastic pipe, Schedule 40, Class 12454-B(PVC 112), ASTM D1785; PVC plastic
22 drain, waste and vent pipe and fittings, ASTM D2665; socket fitting patterns, ASTM
23 D3311; primer, ASTM F656; solvent cement, ASTM D2564.
24

25 **2.03 LAKE WATER FILTER PIPING SCHEDULE**

26
27 A. Above & Below Ground Piping:

- 28
29 1. CPVC schedule 40(SDR 11) tubing with solvent weld joints, ASTM
30 D2846 and F442.
31

32 **2.04 VALVES**

33
34 A. Approved Manufacturers:

- 35
36 1. Conbraco Apollo;
37 2. Milwaukee;
38 3. Watts;
39 4. Nibco.
40

41 B. Check valves:

- 42
43 1. 2" and smaller: Bronze, screwed, Y-pattern, 200# WOG, swing check type.
44

45 C. Ball valves:

- 46
47 1. 2" and smaller: Two or Three piece, bronze-body, chrome-plated bronze ball, Teflon seat
48 and packing, 400 pig WOG, with stem extensions on insulated piping. Appollo 70-200
49 series.
50

51 **2.05 VENT FLASHING**

- 52
53 A. Where pipes of this Section pass through the roof, flash the opening with seamless 3 lb./sq.ft.
54 lead flashing with 15" x 17" minimum base size, steel reinforced boot and cast-iron
55 counterflashing sleeve.
56

- 57 B. Approved Manufacturers: SSMC, Oatey or approved equal.
58

1 **2.06 PIPE HANGERS**

2
3 A. Piping:

- 4
5 1. Split ring hangers with supporting rods.
6 2. Adjustable clevis.

7
8 B. Multiple or Trapeze Hangers:

- 9
10 1. Steel channels with welded spacers and hanger rods.

11
12 C. Floor Support:

- 13
14 1. Painted steel pipe saddle, stand and bolted floor flange.

15
16 D. Copper Pipe Supports:

- 17
18 1. All supports, fasteners, clamps, etc. directly connected to copper piping
19 shall be copper-plated or polyvinylchloride (PVC)-coated.
20 2. Where steel strut supports are used, provide isolation collar between supports/clamp and
21 copper piping.

22
23 E. Approved Manufacturers: Fee and Mason, B-line, Grinnell or approved equal.

24
25 **2.07 CLEANOUTS**

26
27 A. Exterior: Smith #4253 with XH cast iron top in concrete areas.

28
29 B. Interior Floors: Smith 4930-PB square nickel-bronze top.

30
31 C. Finished walls: Smith #4532 stainless steel with access plate and screw.

32
33 D. Provide cleanout plugs of extra heavy bronze

34
35 E. Approved Manufacturers: Josam, Smith, Wade, Zurn or approved equal.

36
37 **2.08 ACCESS**

38
39 A. General: All piping, conduit and accessories shall be installed to permit access to equipment for
40 maintenance. Any relocation of piping, equipment or accessories required to provide
41 maintenance access shall be accomplished by the Contractor at no additional cost.

42
43 B. Removable Access Plates: Where only hand access is sufficient for valve access, provide
44 removable plate-type access unit of minimum size which will facilitate required access.

- 45
46 1. Provide units of type, style, design, material and finish appropriate for location and
47 exposure in each instance.
48 2. In exposed surfaces of occupied spaces provide round plate units, flush floor units and
49 frameless low-profile wall units, primed-for-paint in painted surfaces and polished chrome
50 or stainless-steel finish in other surfaces.

51
52 C. Walls:

- 53
54 1. Smith #4767 flush wall stainless steel cover plate with screw latch lock in finished tile
55 walls at wet locations.
56 2. Smith #4760 or #4765 with bonderized prime-coated steel face and screw latch lock in
57 walls of other finished rooms.

1 D. Ceilings:

- 2
3 1. Provide Smith #4765 flush ceiling bonderized prime-coated steel face with screw latch
4 lock.

5
6 E. Floors:

- 7
8 1. Smith #4910 with aluminum or nickel-bronze non-skid top.
9

10 **2.09 WATER HAMMER ARRESTORS**

- 11
12 A. Provide Smith #5000 series or equal, stainless steel or air chambers at each fixture group utilizing
13 a flush valve or fast closing solenoid valve, as sized and recommended by the manufacturer.

- 14
15 B. *Approved Manufacturers:* Josam, PPP, Smith, Wade, Zurn or approved equal.
16

17 **2.10 HANDICAPPED INSULATION**

- 18
19 A. Where shown on the Drawings or required by governmental agencies having jurisdiction, provide
20 "Truebro" insulation system or approved equal on exposed hot
21 and cold water supply piping, waste tailpiece and trap at lavatories requiring ADA compliance.
22

23 **2.11 PIPE INSULATION**

- 24
25 A. General: Provide composite piping insulation (insulation, jackets, coverings, sealers, mastics,
26 and adhesives) with ratings not exceeding flame spread of 25 and a smoke developed of 50 in
27 active return air plenums. Ratings in all other areas shall not exceed a flame spread of 25 and a
28 smoke developed of 150 (test method ASTM E-84). Comply with all codes regarding the use of
29 foam insulation.
30

- 31 B. Insulate piping located in interior space, including (but not necessarily limited to) the following
32 services:
33

- 34 1. Interior cold and hot domestic water piping.
35

- 36 C. Insulate each piping system with one of the following types and thickness of insulation, except as
37 otherwise indicated (Installer's option where more than one type is indicated).
38

- 39 1. Fibrous Glass: Minimum density 3 lb./cu.ft., thermal conductivity of not more than 0.23 at
40 75 degrees F mean temperature, suitable for temperatures to 450 degrees F. Kraft-
41 reinforced, foil-vapor barrier, laminate all-service jacket, factory applied to insulation with a
42 self-sealing pressure sensitive adhesive lap, maximum permeance of 0.02 perms and
43 minimum beach puncture resistance of 50 units.
44

- 45 2. Elastomeric Insulation: Closed-cell type, with minimum nominal density of 5.5 lbs./cu.ft.,
46 thermal conductivity shall be not more than 0.27 at 75 degrees F mean temperature, and
47 maximum water vapor transmission of 0.17 perm/inch. The material shall be suitable for a
48 temperature range from 220 degrees F to minus 40 degrees F.
49

50 D. Insulation Installation Schedule:

	<u>Service</u>	<u>Pipe Size</u>	<u>Insulation Thickness</u>
51			
52			
53	1. Hot Water Piping	Less than 1"	1"
54		1-1/4 thru 4"	1"
55	2. Cold Water Piping	Less than 1"	1/2"
56		1-1/4" thru 4"	1"
57			

58 **2.11 FIXTURES AND EQUIPMENT**

- 1
2 A. General: Provide plumbing fixture, trim, and equipment as shown on the **"Fixture and**
3 **Equipment Schedule"** on the Contract Drawings, and as specified herein.
4
5 B. All vitreous chinaware and porcelain fixtures shall be select quality.
6
7 1. All wastes and supplies for fixtures, except as otherwise specified or required, shall turn
8 back into walls.
9
10 C. All trim, except as otherwise specified, shall be constructed of brass. Finish shall be polished
11 chrome, except where concealed (inside cabinets, etc.).
12
13 D. Faucets shall have replaceable control assemblies or replaceable washers and seats.
14
15 E. Exposed waste fittings shall be constructed of 17 gauge tubular brass. Slip joints are permitted
16 only on the fixture side of the trap.
17
18 F. All fixtures with non-accessible traps such as bathtubs, showers, floor drains, shall have a
19 completely removable stopper or grate in order to be accessible for cleanout.
20
21 G. Quarter-turn (1/4) ball valve type fixture stops shall be installed at each fixture. It is the
22 Contractor's option to install straight or angle type. All stops are to have a minimum of 1/2" inlets
23 with flexible riser and loose key handles where exposed to the public.
24
25 1. All shower/bath valves are to have integral stops.
26 2. All loose stops shall be from the same manufacturer.
27
28 H. Approved manufacturer's for Vitreous China and enameled Cast Iron Fixtures:
29
30 1. American Standard.
31 2. Kohler.
32
33 I. Approved manufacturer's for Water Closet Seats:
34
35 1. Bemis.
36 2. Olsonite.
37
38 J. Approved manufacturer's for Sink and Lavatory Fittings:
39
40 1. American Standard.
41 2. Chicago faucet.
42 3. Delta.
43 4. T&B Brass.
44 5. Symmons.
45
46 K. Approved manufacturer's for Supplies, Stops and Traps:
47
48 1. McQuire Manuf.
49 2. Brass Craft.
50 3. Chicago Faucet.
51 4. Dearborn Brass.
52
53 **2.12 WATER SOFTENER**
54
55 A. Acceptable Manufacturers:
56
57 1. Hellenbrand.
58 2. Capital Water Softener

- 1
2 B. Softener Tank: Tank shall be of NSF approved, UL listed, non-corrosive reinforced pressure
3 vessel rated for 150 psig working pressure and 120 deg F, and hydrostatically tested at 50% in
4 excess of the working pressure.
5
6 C. Internal Distribution:
7
8 1. Upper distributor system shall be of the single point baffle type, constructed of Schedule
9 40 galvanized steel and fittings.
10 2. Lower distribution system shall be the hub and radial arm type, PVC constructed with
11 individual fine slotted non-clogging polyethylene strainers arranged for even flow
12 distribution through the resin bed. Slotted lateral arms are unacceptable. The
13 distribution system shall be embedded in a single layer sub fill of washed 1/8" x 1/16"
14 gravel to support the resin bed.
15
16 D. Main Operating Valve: The main operating valve shall be an Industrial Automatic Multiport
17 diaphragm type, slow opening and closing, free of water hammer.
18
19 1. The diaphragm assembly shall be fully guided on its perimeter when pressure actuated
20 from one position to another to assure a smooth reliable shut-off without sticking.
21 2. There shall be no contact of dissimilar metals within the valve and no special tools shall
22 be required to service the valve.
23 3. The main operating valve shall be manufactured by the manufacturer of the softening
24 equipment.
25 4. Valve shall be equipped with an internal automatic self-adjusting brine injector to draw
26 brine and rinse at a constant rate regardless of water pressure in the range 30 to 100 psi.
27 5. Single units shall have an internal automatic by-pass of untreated water during
28 regeneration. Valve shall have a soft water sampling cock.
29
30 E. Control: A factory-mounted and wire cycle controller shall incorporate a water meter demand
31 control system with 2" turbine meter and electronic meter controller with multiported pilot valve to
32 control all steps of automatic regeneration. Water demand controller shall backwash resin based
33 on water volume metered as monitored by microprocessor-based controls including the following
34 functions:
35
36 1. Volume of gallons.
37 2. Hardness display in grains.
38 3. Totalizing metering.
39 4. System flow rate in GPM.
40 5. Adjustable regeneration times.
41 6. Delayed or immediate regeneration.
42 7. System diagnostic displays.
43 8. Calendar day override.
44
45 F. Flow Control: An automatic flow controller shall be provided to maintain proper backwash and
46 flush rates over wide variations in operating pressures and require no field adjustment.
47
48 G. Exchange Resin: The ion exchange resin shall be virgin, high capacity sulfonated polystyrene
49 type stable over entire pH range with good resistance to bead fracture from attrition or osmotic
50 shock.
51
52 1. Each cubic foot of resin shall be capable of removing 30,000 grains of hardness as
53 calcium carbonate when regenerated with 15 lbs. of salt.
54
55 H. Brine System: Provide a single brine measuring and dry salt storage tank with salt platform. Size
56 tank for at least four (4) regenerations at full salting. Brine dosage shall be easily adjusted in the
57 field without piping revision.
58

1. Tank shall be constructed of rigid 3/8" thick rotationally molded polyethylene with cover.
2. The brine tank shall be equipped with a float operated plastic, fitted field serviceable brine valve for automatic control of brine withdrawal and fresh water refill. The brine valve shall provide positive shut-off to prevent air from entering system. High purity pellet type or solar salt is required.

2.13 COMMERCIAL ELECTRIC WATER HEATER

- A. Type: Floor-mounted electric storage domestic water heater with top connections. Design to be UL listed with 5-year commercial use tank warranty and 1 year parts warranty. Water heater shall meet or exceed ASHRAE std. 90.1b.
- B. Tank: Steel glass lined tank rated for 150 psig complete with removable magnesium anode rod, plastic diffuser type dip tube, inlet and outlet heat trap fittings, minimum R-20 polyurethane foam insulation, painted steel jacket, drain valve and temperature and pressure relief valve.
- C. Elements: Dual 4500 watt heating elements to be replaceable threaded low watt density incoloy sheath with adjustable thermostat control, energy cutoff and wired for non-simultaneous operation.

2.14 DOMESTIC HOT WATER RECIRCULATION PUMPS

- A. Horizontal single stage close coupled system lubricated in-line pumps, 125 psig maximum working pressure at operating temperature of 225 deg F continuous. The manufacturer shall certify all pump ratings.
 1. Casing: Bronze or stainless steel; flanged suction and discharge connection.
 2. Impeller: Bronze, stainless steel or thermoplastic, keyed to the shaft, single suction enclosed type, hydraulically and dynamically balanced.
 3. Bearings: System lubricated carbon sleeve bearings.
 4. Shaft: Stainless steel or ceramic.
 5. Seal: Stainless steel isolating rotor and stator.
 6. Integral time clock control.
 7. 115 volt, 1-phase, 60 hertz.
- B. Motor: Provide ECM pump motor with impedance protected motor sized for non-overloading over the entire pump curve. Furnish each pump and motor with a nameplate giving the manufacturer's name, serial number of pump.
- C. Approved Manufacturer: Bell and Gossett, Grundfos or approved equal.

2.15 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 SITE UTILITIES

- 1 A. Verify all flow lines to the septic system sewer prior to installing any underground sewer piping.
2 Advise the General Contractor of site conditions or inverts inconsistent with the plumbing layout
3 and proposed flow line prior to proceeding.
4

5 **3.03 PLUMBING SYSTEM LAYOUT**
6

- 7 A. Lay out the plumbing system in careful coordination with the Drawings, determining proper
8 elevations for all components of the system and using only the minimum number of bends to
9 produce a satisfactorily functioning system.
10
11 B. Follow the general layout shown on the Drawings in all cases except where other work may
12 interfere.
13
14 C. Lay out pipes to fall within partition, wall, or roof cavities, and to not require furring other than
15 shown on the Drawings.
16
17 D. Where work is to connect to existing, Plumbing contractor must field verify all connection points
18 before beginning any rough-in work. Verify all connecting invert elevations and flow lines of new
19 work connected to existing gravity drainage.
20

21 **3.04 TRENCHING AND BACKFILLING**
22

- 23 A. Perform trenching and backfilling associated with the work of this Section in strict accordance
24 with the provisions of Division 2 of these Specifications and consistent with the national, state and
25 local plumbing codes.
26
27 B. Cut bottom of trenches to grade. Make trenches 12" wider than the greatest dimension of the
28 pipe.
29
30 C. Bedding and backfilling:
31
32 1. Install piping promptly after trenching. Keep trenches open as short a time as
33 practicable.
34 2. Under the building, install pipes on a 6" bed of damp sand. Backfill to bottom of slab with
35 damp sand.
36 3. Outside the building, install underground piping on a 6" bed of damp sand. Backfill to
37 within 12" of finish grade with damp sand. Backfill remainder with native topsoil.
38 4. Do not backfill until installation has been approved and until Project Record Documents
39 have been properly annotated.
40

41 **3.05 INSTALLATION OF PIPING AND EQUIPMENT, GENERAL**
42

- 43 A. General:
44
45 1. Proceed as rapidly as the building construction will permit.
46 2. Thoroughly clean items before installation. Cap pipe openings to exclude dirt until
47 fixtures are installed and final connections have been made.
48 3. Cut pipe accurately, and work into place without springing or forcing properly clearing
49 window, doors, and other openings. Excessive cutting or other weakening of the building
50 will not be permitted.
51 4. Show no tool marks or threads on exposed plated, polished, or enameled connections
52 from fixtures. Tape all finished surfaces to prevent damage during construction.
53 5. Make changes in directions with fittings; make changes in main sizes with eccentric
54 reducing fittings. Unless otherwise noted, install water supply and return piping with
55 straight side of eccentric fittings at top of the pipe.
56 6. Run horizontal sanitary piping at a uniform grade of 1/4" per ft., unless otherwise noted.
57 Run horizontal water piping with an adequate pitch upwards in direction of flow to allow
58 complete drainage.

- 1 7. Provide sufficient swing joint, ball joints, expansion loops, and devices necessary for a
- 2 flexible piping system, whether or not shown on the Drawings.
- 3 8. Support piping independently at pumps, coils, tanks, and similar locations, so that weight
- 4 of pipe will not be supported by the equipment.
- 5 9. Pipe the drains from pump glands, drip pans, relief valves, air vents, and similar
- 6 locations, to spill an open sight drain, floor drain, or other acceptable discharge point, and
- 7 terminate with a plain and unthreaded pipe 6" above the drain.
- 8 10. Securely bolt all equipment, isolators, hangers, and similar items in place.
- 9 11. Support each item independently from other pipes. Do not use wire for hanging or
- 10 strapping pipes.
- 11 12. Provide complete dielectric isolation between ferrous and non-ferrous metals.
- 12 13. Provide union and shut off valves suitably located to facilitate maintenance and removal
- 13 of equipment and apparatus.

14
15 **B. Equipment access:**

- 16
- 17 1. Install piping, equipment, and accessories to permit access for maintenance. Relocate
- 18 items as necessary to provide such access, and without additional cost to the Owner.
- 19 2. Provide access doors where valves, motors, or equipment requiring access for
- 20 maintenance are located in wall or chases or above ceilings. Coordinate location of
- 21 access doors with other trades as required.
- 22

23 **3.06 PIPE JOINTS**

24
25 **A. Copper tubing:**

- 26
- 27 1. Cut square, remove burrs, and clean inside of female fitting to a bright finish.
- 28 a. Apply solder flux with brush to tubing.
- 29 b. Remove internal parts of solder-end valves prior to soldering.
- 30 2. Provide dielectric unions at points of connection of copper tubing to ferrous piping and
- 31 equipment.
- 32 3. For joining copper tubing, use the following:
- 33 a. Water piping 3" and smaller: 95-5 solder;
- 34 b. Water piping larger than 3": "Sil-fos" brazing;
- 35 c. Underground: "Sil-fos" brazing.
- 36

37 **B. Screwed piping:**

- 38
- 39 1. Deburr cuts.
- 40 a. Do not ream exceeding internal diameter of the pipe.
- 41 b. Thread to requirements of ANSI B2.1.
- 42 2. Use Teflon tape on male thread prior to joining other services.
- 43 3. Use litharge and glycerin on joint prior to cleaning for air and oil piping.
- 44

45 **C. PEX Tube Joints**

- 46
- 47 1. Installed per ASTM F-1807 with insert-type fittings with cold memory flaring as
- 48 manufactured by Uponor are approved.
- 49 2. Brass compression type fittings with threaded nut, compression ring and insert will not be
- 50 acceptable.
- 51 3. Provide copper type L manifolds, where manifold distribution is used with labeled quarter
- 52 turn ball valve stops for each service line.
- 53 4. Install piping and fittings per manufacturers recommendations.
- 54

55 **D. Leaky joints:**

- 56
- 57 1. Remake with new material.
- 58 2. Remove leaking section and/or fitting as directed.

3. Do not use thread cement or sealant to tighten joint.

3.07 PIPE SUPPORTS

A. Support suspended piping with clevis or trapeze hangers and rods.

B. Space hangers and support for horizontal steel pipes according to the following schedule:

<u>Pipe size:</u>	<u>Maximum spacing on centers:</u>
1-1/4" and smaller:	8'-0"
1-1/2" to 3":	10'-0"
4" to 5":	14'-0"

C. Space hangers and supports for horizontal copper tubing according to the following schedule:

<u>Tube size:</u>	<u>Maximum spacing on centers:</u>
1" and smaller:	6'-0"
1-1/2":	7'-0"
2":	8'-0"
2-1/2":	9'-0"
3" and larger:	10'-0"

D. Provide sway bracing on hangers longer than 18".

E. Support vertical piping with riser clamps secured to the piping and resting on the building structure. Provide at each floor unless otherwise noted.

F. Provide insulation continuous through hangers and rollers. Protect insulation by galvanized steel shields.

G. Arrange pipe supports to prevent excessive deflection, and to avoid excessive bending stress.

H. Hubless piping:

1. Provide hangers on the piping at each side of, and within 6" of, hubless pipe coupling so the coupling will bear no weight.
2. Do not provide hangers on couplings.
3. Provide hangers adequate to maintain alignment and to prevent sagging of the pipe.
4. Make adequate provision to prevent shearing and twisting of the pipe and the joint.

3.08 SLEEVES AND OPENINGS

A. Provide sleeves for each pipe passing through walls, partitions, floors, roofs, and ceilings.

1. Set pipe sleeves in place before concrete is placed.
2. For uninsulated pipe, provide sleeves two pipe sizes larger than the pipe passing through, or provide a minimum of 1/2" clearance between inside and outside of the pipe.
3. For insulated pipe, provide sleeves of adequate size to accommodate the full thickness of pipe covering, with clearance for packing and caulking.

B. Caulk the space between sleeve and pipe or pipe covering, using a noncombustible, permanently plastic, waterproof, non-staining compound which leaves a smooth finished appearance, or pack with noncombustible asbestos cotton, or fiberglass to within 1/2" of both wall faces, and provide the waterproof compound described above.

C. Finish and escutcheons:

1. Smooth up rough edges around sleeves with plaster or spackling compound.

- 1 2. Provide 1" wide chrome or nickel plated escutcheons on all pipes exposed to view where
2 passing through walls, floors, partitions, ceilings, and similar locations.
3 a. Size the escutcheons to fit pipe and covering.
4 b. Hold escutcheons in place with set screw.
5

6 **3.09 CLEANOUTS**

- 7
8 A. Secure the Architect's approval of locations for cleanouts in finished areas prior to installation.
9
10 B. Provide cleanouts of same nominal size as the pipes they serve; except where cleanouts are
11 required in pipes 4" and larger provide 4" cleanouts.
12
13 C. Make cleanouts accessible. After pressure tests are made and approved, thoroughly graphite the
14 cleanout threads.
15

16 **3.10 VALVES**

- 17
18 A. Provide valves in water and gas systems. Locate and arrange so as to give complete regulation
19 of apparatus, equipment, and fixtures.
20
21 B. Provide valves in at least the following locations:
22
23 1. In branches and/or headers of water piping serving a group of fixtures.
24 2. On both sides of apparatus and equipment.
25 3. For shutoff of risers and branch mains.
26 4. For flushing and sterilizing the system.
27 5. Where shown on the Drawings.
28
29 C. Locate valves for easy accessibility and maintenance.
30

31 **3.11 WATER HAMMER ARRESTORS**

- 32
33 A. Provide water hammer arrestors on hot water lines and cold water lines.
34
35 1. Install in upright position at all quick closing valves, isolated plumbing fixtures, and supply
36 headers at plumbing fixture groups.
37 2. Locate and size as specified, locate in accordance with Plumbing and Drainage Institute
38 Standard WH-201.
39 3. Install water hammer arrestors behind access panels.
40

41 **3.12 BACKFLOW PREVENTION**

- 42
43 A. Protect plumbing fixtures, faucets with hose connections, and other equipment having plumbing
44 connection, against possible back siphonage.
45
46 B. Arrange for testing of backflow devices as required by the governmental agencies having
47 jurisdiction.
48

49 **3.13 PLUMBING FIXTURE INSTALLATION**

- 50
51 A. Installation:
52
53 1. Set fixtures level and in proper alignment with respect to walls and floors, and with
54 fixtures equally spaced.
55 2. Provide supplies in proper alignment with fixtures and with each other.
56
57 B. Grout wall and floor mounted fixtures watertight where the fixtures are in contact with walls and
58 floors.

- 1
2 C. Caulk deck-mounted trim at the time of assembly, including fixture and casework mounted. Caulk
3 self-rimming sinks installed in casework.
4

5 **3.14 DISINFECTION OF WATER SYSTEMS**
6

- 7 A. Disinfect hot and cold water systems.
8

- 9 1. Perform disinfection under the Architect's observation. Notify the Architect at least 48
10 hours prior to start of the disinfection process.
11 2. Upon completion of disinfecting, secure and submit the Certificate of Performance,
12 stating system capacity, disinfectant used, time and rate of disinfectant applied, and
13 resultant residuals in ppm at completion.
14 3. Use disinfectant method approved by the Architect.
15

- 16 B. When disinfection operation is completed, and after final flushing, secure an analysis by a
17 laboratory approved by the Architect, based on water samples from the system, showing test
18 negative for coli-aerogene organisms. Provide a total plate count of less than 100 bacteria per
19 cc, or equal to the control sample.
20

- 21 C. If analysis results are not satisfactory, repeat the disinfection procedures and retest until specified
22 standards are achieved.
23

24 **3.15 OTHER TESTING AND ADJUSTING**
25

- 26 A. Provide personnel and equipment, and arrange for and pay the costs of, all required tests and
27 inspections required by governmental agencies having jurisdiction.
28

- 29 B. Where test show materials or workmanship to be deficient, replace or repair as necessary, and
30 repeat the tests until the specified standards are achieved.
31

- 32 C. Adjust the system to optimum standards of operation.
33

34 **END OF SECTION**

1 SECTION 23 00 00 - HEATING, VENTILATING AND AIR CONDITIONING

2
3
4 PART 1 - GENERAL

5
6 1.01 DESCRIPTION

7
8 A. Work Included: Provide heating, ventilating, and air conditioning systems where shown on the
9 Drawings, as specified herein, and as needed for a complete and proper installation including, but
10 not necessarily limited to:

- 11
12 1. Exhaust systems including, inline fans, motors, dampers, actuators, controls and related
13 items;
14 2. Air Inlets and Outlets;
15 3. Electric heat;
16 4. Acoustical and thermal insulation of ductwork and related equipment.
17 5. Test, adjust, and balance air systems;
18 6. O&M manuals, warranty work and Owner instructions.

19
20 B. Related Work:

- 21
22 1. Documents affecting work of this Section include, but are not necessarily limited to,
23 General Conditions, Supplementary Conditions, and Sections in Division 1 of these
24 Specifications.
25 2. Equipment structural supports, etc.
26 3. Louvers provided by HVAC Contractor; installed by General Contractor.

27
28 C. Work of Other Sections:

- 29
30 1. Openings for ventilating work in walls, floors, roof, ceiling, etc., will be provided by
31 General Contractor. Location and size of these openings will be the responsibility of the
32 HVAC Contractor.
33 2. Lintels and structural supports for HVAC openings and equipment by the General
34 Contractor.
35 3. Electrical line voltage wiring (110 volts and greater). Wiring diagrams will be furnished to
36 Electrical Contractor by the HVAC Contractor.
37 4. Motor starters not provided integral with HVAC equipment shall be provided by the
38 Electrical Contractor.
39 5. Floor drains and open site drains by Plumbing Contractor.
40 6. Painting HVAC equipment will be the responsibility of General Contractor.
41 7. Roofing, exterior wall and related exterior opens shall be caulked, sealed and patched by
42 the General Contractor.

43
44 1.02 GENERAL PROVISIONS

45
46 A. Everything essential for the completion of the work implied to be covered by these Specifications
47 to make the system ready for normal and proper operation must be furnished and installed by this
48 Contractor. Accordingly, any omission from either the plans or the Specifications, or both, of
49 details necessary for the proper installation and operation of the system shall not relieve this
50 Contractor from furnishing such detail in full and proper manner.

51
52 B. The plans show various details indicating the general arrangement of the heating and ventilating
53 work, sizes and locations of pipe work, ducts, units, etc., the said plans with figures, lettering, etc.,
54 shall be considered a part of these Specifications and no charge or alternation shall be made in
55 either case unless ordered by the Engineer.

56
57 C. In addition to the heating and ventilating plans, see General Plans of the building, as all heating
58 and ventilating work appearing on the latter plans will be part of this Contract unless especially

1 specified to be done by other contractors, as well as, the said work detailed on the heating and
2 ventilating plans.

3 **1.03 QUALITY ASSURANCE**

4
5 A. Qualifications of Installers:

- 6
7 1. For the actual fabrication, installation and testing of heating and ventilating work, use only
8 thoroughly trained and experienced workmen completely familiar with the items required
9 and manufacturer's current recommended methods of installation.
10 2. In acceptance or rejection of installed work, the Architect or Engineer shall make no
11 allowance for lack of skill on the part of the Workmen.
12

13 B. Reference Standards: The following standards are imposed, as applicable to work in each
14 instance:

15
16 AABC Associated Air Balance Council
17 ARI Air Conditioning and Refrigeration Institute
18 ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers
19 ASME American Society of Mechanical Engineers
20 ASTM American Society of Testing and Materials
21 MCA Mechanical Contractors Association
22 MSS Manufacturers Standardized Society
23 NEC National Electric Code
24 NEMA National Electrical Manufacturers Association
25 NFPA National Fire Protection Association
26 SMACNA Sheet Metal and Air Conditioning Contractors National Association
27

28 C. Environmental design conditions for all occupied areas are as follows:

29
30 Inside: 70 deg. F 74 deg. F 50% RH
31 Outside: -15 deg. F 91 deg. dbF/ 74 deg. wbF
32

33 **1.04 CODES AND PERMITS**

34
35 A. This Contractor must comply with building laws and other ordinances in force where the building
36 is located as far as same apply to his work.

- 37
38 1. IBC 2015.
39 2. IMC 2015; SPS 364.
40

41 B. He must secure permits from proper offices and pay legal fees as may be necessary for fulfilling
42 the requirements of these Specifications.
43

44 C. One (1) copy of all permits must be furnished to the Owner.
45

46 **1.05 COORDINATION**

47
48 A. Cooperate and coordinate with other trades to assure that all systems in the heating and
49 ventilating work may be installed in the best arrangement. Coordinate as required with all other
50 trades to share space in common areas and to provide the maximum of access to each system.
51

52 B. Arrange heating and ventilating work in neat, well organized manner with piping and similar
53 services running parallel with primary lines of building construction, and with minimum of 8 foot
54 overhead clearance where possible.
55

56 C. Locate operating and control equipment properly to provide easy access, and arrange entire
57 heating and ventilating work with adequate access for operation and maintenance.
58

1 D. Give right-of-way to piping which must slope for drainage.

2
3 **1.06 ELECTRICAL PROVISIONS OF HVAC WORK**
4

5 A. Line Voltage Wiring: The Electrical Contractor is to make all line voltage (100 volts and greater)
6 electrical wiring connections for hookup of the units and systems.

7
8 B. Control Wiring: Exposed low voltage (less than 100 volts) temperature control wiring in
9 connection with heating and ventilating system shall be in EMT conduit by the Heating Contractor
10 in strict accordance with the applicable sections of the Electrical Specifications. *Concealed*
11 *control wiring* may be routed to equipment without conduit, unless subject to physical damage.
12

13 C. This Contractor shall consult with the Electrical Contractor before ordering electrical motors, to
14 ascertain correct electrical current characteristics. HVAC Contractor shall furnish complete list
15 and location of equipment requiring electrical connections and necessary wiring diagrams to
16 Electrical Contractor.
17

18 D. Motors: Where not otherwise indicated, comply with applicable provisions of the National
19 Electrical Code, NEMA Standards, and sections of Division 16 of Specifications.
20

- 21 1. Phases and Current: 1/6 HP and smaller is Contractor's option; up to 1/3 HP, capacitor-
22 start, 120 volt, 60 cycle single-phase; 1/2 HP and larger, squirrel-cage induction NEMA
23 rated 200 volt, three-phase, 60 cycle. Provide two (2) separate windings on 2 speed
24 three-phase motors. Coordinate with actual current characteristics; refer to Division 16 of
25 Specifications.
- 26 2. High Efficiency Motors: All motors 1 HP and larger shall be high efficiency motors
27 meeting or exceeding values tested in accordance with IEEE Standards 112, Method B
28 procedures as stated in NEMA MG 1-12.53a.
- 29 3. Service Factor: 1.15 for three-phase; 1.35 for single-phase.
- 30 4. Construction: General purpose, continuous duty.
- 31 5. Frames: NEMA Standard for horsepower specified.
- 32 6. Overload Protection: Built-in thermal, with internal sensing device for stopping motor,
33 and for signaling where indicated.
34

35 E. Starter and Switches: Where motor starters and switches are indicated to be an integral part of
36 equipment furnished by Heating installer, they shall meet requirements of Division 16 and shall be
37 connected by the Electrical installer.
38

39 F. Wiring Connections: Wired connections in flexible conduit, except where plug-in electrical cords
40 are indicated and permitted by governing regulations.
41

42 G. General Wiring: Comply with applicable provisions of Division 16 Section.
43

44 **1.07 PAINTING HVAC WORK**
45

46 A. General: All field painting of mechanical equipment will be done by the General Contractor
47 unless equipment is specified otherwise or is to be furnished with factory-applied finish coats.
48

49 B. All equipment shall be provided with factory-applied prime finish, unless otherwise specified.
50

51 C. If the factory shop paint finish on any equipment furnished by the Contractor is damaged in
52 shipment or during construction of the building, the equipment shall be refinished by the
53 Contractor to the satisfaction of the Architect/Engineer.
54

55 D. Prime paint all field-fabricated metal work under HVAC work, comply with applicable provisions of
56 Division 9.
57

58 **1.08 IDENTIFICATION**

- 1
2 A. General: Provide adequate marking of the HVAC system and control equipment to allow
3 identification and coordination of maintenance activities and maintenance manuals. Tag and
4 label HVAC equipment located in exposed or accessible areas to conform to ANSI A13.1-1981.
5 After painting and/or covering is complete, identify all equipment, piping and ductwork by its
6 abbreviated generic name as shown/scheduled/specified.
7
8 B. Equipment: Identify all major HVAC equipment with plastic-laminate signs of 2" high painted
9 stencils and contrasting background. Provide test of sufficient clarity and lettering to convey
10 adequate information at each location and mount permanently. Identify control equipment by 1-
11 1/2" x 4" plastic laminate nameplates with 1/4" high lettering.
12
13 C. Piping and Ductwork: Identify all exposed and accessible piping and ductwork once every 30 feet
14 at each branch, at termination of lines, and near valve or equipment connections. Place flow
15 directional arrows at each piping or duct identification. Provide appropriate sized letters to
16 convey information on wrap-around signage, adhesive-backed or paint stenciled labels.
17
18 1. Exposed includes all piping and ductwork above suspended ceiling systems.
19
20 D. Valves: Identify all valves with 1-1/2" diameter minimum polished brass stamp-engraved or
21 plastic laminate tags. Prefix or color-code tags for each generic piping service. Prepare and
22 submit valve tag schedule, service and tag description, incorporate in Instruction/O&M Manual.
23
24 E. Operational Labels: Where needed for proper or adequate information on operation and
25 maintenance of HVAC systems, provide labels or markers of plasticized or laminated card stock,
26 typewritten of appropriate size to convey the information.
27
28 F. Submit schedule of Identification labels for Architect/Engineer approval.
29

30 **1.09 FLOOR, WALL, ROOF AND CEILING OPENINGS**

- 31
32 A. The General Contractor will be required to leave openings in new ceiling, floors, walls, roof,
33 partitions, etc., as required to install the ventilating work specified or shown on the Drawings. The
34 HVAC Contractor is responsible for correct size and location of his openings. Where penetrations
35 through existing construction are required, they shall be the responsibility of the HVAC
36 Contractor.
37
38 B. The HVAC Contractor shall set sleeves and anchors for all equipment, etc., and shall provide
39 watertight seals on pipes through exterior walls, floors and roof and where noted on the
40 Drawings.
41
42 1. Pipe sleeves: Schedule 40 black steel pipe, 1" larger than the pipe;
43 2. Duct sleeves: 24 gauge galvanized sheetmetal, 1/2" larger than the duct on all
44 sides.
45
46 C. Pack annular space between sleeves and pipe or ducts with fiberglass insulation and seal.
47 Where penetrations through fire rated walls or floors, fill space with fire-resistive insulation similar
48 to US Gypsum Thermafiber batts or other approved fire-resistive insulation material and seal
49 annular openings with a UL approved, fire-stopping sealant/caulk.
50
51 D. Provisions for openings, holes and clearances through walls, floors, ceilings and partitions to be
52 made in advance of construction of such parts of the building.
53
54 E. If the HVAC Contractor should neglect to inform the General Contractor of his opening
55 requirements and that portion of the building construction has been completed, the HVAC
56 Contractor shall pay the General Contractor for providing these openings.
57

- 1 F. Make arrangements with various other contractors for all special framing, spacing and chases.
2 Mason will leave chases in mason work, but HVAC Contractor is responsible for correct size and
3 location.
4

5 **1.10 CUTTING AND PATCHING**
6

- 7 A. General: Refer to Division 1 General Requirements.
8
9 B. Perform all cutting and patching required for complete installation of the HVAC systems, unless
10 specifically noted otherwise. Provide all materials required for patching unless otherwise noted.
11
12 1. All cutting and patching necessary of structural members to install any Electrical work
13 shall not be done without permission, and then only carefully done under the direction of
14 the Architect and General Contractor.
15
16 C. The Contractor shall not endanger any work of other trades by demolition, cutting, digging or
17 otherwise. Any cost caused by defective or ill-timed cutting and patching work shall be borne by
18 the contractor responsible. Each contractor requiring cutting and patching shall hire men skilled
19 in such cutting and patching to do the work.
20

21 **1.11 CONCRETE FOR HVAC WORK**
22

- 23 A. General: Comply with pertinent provisions of Division 1 and Division 3.
24
25 B. None anticipated for project.
26

27 **1.12 EQUIPMENT ACCESS**
28

- 29 A. General: All valves, volume dampers, equipment and accessories shall be installed to permit
30 access to equipment for maintenance, servicing or repairs. Relocation of piping, ducts or
31 equipment to accomplish equipment access shall be completed by this Contractor at no additional
32 cost.
33
34 B. Location: Provide access doors where equipment is located in chases or inaccessible locations.
35 Access panels shall be furnished by this Contractor and installed by the specific trade responsible
36 for the material in which the access panels are installed.
37
38 C. Construction: Access doors shall be of size to provide adequate access to equipment concealed
39 in wall, ceiling and or furred-in spaces. Milcor or approved equal; 14 gauge steel frame and door,
40 prime-coated, except stainless steel in areas subject to excessive moisture.
41

42 **1.13 EQUIPMENT SUPPORTS**
43

- 44 A. General: Provide all supporting steel and related materials not indicated on structural drawings
45 as required for the installation of equipment and materials, including angles, channels, beams
46 and hangers.
47
48 1. Prime coat paint all supports.
49 2. Turn over equipment curbs to the General Contractor for installation; structural steel
50 supports under equipment curbs by the General Contractor.
51

52 **1.14 EQUIPMENT GUARDS**
53

- 54 A. General: Provide equipment guard over belt-driven assemblies, pump shafts, exposed fans and
55 elsewhere, as indicated in this specification or required by code.
56
57 1. Prime coat paint all supports.
58

1 **1.15 GUARANTEE**

- 2
- 3 A. All material and workmanship must be new and first class in every respect; the heating,
4 ventilating and air conditioning equipment must be turned over to the owner in complete working
5 order and free from mechanical defects.
6
- 7 B. The HVAC Contractor must guarantee all labor and materials for one (1) year from the substantial
8 completion and acceptance of the HVAC system and keep or place same in repair for said period,
9 unless such defects are clearly the result of bad management after HVAC system was turned
10 over to the Owner.
11
- 12 C. The system must be guaranteed to operate noiselessly and to the satisfaction of the Owner and
13 to supply and exhaust quantities of air shown on the Drawings.
14
- 15 D. Before final acceptance of this work, the Contractor shall have the entire apparatus and system in
16 complete and satisfactory operation and shall maintain same in satisfactory and continuous
17 operation for a period of ten days prior to the date of acceptance; fuel to be furnished by the
18 Owner.
19
- 20 E. The HVAC Contractor shall submit to the Engineer in triplicate, at the completion of his work, a
21 certified statement, signed by a principal of the firm, stating that the system has been fully
22 installed and is operating within the intent of the plans and specifications and that all system
23 components have been tested and adjusted. This statement shall be submitted before the
24 system is presented to the Owner for final inspection.
25

26 **1.16 SUBMITTALS**

- 27
- 28 A. Refer to Division 1 for additional submittal requirements.
29
- 30 B. The HVAC Contractor will be held responsible for correction of work deemed necessary by the
31 Engineer due to proceeding with the work without shop drawings that have the Engineer's final
32 approval.
33
- 34 C. Shop drawings shall include data on physical dimensions, gauges, materials of construction and
35 capacities.
36
- 37 D. This Contractor will be responsible for all figures and dimensions shown on the shop drawings.
38 Approval of shop drawings describing equipment that cannot fit in the space allotted does not
39 relieve this Contractor from providing equipment that will meet the space requirements.
40
- 41 E. Submit six (6) copies of shop drawings to the Architect/Engineer for approval, with
42 complete detail for all equipment, materials, etc., to be furnished and installed for this project as
43 follows:
44
- 45 1. Exhaust fans and accessories;
 - 46 2. Controls;
 - 47 3. Diffusers, grilles, registers and louvers;
 - 48 4. Insulation systems;
 - 49 5. TAB air balance report;
 - 50 6. Instructions and O&M manuals (2 copies);
 - 51 7. As-built drawings.
- 52
- 53 F. Marked-up drawings indicated record installation as-built HVAC work.
54

55 **1.17 HOUSEKEEPING AND CLEANUP**

56

- 1 A. Periodically as work progress and/or as directed by the Architect, the Contractor shall remove
2 waste materials from the building and leave the area of the work room clean. Upon completion of
3 work remove all tools, scaffolding, broken and waste materials, etc., from the site.
4

5 **1.18 LUBRICATION**

6

- 7 A. Upon completion of the work and before turning over to the Owner, clean and lubricate all
8 bearings except sealed and permanently lubricated bearings. Use only lubricant recommended
9 by the manufacturer.
10

11 **1.19 INSTRUCTIONS AND MANUALS**

12

- 13 A. Upon completion of the installation, but before final acceptance of the system, this Contractor
14 shall instruct the Owner on the care and operation of all parts of the system.
15
16 B. Assemble two (2) complete sets of manufacturer's printed operating and maintenance
17 instructions for all HVAC equipment and installed under this contract. Prepare in bound copies
18 complete with index tabs. Information must include parts lists, equipment warranties, and wiring
19 diagrams. Submit bound copies to the Architect for distribution.
20

21 **1.20 AS-BUILT DRAWINGS**

22

- 23 A. During construction maintain a set of prints showing installed as-built work for the project.
24
25 B. Upon completion of construction before final acceptance, provide a set of as-built drawings to the
26 Architect/Engineer.
27
28

29 **PART 2 - PRODUCTS**

30

31 **2.01 DUCTWORK**

32

- 33 A. Sheet Metal: Furnish, install, fit and secure in place all supply, return, exhaust and vent air ducts,
34 risers, branches, etc., as shown and detailed on plans, built of galvanized iron as hereinafter
35 specified.
36
37 1. Above ground, general ductwork: Galvanized steel, lock-forming quality, ASTM A527;
38 1.25 oz. zinc coating each side, mill phosphatized, ASTM A525.
39 2. Steel Ducts: Galvanized steel, lock-forming quality, ASTM A527; 1.25 oz. zinc coating
40 each side, mill phosphatized, ASTM A525.
41
42 B. Ductwork Construction:
43 1. Sheet metal work shall be constructed according to practices recommended in the HVAC
44 Duct Construction Standards - Metal and Flexible 1st ED. 1985, as published by
45 SMACNA, and hereinafter specified.
46 2. Ductwork Pressure-Velocity Classification: + 2" static pressure class 2,500 FPM velocity
47 level.
48 3. Duct Sealing Requirements: Seal Class B. Transverse and longitudinal joints.
49 4. All duct dimensions noted on the drawings are finished inside dimensions.
50 5. Install ducts, risers, etc., as indicated on plans, making necessary changes in cross
51 section, offsets, etc., whether or not same is specifically indicated. If ducts cannot be run
52 as shown on drawings, install ducts between required points, subject to the approval of
53 Engineer without additional cost to the Owner.
54 6. At all outlets and inlets in rooms, flange ducts for attachment of grilles. Install grilles
55 according to manufacturer's recommendations.
56 7. Sheet metal work throughout shall be assembled and erected in such a manner that no
57 vibration will occur and no noise be transmitted by the moving air due to inappropriate

- fitting or offsets. *All corrective measures will be determined by the Engineer at the HVAC Contractor's expense.*
8. All duct turns shall have either an inside radius equal to the duct width or be a miter turn with turning vanes. Turning vanes shall be double wall air-foil type.
 9. Branch Take-Off Fittings: Round branch take-off fittings shall be low-loss type fittings such as bellmouth or conical type; *no scoops or 90 degree tee fittings allowed.* Square/rectangular branch take-off fittings shall have 45 degree leading edge with 4 inch minimum depth; *no air turns or scoops allowed.*

C. Ductwork Accessories:

1. Volume Dampers: Furnish and install in branches of supply air and exhaust ducts. Substantial volume dampers to be fitted with locking devices for adjusting the air delivery. Damper blades shall not exceed 6" width.
2. Access Panels: Install access panels with latches and gaskets in ducts at automatic dampers, coils, fire dampers, louver plenums and other duct mounted equipment. Panels in insulated ducts must be internally insulated.
3. Openings around Ducts: Through walls must be filled with fiber-glass, caulked and sealed with 14 gauge galvanized sheet metal angle around duct on each side of wall.

2.02 VIBRATION ISOLATION

A. General:

1. Isolate all motor driven mechanical, unless otherwise noted, from the building structure and from the systems which they serve, to prevent equipment vibrations from being transmitted to the structure.
2. Consider equipment weight distribution to provide uniform deflections.
3. For equipment with variable speed capability, select vibration isolation devices based on the lowest speed.

B. Manufacturers: Products and methods of fabrication shall be as manufactured by Mason Industries, Korfund Co., Amber/Booth Co., Vibration Mounting and Controls, or Kinetics, similar to the manufacturers model listed.

C. Performance:

1. Select all vibration isolation devices to provide minimum 95% isolation efficiency or based on the minimum static deflection and mounting criteria listed below, whichever is greater.

2. Vibration Isolation Schedule:

Type of Equipment	Isolation Type	Minimum Static Deflection - Inches
Inline Exhaust Fans	Type 'X' Flexible Duct Connector & Type 'D' Hanger	3/4"
		3/4"

D. Type D Hangers:

1. Mason type 30N, vibration hangers with a steel spring and 0.3" deflection neoprene element in series. The neoprene element shall be molded with a rod isolation bushing that passes through the hanger box. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing thru a 30 degrees arc before contacting the hole and short circuiting the spring.
2. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection

E. Type X Flexible Duct Connectors:

1. Laminated flexible sheet of cotton duct and sheet elastomeric (neoprene or vinyl), reinforced with steel wire mesh where required for strength to withstand duct pressure indicated.
2. Form connectors with full-faced flanges and accordion bellows to perform as flexible isolation units.
3. Provide galvanized steel retaining rings for airtight connections with ductwork.

2.03 GRILLES, REGISTERS AND DIFFUSERS

- A. Furnish grilles, registers and diffusers in the sizes, type and capacity as shown on the Drawings by the selected manufacturer or approved equal.
- B. Grilles, Registers and Diffusers shall be suitable and compatible with ceiling construction in which they are installed. Check architectural schedules for ceiling construction. Coordinate locations with T-bar ceiling system and lighting fixtures.

2.04 LOUVERS

- A. Extruded aluminum louver, 2" deep, 30 deg. J-blades mounted, 1.75" O.C. with rain hooks. Stainless steel screws.
 1. Frame: Aluminum extrusions 0.081" 6063-TS
 2. Blades: Z-shaped extruded aluminum 6063-TS.
 3. Bird Screens: 1/2" mesh PVC crated.
 4. Insect Screens where scheduled - aluminum.
 5. Finish: Powder-coat baked-on enamel finish, finish color selection by Architect.

2.05 FANS

- A. General: Furnish fans in the size and capacity as shown on the drawings. Shall be manufactured by Broan, Carnes, Greenheck, ILG, Penn or approved equal.
- B. Inline Fan: Furnish duct mounted centrifugal, direct-driven or belt-driven inline fan. Fan shall be constructed of heavy gauge steel with acrylic enamel finish over iron phosphate primer. Motor or drive compartment shall be isolated from the airstream and be externally ventilated. Bearings shall be prelubricated and sealed for 200,000 hours operation. Fan wheel shall be aluminum, backward inclined, centrifugal type, dynamically and statically balanced with venturi inlet. One side of the housing shall be equipped with a hingeable service door assembly supporting the motor, drives, wheel and inlet venturi for servicing without disconnecting the fan connections. Fan shall be AMCA certified for air and sound performance.
 1. Accessories (as indicated on plans and schedules).
- C. Ceiling Mounted: Furnish ceiling-mounted exhaust fans complete with centrifugal blower, inlet grille, gravity back-draft damper, and discharge duct connection as shown on the drawings. Fan shall be AMCA certified with a sound rating of less than 4.5 sones. Housing shall be insulated with minimum 1/2" acoustic insulation.
 1. Accessories (as indicated on plans and schedules).
- D. Motors: 1 HP and larger shall be suitable for 240/60/1 1-phase operation and less than 1 HP shall be 115/60/1 with integral thermal overload. Horsepower rating shall be such that motor will not be overloaded at rated capacity. Motors in air stream shall be totally enclosed, other shall be open type. Motors shall have permanently lubricated ball bearings, mounted on neoprene vibration-isolator supports. All units shall have remote disconnect switch.
 1. ECM motor with local speed control, where scheduled.

1 **2.06 ELECTRIC HEAT**

- 2
- 3 A. General: Furnish electric heat equipment of the type and capacities as shown on the Drawings
- 4 and schedules.
- 5
- 6 B. Architectural Heavy Duty - Electric Wall Heater: Louvered front cover with aluminum frame and
- 7 recessed tamperproof thermostat control. Back box for recessed mounting, semi-recessed
- 8 mounting or surface mounting, as scheduled. Heating element of 80/20 nickel-chromium
- 9 resistance wire enclosed in a steel sheath with brazed copper plate fins. Fan shall be provided
- 10 with aluminum fan blades with protected electric motor mounted on permanently lubricated
- 11 bearings with totally enclosed rotor. Electric wall heater shall be provided with disconnect switch,
- 12 integral bi-metallic thermostat controller and manual reset thermal cutout.
- 13
- 14 1. 14-gauge cover security cover, as scheduled.
- 15 2. Surface mounting frame-box, as scheduled.
- 16

17 **2.07 TEMPERATURE CONTROLS**

- 18
- 19 A. This Contractor shall be responsible for all automatic electric controls for HVAC equipment as
- 20 indicated on the plans and as described herein.
- 21
- 22 B. Furnish all motorized dampers, thermostats, protected relays, interlocks and transformers as
- 23 required; and this Contractor shall mount same in suitable control panels, occupied space, or on
- 24 equipment as required or specified herein. Furnish low voltage relays as required for all fans and
- 25 motors automatically controlled.
- 26
- 27 C. All line voltage temperature control wiring by the Electrical Contractor. All exposed low voltage
- 28 wire shall be run in EMT metal conduit per Division 16. All low-voltage control wiring by the
- 29 HVAC Contractor.
- 30
- 31 D. Electrical power sources and motor connections for equipment will be provided by the Electrical
- 32 Contractor. All power wiring by Electrical Contractor. Furnish necessary wiring diagrams, and be
- 33 responsible for obtaining proper working installation. Furnish all starters, multi-speed switches
- 34 and control apparatus.
- 35
- 36 E. Automatic Control Dampers: Automatic Control Dampers (ACD) required but not included with
- 37 fan equipment shall be furnished by this contractor.
- 38
- 39 1. Dampers shall be opposite blade or parallel-type with blades not over 6" wide and with
- 40 interlocking edges and brass or nylon bearings.
- 41 2. Dampers shall be 16 gauge galvanized iron or heavier. Outdoor dampers (exposed to
- 42 ambient conditions) shall be low-leakage type with neoprene blade and edge seals.
- 43
- 44 F. Control Damper Operators: Provide electric motor operators for all dampers requiring operators,
- 45 of the type which meet requirements of operation described in the sequence of control.
- 46
- 47 1. Acceptable Manufacturer: Belimo or approved equal.
- 48 2. Two-position, spring-return: Direct-coupled actuator, 24 VAC, spring-
- 49 return, minimum torque 133in-lb(35 SF). Belimo model SF-24.
- 50
- 51 G. Thermostats:
- 52
- 53 1. Line-voltage Cooling thermostat: Commercial cooling thermostat with room setpoint
- 54 adjustment, LCD display, 20-amp rated contracts for 115 volt service.
- 55
- 56 H. Relays: Furnish necessary relays, interlock control wiring and related accessories.
- 57

58 **2.08 SEQUENCE OF CONTROL**

- 1
2 A. Exhaust Fan EF-1:
3
4 1. Interlock exhaust fan operation with LCP-1 relay to operate on time schedule.
5 2. Interlock motorized exhaust air dampers to open upon operation of exhaust fan.
6
7 B. Exhaust Fan EF-2:
8
9 1. Interlock exhaust fan operation with cooling thermostat to operate upon rise in space
10 temperature above setpoint.
11 2. Interlock motorized exhaust and fresh air dampers to open upon operation of exhaust
12 fan.
13
14

15 **PART 3 - EXECUTION**

16
17 **3.01 JOB CONDITIONS**

- 18
19 A. Examine and check conditions at the actual job site and determine facilities for delivery, storing
20 and handling of materials and equipment.
21
22 B. Drawings show approximate locations of equipment, verify exact locations.
23
24 C. Cooperate as necessary with other trades in order that all systems in the work may be installed in
25 the best arrangement. Coordinate as required with all other trades to share space in common
26 areas and to provide the maximum of access to each system.
27

28 **3.02 DUCTWORK INSTALLATION**

- 29
30 A. Ducts shall be constructed, supported and installed in accordance with the latest low pressure
31 duct standards of SMACNA. Install all turning vanes, access doors, extractors, and accessories
32 as indicated or specified herein.
33
34 B. Fabricate and install all ductwork to be air tight in accordance with SMACNA Class B, seal.
35 Evident air leaks in the ductwork shall be sealed.
36
37 C. Seal exposed outside ductwork joints water tight with mastic sealant.
38
39 D. Install all motor operated dampers per manufacturer's instructions in accordance with control
40 sequence intended.
41

42 **3.03 INSTALLATION OF EQUIPMENT**

- 43
44 A. Locations: Install all equipment in the locations shown on the Drawings, except where specifically
45 otherwise approved on the job by the Owner.
46
47 B. All equipment, as called for on the drawings and herein specified, shall be installed in strict
48 accordance with manufacturer's recommendations.
49
50 C. Interferences: Avoid interference with structure, and with work of other trades, preserving
51 adequate headroom and clearing all doors and passageways.
52
53 D. Inspection: Check each piece of equipment in the system for defects, verifying that all parts are
54 properly furnished and installed, that all items function properly, and that all adjustments have
55 been made.
56

3.04 TESTING, ADJUSTING, AND BALANCING

- 1 A. Provide all necessary personnel, equipment, and services and perform all tests necessary to
2 demonstrate the integrity of the completed installation to the approval of the Owner and Architect.
3 The air system shall be tested, adjusted and balanced in accordance with the latest edition of the
4 Associated Air Balance Council (AABC) Procedural Standards, NEBB or equivalent by an
5 independent TAB Contractor. TAB work performed by the HVAC Contractor shall not be
6 accepted.
7
8 B. Submit three (3) certified copies of the final report to Architect on applicable AABC reporting
9 forms or equivalent for approval.
10
11 1. Air volume at exhaust inlets and outlets;
12 2. Air volume at each fan/air handler unit for exhaust air;
13 3. Record fan speed, RPM, motor nameplates and amperage/voltage;
14 4. Report all equipment model #'s and related drawing identification on the TAB report;
15
16 C. Upon completion of TAB work, mark equipment settings, including damper control levers, and
17 similar devices to indicate final settings. Plug all holes in insulation, ductwork and housings with
18 acceptable test plugs.
19
20 D. Eliminate noise and vibration and assure proper function of all controls, maintenance of
21 temperature, and operation with the approved design.
22

23 **3.05 CLEANING**

- 24
25 A. Ductwork: After the ductwork has been tested and proved tight, thoroughly vacuum and clean all
26 components of the ductwork. Remove all dirt, scale, oil and other foreign substances which may
27 have accumulated during the installation process.
28
29 B. Equipment: After the equipment has been started and proved operational, carefully clean all
30 accessible parts of each piece of equipment, thoroughly removing all traces of dirt, oil, grease
31 and other foreign substances.
32

33 **3.06 LUBRICATION**

- 34
35 A. Upon completion of the work and before turning over to the Owner, clean and lubricate all
36 bearings except sealed and permanently lubricated bearings. Use only lubricant recommended
37 by the manufacturer.
38
39 B. Contractor is responsible for maintaining lubrication of all mechanical equipment under his
40 contract until work is accepted by the Owner.
41
42 C. Furnish a chart with each piece of equipment listed, itemizing location for lubricant required and
43 recommended periods of lubrication. Incorporate chart in Instruction Manual.
44

45 **3.07 INSTRUCTIONS**

- 46
47 A. Instruct owner's representative in the operation and maintenance of all mechanical systems.
48
49 B. Assemble two (2) complete sets of manufacturer's printed operating and maintenance
50 instructions for all mechanical equipment installed under this contract. Prepare in bound copies
51 with index tabs. Information must include parts list and wiring diagrams. Submit to Architect for
52 presentation to the Owner.

53 **3.08 CLOSEOUT OPERATIONS**

- 54
55 A. Refer to Division 1 for additional project closeout requirements.
56

- 1 B. Closeout Equipment/System Operations: Sequence operations properly so that work of the
2 project will not be damaged or endangered. Coordinate with seasonal requirements.
3
- 4 1. Operate each item of equipment and each system in a test run of appropriate duration
5 with the Owner's operating personnel present to demonstrate sustained, satisfactory
6 performance.
7 2. Adjust and correct operations as required for proper performance.
8 3. Clean and lubricate each system, and replace dirty filters, especially worn belts and parts
9 and similar expandable items of the work.
10
- 11 C. Instruction, O&M: Instruct Owner (Owner's personnel) in the proper operation and maintenance
12 of the HVAC systems. Train personnel in the setting and scheduling of programmable
13 thermostats for occupied/unoccupied periods.
14
- 15 D. Service Organization: At time of substantial completion, Contractor shall provide Owner with a
16 listing of qualified service organizations (including addresses and telephone numbers) for each
17 piece of major equipment.
18
- 19 E. Turn-Over of Operations: At time of substantial completion, turn over the prime responsibility for
20 operation of HVAC equipment and systems to the Owner's operating personnel. However, during
21 the guarantee period, provide and operating engineer, who is completely familiar with work, to
22 consult with and continue training the Owner's personnel on an as-needed basis.
23
24
25

END OF SECTION

1 SECTION 26 00 00 - ELECTRICAL

2
3
4 PART 1 - GENERAL

5
6 1.01 DESCRIPTION

7
8 A. Work Included: Provide complete electrical service and distribution system with equipment and
9 materials where shown on the Drawings, as specified herein, and as needed for a complete and
10 proper installation including, but not necessarily limited to:

- 11
12 1. Underground Electric Service (200-amp, 1-phase, 120/240 volt), service disconnect -
13 meter cabinet with service ground, distribution panel with main circuit breaker, SPD
14 device and branch circuit breakers;
15 2. Branch circuit wiring, for lighting, receptacles, motors and equipment;
16 3. Lighting fixtures;
17 4. Wiring system for equipment and controls provided under other Sections of these
18 Specifications including General Construction, Plumbing and HVAC trades;
19 5. Lighting Control System;
20 6. Power to new site lighting and new lighting and receptacles at existing shelter.
21 7. Power to door operators and electric hand dryers by others.
22 8. Hangers, anchor sleeves, chase supports for fixtures, and other electrical materials and
23 equipment;
24 9. Demolition and deactivation of electrical systems in existing facilities as noted on Site
25 Drawings.
26 10. Other items and services required to complete the electrical systems.

27
28 B. Related Work:

- 29
30 1. Documents affecting work of this Section include, but are not necessarily limited to,
31 General Conditions, Supplementary Conditions, and Sections in Division 1 of these
32 Specifications;
33 2. Equipment structural supports, etc.;
34 3. All line voltage control wiring and starter interlocks, where specified;
35 4. Final equipment electrical connections.

36
37 C. Work of Other Sections:

- 38
39 1. Low-voltage (less than 100 volts) controls for General Construction, Plumbing, and HVAC
40 trades.

41
42 1.02 GENERAL PROVISIONS

43
44 A. Everything essential for the completion of the work implied to be covered by these Specifications
45 to make the system ready for normal and proper operation must be furnished and installed by this
46 Contractor. Accordingly, any omission from either the plans or the Specifications, or both, of
47 details necessary for the proper installation and operation of the system shall not relieve this
48 Contractor from furnishing such detail in full and proper manner.

49
50 B. In addition to the electrical plans, see General Plans of the building, as all electrical work
51 appearing on the latter plans will be part of this contract unless especially specified to be done by
52 other contractors, as well as, the said work detailed on the electrical plans.

53
54 1.03 QUALITY ASSURANCE

- 1 A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the
- 2 necessary crafts and who are completely familiar with the specified requirements and methods
- 3 needed for proper performance of the work of this Section.
- 4
- 5 B. Without additional cost to the Owner, provide such other labor and materials as required to
- 6 complete the work of this Section in accordance with the requirements of governmental agencies
- 7 having jurisdiction, regardless of whether such materials and associated labor are called for
- 8 elsewhere in these Contract Documents.
- 9
- 10 C. Reference Standard: The following standards are imposed, as applicable to the work:
- 11
- 12 ASTM American Society of Testing and Materials
- 13 NEC National Electrical Code
- 14 NEMA National Electrical Manufacturers Association
- 15 NFPA National Fire Protection Association
- 16 UL Underwriters Laboratories
- 17

18 **1.04 CODES AND PERMITS**

- 19
- 20 A. The Contractor must comply with national, state of Wisconsin and city of Kenosha building and
- 21 electrical codes and other ordinances in force where the building is located as far as same apply
- 22 to his work.
- 23
- 24 1. IBC 2015;
- 25 2. IEEC 2015;
- 26 3. NEC 2014;
- 27 4. Wisconsin Electrical Code SPS sections.
- 28
- 29 B. He must secure permits from proper offices and pay fees as may be necessary for fulfilling the
- 30 requirements of these Specifications.
- 31
- 32 C. One (1) copy of all permits must be furnished to the Owner.
- 33
- 34 D. Electric Service Fee: Electrical Contractor shall secure and pay all fees for new electrical service
- 35 from electric utility, including temporary power services.
- 36

37 **1.05 COORDINATION**

- 38
- 39 A. Cooperate and coordinate with other trades to assure that all systems in the electrical work may
- 40 be installed in the best arrangement. Coordinate as required with all other trades to share space
- 41 in common areas and to provide the maximum of access to each system.
- 42
- 43 B. Arrange electrical work in neat, well-organized manner with piping and similar running parallel
- 44 with primary lines of building construction.
- 45
- 46 C. Locate operating and control equipment properly to provide easy access, and install entire
- 47 electrical systems with adequate access for operation and maintenance.
- 48
- 49 D. Give right-of-way to piping which must slope for drainage.
- 50

51 **1.06 ELECTRICAL PROVISIONS OF THE MECHANICAL WORK**

- 52
- 53 A. Line Voltage Wiring: The Electrical Contractor shall make all line voltage (100 volts and greater)
- 54 electrical wiring, final connections and motor wiring for Mechanical equipment.
- 55

- 1 B. Control Wiring: Low-voltage (less than 100 volts) control wiring in conjunction with Mechanical
2 work shall be by the Mechanical Contractor in strict accordance with the applicable sections of
3 the Electrical Specifications.
4
5 C. Motors, Starters, and Disconnects: All motors starter and disconnects shall be provided by the
6 Electrical Contractor, unless provided with the equipment or indicated otherwise.
7
8 1. Mechanical Contractors shall furnish list of and location of all Mechanical equipment and
9 requirements for electrical connections, along with wiring diagrams.

10 **1.07 FLOOR, WALL, ROOF AND CEILING OPENINGS**

- 11 A. The General Contractor will be required to leave openings in new construction ceiling, floors,
12 walls, roof, partitions, etc., as required to install the Electrical work specified or shown on the
13 Drawings. The Electrical Contractor is responsible for correct size and location of openings.
14
15 B. Provisions for openings, holes and clearances through new construction walls, floors, ceilings and
16 partitions are to be made in advance of construction of such parts of the building.
17
18 C. The Electrical Contractor shall set sleeves and anchors for all equipment, etc., and shall provide
19 watertight seals on pipes through exterior walls, floors and roof locations, and where noted on the
20 Drawings.
21
22

23 **1.08 CUTTING AND PATCHING**

- 24 A. General: Refer to Division 1 General Requirements.
25
26 B. Perform all cutting and patching required for complete installation of the Electrical systems,
27 unless specifically noted otherwise. Provide all materials required for patching unless otherwise
28 noted.
29
30 1. All cutting and patching necessary of structural members to install any Electrical work
31 shall not be done without permission, and then only carefully done under the direction of
32 the Architect and General Contractor.
33
34
35

36 **1.09 TRENCHING AND BACKFILLING**

- 37 A. Comply with pertinent provisions of Division 1.
38
39 B. Perform trenching and backfilling associated with the work of this Section in strict accordance
40 with the provisions of Division 2 of the Specifications.
41
42

43 **1.10 SUBMITTALS**

- 44 A. Comply with pertinent provisions of Division 1.
45
46 B. Shop Drawing Submittals: Submit six (6) copies of shop drawings to the Architect for approval,
47 with complete detail for all equipment, materials, etc., to be furnished and installed for this project
48 as follows:
49
50
51 1. Electric Service Equipment;
52 2. Distribution Panelboards;
53 3. Starters and Disconnects;
54 4. Light Fixtures;
55 5. Electrical Devices.
56 6. Lighting Controls;

1
2 C. Shop Drawings:
3

- 4 1. The Electrical Contractor will be held responsible for correction of work deemed
5 necessary by the Engineer due to proceeding with the electrical work without approved
6 shop drawings that have the Architect/Engineers final approval.
7 2. Shop drawings shall include data on physical dimensions, gauges, materials of
8 construction and capacities. Incomplete drawings will be disapproved.
9 3. This Contractor will be responsible for all figures, quantities and dimensions shown on
10 the shop drawings.
11 4. Approval of shop drawings describing equipment that cannot fit in the space allotted does
12 not relieve this Contractor from responsibility of resubmitting equipment that will meet the
13 space requirements.
14

15 D. O & M Manual: Upon completion of this portion of the Work, and as a condition of its
16 acceptance, deliver to the Architect two (2) copies of an operation and maintenance manual
17 compiled in accordance with the provisions of Division 1 of these Specifications. Include the
18 following within the bound O&M manual:
19

- 20 1. Copy of the approved Record Documents for this portion of the Work;
21 2. Copies of all warranties and guaranties.
22 3. As-built drawings.
23

24 E. As-built Drawings: Record installation as-built on a set of blueline prints during construction.
25 Plan shall represent actual locations, materials and circuiting of equipment installed.
26

27 **1.11 PRODUCT HANDLING**
28

- 29 A. Comply with pertinent provisions of Division 1.
30

31 **1.12 WARRANTY**
32

- 33 A. In addition to standard one year warranty on all labor and materials, provide an additional
34 warranty on ballasts for all new fluorescent and HID lighting fixtures as specified.
35

36 **1.13 HOUSEKEEPING AND CLEAN-UP**
37

- 38 A. Periodically as work progresses and/or as directed by the Architect, the Contractor shall remove
39 waste materials from the building and leave the area of the workroom clean. Upon completion of
40 work remove all tools, scaffolding, broken and waste materials, etc., from the site.
41

42 **1.14 TEMPORARY SERVICES**
43

- 44 A. This Contractor shall provide temporary lighting and power as required throughout the
45 construction period.
46
47 B. Arrange for temporary electrical utility with local electrical utility. Electrical Contractor shall pay all
48 temporary electrical service and usage fees.
49

50
51 **PART 2 - PRODUCTS**
52

53 **2.01 GENERAL**
54

- 1 A. Provide only materials that are new, of the type and quality specified. Where Underwriters'
2 Laboratories, Inc. has established standards for such materials, provide only materials bearing
3 the UL label.
4

5 **2.02 SERVICE ENTRANCES AND METERING**
6

- 7 A. New Service: Provide new underground 200A, 120/240 volt, 1-phase, 3-wire electric service from
8 pad-mounted transformer as required by the local electrical utility (MG&E) and as shown on
9 Drawings.

- 10
11 B. Metering: Provide combination service disconnect with ground and metering socket cabinet for
12 exterior mounting and related metering equipment per local electrical utility requirements
13 (MG&E).
14

- 15 1. Utility approved metering equipment: Milbank U5784-O-200-5T-CB
16

- 17 C. Main Switches: Provide 200-amp main circuit breakers in the service metering cabinet with
18 current limiting capabilities to meet utility AIC requirements.
19

- 20 D. Service Distribution Panel (Panel 'A'):
21

- 22 1. Provide 200-amp, 1-phase main distribution panel as indicated on plans complete with
23 200-amp main circuit breaker, 10,000 AIC branch circuit breakers, NEMA 1 enclosure,
24 main service ground and solid neutral buss lugs and other components required for a
25 complete installation.
26 2. SPD service device as specified herein and scheduled on Drawings.
27

28 **2.03 SURGE PROTECTIVE DEVICES**
29

- 30 A. The surge protective device (SPD) shall be designated a location Type 2 device intended for
31 installation on the load side of the service equipment overcurrent device, including SPDs located
32 at the branch panel. The SPD shall be Listed in accordance with UL 1449.
33

- 34 B. The SPD shall be made up of metal oxide varistors (MOV's), or a combination of MOV's with
35 selenium cells or silicon avalanche diodes, ensuring that all of the performance requirements are
36 met. Gas tubes shall not be used.
37

- 38 C. The SPD shall have a maximum continuous operating voltage (MCOV) rating not less than 115%
39 of nominal voltage of the system it is protecting.
40

- 41 1. MCOV = 150 volt.
42

- 43 D. Protection Modes: The SPD shall have line to neutral (L-N), line to ground (L-G), line to line (L-L)
44 and neutral to ground (N-G) protection modes for grounded wye configured systems. For a delta
45 configured system, the device shall have line to line (L-L) and line to ground (L-G) protection
46 modes.
47

- 48 E. Voltage Protection Rating (VPR):

49 The UL 1449 Voltage Protection Rating (VPR) for the device shall not exceed the following:
50

- 51 1. Surge current per phase rating: 80kA
52 2.. 240/120 volt applications: 900V L-N, 1200V L-G, 700V N-G, 1500 L-L
53

- 54 F. Nominal Discharge Current (In): The SPD shall have a UL 1449 Nominal Discharge Current
55 Rating (In) of not less than 20kA.
56

- 1 G. Short Circuit Current Rating (SCCR):
2 The SPD shall have a UL 1449 Short Circuit Current Rating (SCCR) of not less than 200kA.
3

4 **2.04 GROUNDING SYSTEM**
5

- 6 A. Ground all equipment, including switches, transformers, conduit systems, motors, and other
7 apparatus, by conduit or conductor to cold water main and to independent electrode, using
8 ground clamps manufactured by Burndy or T&B, and approved by the Engineer.
9
10 B. Provide new service grounding electrode system. Add ground rods, foundation rebar ground and
11 water service grounding electrodes as required per NEC 250.50 for a common grounding
12 electrode system.
13
14 C. Provide grounding conductor from service ground to solid ground buss bar at all distribution
15 panelboards.
16
17 D. Provide grounding jumper from electrical devices to the metallic device boxes.
18
19 E. GFI receptacles shall be provided with separate insulated ground wire conductor to the main
20 service ground bar.
21
22 F. Ground all motor and equipment connections with dedicated ground conductor.
23

24 **2.05 IDENTIFICATION**
25

- 26 A. Junction and pull boxes shall be stenciled utilizing a coded identification system. The following
27 junction and pull boxes shall be identified using a coded system. Coding shall be submitted to
28 Engineer for approval.
29
30 1. Light and Power - 120/240V;
31
32 B. Label circuit numbers for all accessible line voltage power distribution raceways and junction
33 boxes.
34
35 C. Laminated Bakelite Plates: Engraved plastic nameplate shall be securely fastened to the
36 following equipment. Size 1" x 4" with 3/8" high letters unless space available dictates differently.
37
38 1. Panelboards.
39 2. Lighting Control Panel.
40
41 D. Typewritten Directory: Each panelboard shall be provided with a typewritten directory in a steel
42 frame with plastic cover contained on the inside of panel door. These directories shall indicate
43 load served and rooms served by each protective device in the respective panel.
44
45 E. Identify all conductors per NEC:
46
47 120/240V - Phase A - Black
48 - Phase B - Red
49 - Neutral - White
50 - Ground - Green
51

52 **2.06 POWER DISTRIBUTION SYSTEM**
53

- 54 A. See plans for panelboard capacity, voltage ratings, and branch circuit breaker units.
55

- 1 B. All panelboards to be of the circuit breaker type with bolt-on circuit breakers. AIC rating as
 2 scheduled on drawings.
 3
 4 C. Branch circuit breakers shall be thermal magnetic; quick-make and quick break. Multi-pole
 5 breakers to have common trip. Handle ties of any sort not allowed.
 6
 7 D. Panelboards shall be Square "D" type NQOD with bolt-on branch circuit breakers rated for 10,000
 8 AIC.
 9
 10 1. Square 'D' is the only approved manufacturer for this project.
 11
 12 F. Each panel shall be provided with a typewritten directory mounted on inside of panel door and
 13 covered with clear plastic. This directory shall indicate the load supplied by each branch circuit
 14 breaker in panel. Room numbers shall be actual room numbers.
 15
 16 G. Each panelboard shall be securely attached to the building structure on 3/4" AC plywood backer
 17 board with non-metallic painted surface.
 18
 19 H. All panelboards shall be equipped with an equipment grounding bar that is separate from the
 20 solid neutral bar.
 21

22 **2.07 WIRING DEVICES**

- 23
 24 A. General:
 25
 26 1. Devices shall be provided at each location shown on the plans or called for in the
 27 Specifications.
 28 2. All devices shall be of one manufacturer. Acceptable manufacturers: Leviton, Pass and
 29 Seymour, Hubbell or General Electric.
 30 3. Device catalog references herein and on the plans are to be considered as standards of
 31 comparison. Comparable devices manufactured by the other manufacturer will be
 32 considered as an optional choice.
 33 4. Device finish color to be selected by Architect.
 34
 35 B. Receptacles:
 36
 37 1. Duplex Receptacles: Industrial-specification grade, nylon face and base, NEMA 5-15R,
 38 15A, tamperproof, side-wired only, 3-wire grounding type with the third terminal U-shaped
 39 and grounded to the conduit system or green wire ground. Use of self-grounding option
 40 not permitted.
 41 a. 15-amp: Leviton 5262;
 42 b. 20-amp: Leviton 5362;
 43 2. GFCI Receptacle: Industrial-specification grade, NEMA 5-15R or 20R with indicator light
 44 and feed through. Provide tamper resistant devices in public areas.
 45 a. 15-amp: Leviton 7599; tamper resistant: Leviton T7599
 46 b. 20-amp: Leviton 7899; tamper resistant: Leviton T7899
 47
 48 C. Switches:
 49
 50 1. All toggle switches used to control lighting shall be 20 amp rated for 120/277 volts, A.C.,
 51 industrial-specification grade.
 52 2. 15 amp switches shall not to be used unless specifically shown otherwise for special
 53 control.
 54 3. Switches to be back and side wired, silent or quiet type.
 55 4. The following catalog numbers refer to Leviton, Inc.:

- a. single pole – 1221-2;
- b. three way – 1223-2;
- c. four way – 1224-2;
- d. Single pole with pilot light – 1221-PLR;

D. Plates:

1. Provide as required for each outlet, single or multiple gang.
2. Provide blank covers on all empty boxes or outlets.
3. Plates shall be 204 stainless steel construction in all finished areas.
4. Galvanized steel box covers shall be used in unfinished areas. Cover shall be 1/2" raised with no sharp edges.
5. Provide single gang die-cast weather resistant in-use covers equal to Leviton M5979 on receptacles in damp areas and exterior locations.

2.08 RACEWAY SYSTEM

A. Steel Conduit: Galvanized or sheradized steel intermediate or rigid metal conduit, or electrical metallic tubing (EMT) with steel set screw or compression ring type fittings.

1. Provide steel conduits as all exposed in the work areas.
2. Where conduit is installed underground or in the floor slab, provide rigid galvanized steel conduit, or PVC coated steel conduit is acceptable.

B. Rigid Non-Metallic Conduit: Schedule 40 PVC with solvent welded fittings.

1. Below grade installation only.
2. Encase in concrete below drives and roadways.

C. Electrical Non-Metallic Tubing (ENT):

1. Above grade indoor concealed installation only, for branch circuit wiring after the first metallic junction box from the panelboard.
2. Not allowed for service conduit and panelboard feeders.
3. Provide and install per NEC Article 331 with grounding conductor.

D. Outlets, Junction Boxes and Switch Boxes:

1. Provide standard one-piece units, galvanized or sheradized, of shape and size best suited to that particular location, of sufficient size to contain enclosed wires without crowding.
2. Provide deep boxes (2-1/8") with 1" and larger conduit.
3. For lighting outlets, provide standard 4" octagon or square units, with 3/8" malleable iron fixture studs and box hangers where required.
4. For switches and receptacles, provide boxes 4" square by 1-1/2" deep minimum with rings and covers as required.

E. Low Voltage Cabling Raceways:

1. Provide 4" square boxes with single device ring and 3/4" raceway stubbed to accessible area at ceiling with insulating bushing.
2. In areas with no ceiling, extend raceway to adjacent accessible ceiling space or to telephone backboard or as directed by Owner.
3. Provide pull string for all low-voltage raceways.

1 F. Pull Boxes:

- 2
3 1. Provide galvanized code-gauge sheet units with screw-on covers, of size and shape required
4 to accommodate wires per NEC wire bending requirements, without crowding access and to
5 suit the location.
6

7 G. Electrical Hand Hold Splice Boxes:

- 8
9 1. Provide flush at grade splice boxes constructed of fiberglass polymer
10 concrete reinforced with removable access cover labeled "ELECTRIC" and stainless steel
11 cover fasteners. Cover shall be cast iron, bronze or fiberglass polymer UV rated.
12
13 1. MacLean Highline CHA121212(12"x12"x12" high) or approved equal.
14 2. Cover assembly shall be load tested per ANSI/SCTE 77 for 12,000 lbs.
15 3. Mount splice box on 6" compacted gravel base and pour 6" concrete collar (4" deep)
16 with reinforcing rod around top for protection.
17

- 18 H. Provide sleeves and chases where conduits pass through floors and walls.
19

20 **2.09 CONDUCTORS**

- 21
22 A. Wire and Cable (600 Volt): Provide 600 V insulated copper wire and cable, NEC standard, of
23 types specified below for different applications, with UL label, and color coded as required by
24 governmental agencies having jurisdiction. Use only copper wires and cables.
25

- 26 1. With conductors No. 4 and larger, provide insulating bushings.
27 2. Wire and cable shall be THHN or THWN.
28 3. Branch circuit wiring installed in wiring channels of continuous row-mounted fixtures shall
29 be provided. UL listed type RHH or other approved 90 degree C wires, rated at 600 V.
30 4. Wire No. 10 and smaller shall be solid or stranded wire; wire larger than No. 10 shall be
31 stranded wire.
32 5. Wire in conduits subjected to direct sunlight shall be THWN or RHWN.
33 6. Provide XHHW/CU wiring in underground exterior conduit.
34 7. Identify feeder neutrals with white tape or white paint.
35 8. All low-voltage wiring located in accessible areas shall be installed in metallic conduit.
36 9. Provide separate identified neutral conductor for emergency and exit lighting circuits.
37 10. All branch circuit conductors shall be connected by means of a screw terminal.
38

- 39 B. Armored Cable (AC) or Metal-Clad Cable (MC):

- 40
41 1. Limit AC and MC usage to concealed only locations, branch-circuit wiring after the first
42 junction box from the panelboards; where approved by NEC, state and local electrical
43 inspecting authorities.
44 2. Not allowed for Panelboard feeders or service conduit.
45 3. Provide and install per NEC Articles 333 and 334 with grounding conductor.
46

47 **2.10 MOTOR WIRING**

- 48
49 A. See plans for approximate location and sizes of all motors. Verify exact locations at job site with
50 the contractor that is furnishing the motor driven equipment.
51
52 B. The Drawing motor schedules indicate that the anticipated horsepower loads and circuit sizes.
53 Verify all these requirements with contractor concerned and install accordingly under this
54 contract.
55

- 1 C. Install disconnect means where required by code for motors out of sight of controller. These shall
2 be fusible safety switches, fuse-tron box cover unit, or non-fused switch as indicated on plans. All
3 switches shall be horsepower rated.
4
- 5 D. All motors will be furnished and installed by others, unless noted otherwise.
6
- 7 E. Motor starters to be provided and installed by the Electrical Contractor unless indicated otherwise
8 herein or on the plans. See Motor Schedule.
9
- 10 F. All final connections to motors to be made by this Contractor.
11
- 12 G. All motors to be connected using flexible metallic conduits extending from motor box to outlet box.
13 Use liquid tight flexible metallic conduit with PVC covering in wet or oily locations and for all
14 motors within 12" of floor. See paragraph on GROUNDING. All wires in flexible metallic conduit
15 shall be stranded. Grounding wires shall be in all cases installed in flexible conduit and not
16 wrapped around the outside of the conduit.
17

18 2.11 MOTOR STARTERS

- 19
- 20 A. General:
21
- 22 1. Indoor - NEMA Type 1.
 - 23 2. Outdoors or where exposed to moisture - NEMA Type 3R, raintight.
 - 24 3. Units shall open all ungrounded conductors simultaneously.
 - 25 4. All starters shall be from a single manufacturer.
 - 26 5. Approved Manufacturers: Allen-Bradley, Cutler Hammer, Square D and Siemens.
27
- 28 B. Manual Starters:
29
- 30 1. For single-phase starters, provide units of tumbler switch type that clearly indicate ON,
31 OFF and TRIPPED positions.
 - 32 2. For three-phase starters, provide pushbutton operated units with START, STOP-RESET
33 button on the enclosure cover.
34
- 35 C. Magnetic Starters:
36
- 37 1. Provide units with operating coils designed to operate on line voltage or
38 any other auxiliary voltage indicated on the Drawings.
 - 39 2. For starters with line voltage operating coils, provide built-in under-voltage release.
 - 40 3. Provide units with the accessories and auxiliary contacts needed for automatic or remote
41 operation as shown on the Drawings.
 - 42 4. Provide "H-O-A" control switch and "green" run light on unit cover.
 - 43 5. Provide thermal overload protection in each phase which if any phase trips cause the
44 starter to drop out.
45

46 2.12 SAFETY SWITCHES

- 47
- 48 A. Provide safety switches of general duty type, horsepower rated, quick-make and quick-break
49 design, externally operated with provision for padlocking, fusible or non-fusible as shown on the
50 Drawings.
51
- 52 B. Provide enclosures clearly marked for maximum voltage, current, and horsepower rating, and:
53
- 54 1. Indoor: NEMA type 1.
 - 55 2. Outdoor: NEMA type 3R, raintight.

1
2 C. Approved Manufacturers: Square D, Cutler Hammer or Siemens.
3

4 **2.13 LIGHTING FIXTURES**
5

6 A. Provide fixtures of the types shown on the Drawings, and with the following accessories as
7 applicable.
8

9 B. Light Fixtures:

- 10
11 1. Provide units having a UL label.
12 2. Provide local label in addition if so required by governmental agencies having jurisdiction.
13 3. Verify all ceiling types as shown on final architectural plans and be responsible for
14 ordering proper fixtures and accessories for the proper ceiling.
15

16 C. LED Lighting:
17

- 18 1. The manufacturer of the LED lighting fixture shall utilize high-brightness LEDs and high-
19 efficiency electronic LED drivers, dimmed or no dimmed as required.
20 2. The LED fixture shall be thermally designed as to not exceed the maximum junction
21 temperature of the LED for the ambient temperature of the location the fixture is to be
22 installed
23 3. Light output of the LED system shall be the absolute photometry following IESNA LM-
24 79 and IESNA LM-80 requirements and guidelines.
25 4. Minimum power factor of 0.90.
26 5. LED lighting fixture shall be mercury-free, lead-free and RoHS compliant.
27 6. The LED lighting fixture shall maintain 70% lumen output for a minimum of 50,000 hours.
28 7. All components of the LED lighting fixture shall be replaceable.
29 8. The LED lighting fixture shall carry a limited 3-year warranty minimum.
30

31 D. Acceptable Lighting Fixture Manufacturers:
32

- 33 1. Refer to **Fixture Schedule**. Engineer will evaluate and make final decision on whether
34 submitted fixture is equal to specified light fixture.
35 2. Other fixture manufacturers who consider their products equal to those specified are
36 required to request pre-approval for bidding as base bid in accord with Instructions to
37 Bidders section.
38

39 **2.14 OCCUPANCY SENSOR CONTROLS**
40

41 A. Occupancy Sensors shall be equal to Sensor Switch or approved equal. Refer to Occupancy
42 Sensor schedule on the Drawings for specific types required.
43

- 44 1. All sensors shall be capable of operating normally with electronic fluorescent ballasts
45 and LED driver systems and rated motor loads.
46 2. Coverage of sensors shall remain constant after sensitivity control has been set. No
47 automatic reduction shall occur in coverage due to the cycling of air conditioner or
48 heating fans.
49 3. All sensors shall have readily accessible, user adjustable settings for time delay and
50 sensitivity. Settings shall be located on the sensor (not the control unit) and shall be
51 recessed to limit tampering.
52 4. All sensors shall provide an LED as a visual means of indication at all times to verify that
53 motion is being detected during both testing and normal operation.
54

55 B. Wall Sensors:
56

1. Wall switch sensors shall be capable of detection of occupancy at desktop level up to 300 square feet, and gross motion up to 1000 square feet.
2. Wall switch sensors shall accommodate loads from 0 to 800 watts at 120 volts; 0 to 1200 watts at 277 volts and shall have 180° coverage capability.
3. Wall switch sensors shall have no leakage current to load, in manual or in Auto/Off mode for safety purposes and shall have voltage drop protection.
4. Wall switch sensors shall provide a field selectable option to convert sensor operation from automatic-ON to manual-ON.

C. Passive Infrared Sensors:

1. Passive infrared sensors shall utilize Pulse Count Processing and Digital Signature Analysis to respond only to those signals caused by human motion.
2. Passive infrared sensors shall utilize mixed signal ASIC which provides high immunity to false triggering from RFI (hand-held radios) and EMI (electrical noise on the line), superior performance, and greater reliability.

D. Ultrasonic Sensors:

1. Ultrasonic sensors shall utilize Advanced Signal Processing to adjust the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.
2. Ultrasonic operating frequency shall be crystal controlled at 25 kHz within $\pm 0.005\%$ tolerance, 32 kHz within $\pm 0.002\%$ tolerance, or 40 kHz $\pm 0.002\%$ tolerance to assure reliable performance and eliminate sensor cross-talk. Sensors using multiple frequencies are not acceptable.

E. Dual Technology Sensors:

1. Dual technology sensors shall be corner mounted to avoid detection outside the controlled area when doors are left open.
2. Dual technology sensors shall consist of passive infrared and ultrasonic technologies for occupancy detection. Products that react to noise or ambient sound shall not be considered.

2.15 PROGRAMMABLE LIGHTING CONTROLLER

A. The programmable lighting controller shall consist of intelligent lighting control panel(s) with programmable digital and analog inputs, integral astronomic time-clock scheduling with flash warn before OFF feature and provision for up to 8 relay outputs. The specified system for this project shall include the following components:

1. Eight (8) Relay digital programmable lighting controller.
2. Programmable digital time clock
3. Two (2) local override manual switches.
4. Photocell input.
5. Alphanumeric key pad programming and LCD display.
7. Communication via LAN internet connection with BACnet standard MSTP protocol.

B. Standard Output relays

1. UL Listed 30 Amp @ 277VAC Ballast and HID and 20 Amp Tungsten at 120 Vac. 347V Ballast and HID at 20 amps Latching Relay wit 18,000A SCCR at 277Vac.
2. Relays shall be individually replaceable. Relay terminal blocks shall be capable of accepting two (2) #8AWG wires on both the line and the load side. Relays to be rated for 250,000 operations minimum at a full 30a lighting load.

3. Standard relay shall default to closed at normal power loss, Normally Closed Latching (NCL).
4. Optional relay types available shall include: Normally Open Latching (NOL) relay rated for 250,000 operations, a 600v 2-pole NO and NC and a Single Pole, Double Throw (SPDT) relay.

C. Low Voltage Switches

1. All switches shall be digital and communicate via RS 485. The programming for a digital switch shall reside in the switch itself, via double EPROM memory. Any digital switch button function shall be able to be changed locally (at the DTC or a PC) or remotely via Internet.
2. Digital low voltage switch shall be a device that sits on the lighting control system bus. Digital switch shall connect to the system bus using the same cable and connection method required for relay panels. Each button shall be able to be enabled or disabled over the bus.
3. Keyed switches shall be similarly programmable and connect to the lighting control system bus.
4. Digital switches for high abuse areas (common areas, gymnasiums, etc.) shall be vandal resistant, contain no moving parts, and be touch sensitive and available with up to two buttons in a single gang.
5. Touch pads shall be Stainless Steel and capable of handling both high abuse and wash down locations.
6. High abuse switches shall connect to the lighting control system digital bus. Each high abuse touch button shall be able to be programmed in the same way as other digital switch buttons.

D. Programming shall be accomplished through an integral keypad and display on the unit or via PC software using a local LAN connection over internet connection. Software shall be available for download from the manufacturer's web site free of charge.

1. Local LAN interface network: BACnet protocol LAN connection.

E. Approved Manufacturer - Model: Leviton Green-MAX series (sole source -no substitution).

1. Leviton Green-Max R08TC100

F. Startup and Owner Services: Authorized lighting controller representative shall startup and program lighting controller per Owner's requested schedules.

1. Submit startup report and final lighting schedules for approval and inclusion in O&M manuals.
2. Provide 2 hours of Owner training in the proper operation and maintenance of the lighting control system.

2.16 ELECTRIC HEATERS

- A. Electric heaters provided and installed by HVAC Contractor, line voltage wiring by Electrical Contractor.
- B. Low Voltage (less than 100 volts) control wiring by HVAC Contractor.

2.17 TELEPHONE SERVICE RACEWAY

- A. Provide 2" service conduit stubbed outside the building 24" below grade and capped from the mechanical room for future telephone or data services. Coordinate locations with Owner.

1 **2.18 OTHER MATERIALS**

- 2
3 A. Provide other materials, not specifically described but required for a complete and proper
4 installation, as selected by the Contractor subject to the approval of the Architect.
5
6

7 **PART 3 - EXECUTION**

8
9 **3.01 SURFACE CONDITIONS**

- 10
11 A. Examine the areas and conditions under which work of this Section will be performed. Correct
12 conditions detrimental to timely and proper completion of the Work. Do not proceed until
13 unsatisfactory conditions are corrected.
14

15 **3.02 PREPARATION**

16
17 A. Coordination:

- 18
19 1. Coordinate as necessary with other trades to assure proper and adequate provision in
20 the work of those trades for interface with the work of this Section.
21 2. Coordinate the installation of electrical items with the schedule for work of other trades to
22 prevent unnecessary delays in the work schedule.
23 3. Where lighting fixtures and other electrical items are shown in conflict with locations of
24 structural members and mechanical or other equipment, provide required supports and
25 wiring to clear the encroachment.
26

- 27 B. Data indicated on the Drawings and in these Specifications are as exact as could be secured, but
28 their absolute accuracy is not warranted. The exact locations, distances, levels, and other
29 conditions will be governed by actual construction and the Drawings and Specifications should be
30 used only for guidance in such regard.
31

- 32 C. Where outlets are not specifically located on the Drawings, locate as determined in the field by
33 the Architect. Where outlets are installed without such specific direction, relocate as directed by
34 the Architect and at no additional cost to the Owner.
35

- 36 D. Verify all measurements at the building. No extra compensation will be allowed because of
37 differences between work shown on the drawings and actual measurements at the site of
38 construction.
39

- 40 E. The Electrical Drawings are diagrammatic, but are required to be followed closely as actual
41 construction and work of other trades will permit. Where deviations are required to conform with
42 actual construction and the work of other trades, make such deviations without additional cost to
43 the Owner.
44

45 **3.03 INSTALLATION OF ELECTRIC SERVICE**

- 46
47 A. Coordinate installation with local utility as required for a complete electric service installation.
48

- 49 B. Installation shall be approved by the local utilities.
50

51 **3.04 TRENCHING AND BACKFILLING**

- 52
53 A. Perform trenching and backfilling associated with the work of this Section in strict
54 accordance with the provisions of Division 2 of these Specifications.
55

1 B. Cut bottom of trench to grade, make trench 12" wider than the widest dimension of the pipe.

2
3 C. Bedding and backfilling:

- 4
5 1. Install piping promptly after trenching. Keep trenches open as short a time as
6 practicable.
7 2. *Under the building slab:* Install all pipes on a compacted bed of damp sand 6" deep. Do
8 not lay piping on large stones, rocks or bricks.
9 3. *Outside the building:* Install all underground piping on a compacted bed of damp sand 6"
10 deep. Backfill to within 12" of finish grade with damp sand. Backfill the remainder with
11 native topsoil. Backfill in layers and compact sufficiently to prevent settlement.
12 4. Do not start backfill operations until underground plumbing work has been properly
13 inspected and approved by governing authorities.
14

15 **3.05 INSTALLATION OF RACEWAYS AND FITTINGS**

- 16
17 A. Where conduit is installed concealed in walls or above ceiling, or exposed in work areas, provide
18 rigid galvanized conduit or electrical metallic tubing with compression type fittings.
19
20 1. Seal joints to prevent entrance of water.
21 2. Provide ground wire of proper size per NEC 250.
22 3. Use nylon (rather than steel) fish tape.
23
24 B. Use flexible conduit only for short motor connections, or where subject to vibration.
25
26 C. Provide necessary sleeves and chases where conduits pass through floors and walls and provide
27 other necessary openings and spaces, arranging for proper time to prevent unnecessary cutting
28 in connection with the Work.
29
30 D. Where conduit is exposed, run parallel to or at right angle with lines of the building.
31
32 E. Securely and rigidly support conduits throughout the work.
33

34 **3.06 INSTALLATION OF LIGHTING FIXTURES**

- 35
36 A. Install lighting fixtures complete and ready for service in accordance with the Lighting Fixture
37 Schedule shown on the Drawings.
38
39 B. Wire fixtures with fixture wiring of at least 90 degrees C rating. Where fixtures are mounted in
40 continuous rows, provide conductors in wiring channels of the same size as the circuit wires
41 supplying the row of fixtures.
42
43 C. Use only bonderized, galvanized, or sheradized steel for fixture installation for protection against
44 rust and corrosion, and install fluorescent fixtures straight and true with reference to walls.
45
46 D. Install all lighting fixtures, including those mounted in continuous rows, so that the weight of the
47 fixture is supported, either directly or indirectly, by a safe and sound structural member of the
48 building, using adequate number and type of fastenings to assure safe installation.
49
50 1. Screwed fastenings, and toggle bolts through ceiling material or wall paneling, are not
51 acceptable.
52

53 **3.07 INSTALLATION AND START-UP OF PROGRAMMABLE LIGHTING CONTROLS**

1 A. System Start-up: Provide a factory authorized technician to verify the installation, test the system,
2 and train the owner on proper operation and maintenance of the system. Before requesting start-
3 up services, the installing contractor shall verify that:

- 4
- 5 1. The control system has been fully installed in accordance with manufacturer's
6 installation instructions.
- 7 2. Arrange and coordinate network connections for remote communication with Owner.
8 Owner will provide internet service to lighting control panel.
- 9 3. Low voltage wiring for overrides and sensors is completed.
- 10 4. Accurate "as-built" load schedules have been prepared for each lighting control panel.
- 11 5. Proper notification of the impending start-up has been provided to the
12 Owner's representative.
- 13

14 B. Factory Support: Factory telephone support shall be available at no cost to the owner during the
15 warranty period. Factory assistance shall consist of assistance in solving programming or other
16 application issues pertaining to the control equipment. The factory shall provide a toll-free number
17 for technical support.

18 **3.08 INSTALLATION OF POWER EQUIPMENT**

19 A. Provide power and control wiring for motor starters and safety switches as shown on the
20 Drawings.

21 **3.09 INSTALLATION OF CONDUCTORS**

22 A. Unless otherwise shown on the Drawings or noted in these Specifications, use No. 12 AWG
23 conductors for all branch circuits, protected by 20 amp circuit breakers. For runs exceeding 100
24 feet, use larger wires to limit voltage drops.

25 B. Use identified (white) neutrals and color-coded phase wires for all branch circuit wiring.

- 26 1. Make splices electrically and mechanically secure with pressure-type connectors.
- 27 2. Provide "Scotchlok", Buchanon "B-cap", or Ideal "Wing-nut" connectors for wires sizes 6
28 AWG and smaller.
- 29 3. Provide Burndy compression-type connectors, "Hydent" or equal applied with a
30 mechanical tool and die equipment for wire sizes 4 AWG and larger.
- 31 4. Insulate splices with a minimum of two half-lapped layers of Scotch Branch No. 33 vinyl-
32 plastic electrical tape where insulation is required.
- 33
- 34
- 35
- 36
- 37
- 38
- 39

40 **3.10 INSTALLATION OF PANELBOARDS**

41 A. Unless otherwise shown on the Drawings, install panels with the top of the trim 6'-3" above the
42 finished floor.

43 B. Mount a typewritten directory behind plastic on the inside of each panel door and on the directory,
44 showing the circuit number and complete description of all outlets on each circuit.

45 C. Provide two (2) spare 1" conduits, stubbed out of the top of each flush-mounted panel and
46 terminated in accessible ceiling space, with each conduit tagged with panel description.

47 **3.11 TESTING AND INSPECTION**

48 A. Provide personnel and equipment, make required tests, and secure required approvals from the
49 Architect and governmental agencies having jurisdiction.

- 1 B. Make written notice to the Architect adequately in advance of each of the following stages of
2 construction:
3
4 1. Test all parts of the electrical system and prove that all such items provided under this
5 Section function electrically in the required manner.
6 2. Immediately submit to the Architect a report of maximum and minimum voltages and a
7 copy of the recording volt-meter chart.
8 3. Also measure voltages between phases and between phase wires and neutrals and
9 report these voltages to the Architect.

10
11 **3.12 PROJECT COMPLETION**
12

- 13 A. Upon completion of the work of this Section, thoroughly clean all exposed portions of the
14 electrical installation, removing all traces of soil, labels, grease, oil, and other foreign material,
15 and using only the type cleaner recommended by the manufacturer of the item being cleaned.
16
17 B. Thoroughly indoctrinate the Owner's operation and maintenance personnel in the contents of the
18 operations and maintenance manual required to be submitted under Article 1.3 of this Section of
19 these Specifications.
20

21 **END OF SECTION**

1 **SECTION 31 10 00 - SITE CLEARING**

2 **PART 1 - GENERAL**

3 **GENERAL REQUIREMENTS**

4 These specifications generally follow the design guidelines established by the "Standard
5 Specifications for Public Works Construction" by the City of Madison, Wisconsin. The
6 standards can be found at <http://www.cityofmadison.com/business/pw/specs.cfm>. Work not
7 specified herein or as directed by the Owner shall follow these standards.
8
9

10
11 **END OF SECTION 31 10 00**

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1 **SECTION 31 20 00 - EARTH MOVING**

2 **PART 1 - GENERAL**

3 **GENERAL REQUIREMENTS**

4 These specifications generally follow the design guidelines established by the "Standard
5 Specifications for Public Works Construction" by the City of Madison, Wisconsin. The
6 standards can be found at <http://www.cityofmadison.com/business/pw/specs.cfm>. Work not
7 specified herein or as directed by the Owner shall follow these standards.
8
9

10
11 **END OF SECTION 31 20 00**

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1 **SECTION 32 12 16 - ASPHALT PAVING**

2 **PART 1 - GENERAL**

3 **GENERAL REQUIREMENTS**

4 These specifications generally follow the design guidelines established by the "Standard
5 Specifications for Public Works Construction" by the City of Madison, Wisconsin. The
6 standards can be found at <http://www.cityofmadison.com/business/pw/specs.cfm>. Work not
7 specified herein or as directed by the Owner shall follow these standards.
8
9

10
11 **END OF SECTION 32 12 16**

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1 **SECTION 32 13 13 - CONCRETE PAVING**

2 **PART 1 - GENERAL**

3 **GENERAL REQUIREMENTS**

4 These specifications generally follow the design guidelines established by the “Standard
5 Specifications for Public Works Construction” by the City of Madison, Wisconsin. The
6 standards can be found at <http://www.cityofmadison.com/business/pw/specs.cfm>. Work not
7 specified herein or as directed by the Owner shall follow these standards.
8
9

10
11 **END OF SECTION 32 13 13**

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1 **SECTION 32 33 00 - SITE FURNISHINGS**

2 **PART 1 - GENERAL**

3 **1.1 SECTION REQUIREMENTS**

- 4
- 5 A. Submittals: Product Data, shop drawings showing installation and color Samples.
- 6
- 7 B. Maintenance Data: Include recommended methods for repairing damage to the powder
- 8 coat finish.
- 9
- 10 C. Store bicycle parking racks in original undamaged packages and containers until ready
- 11 for installation.
- 12
- 13 D. Handle powder coated bicycle parking racks with sufficient care to prevent any
- 14 scratches or damage to the finish.
- 15
- 16

17 **PART 2 - PRODUCTS**

18 **2.1 MATERIALS**

- 19
- 20 A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M, hot-dip galvanized.
- 21
- 22 B. Steel Pipe: ASTM A 53/A 53M or ASTM A 13, hot-dip galvanized.
- 23
- 24 C. Steel Tubing: ASTM A 500 0, hot-dip galvanized.
- 25
- 26 D. Steel Finish: Powder coat, color as selected by City Parks Staff from full line of
- 27 manufacturer's standard colors.
- 28
- 29

30 **2.2 SITE FURNISHINGS**

- 31
- 32 A. Bicycle Racks:
 - 33 1. Basis of Design: Madrax Spartan
 - 34 2. Bicycle Rack Construction: Steel galvanized steel tubing
 - 35 3. Style: Double-side parking
 - 36 4. Installation Method: Surface mount on concrete slab, anchor with 1/2" stainless
 - 37 steel expansion anchors with 3" embedment.

1 **PART 3 - EXECUTION**

2 **3.1 INSTALLATION**
3

4 A. Handle and install bicycle parking racks in accordance with manufacturer's
5 recommendations and installation instructions.

6
7 B. General: Anchor bicycle rack securely, positioned at locations and elevations indicated.
8

9
10 **END OF SECTION 32 33 00**

1 **SECTION 32 90 00 - TURF AND GRASSES**

2 **PART 1 - GENERAL**

3 **GENERAL REQUIREMENTS**

4 These specifications generally follow the design guidelines established by the “Standard
5 Specifications for Public Works Construction” by the City of Madison, Wisconsin. The
6 standards can be found at <http://www.cityofmadison.com/business/pw/specs.cfm>. Work not
7 specified herein or as directed by the Owner shall follow these standards.
8
9

10
11 **END OF SECTION 32 90 00**

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1 **SECTION 33 11 00 - WATER UTILITY DISTRIBUTION PIPING**
2

3
4 **PART 1 - GENERAL**
5

6 **1.01 SCOPE**
7

8 A. The work under this section shall consist of providing all work, materials, labor, equipment, and
9 supervision necessary to provide water distribution system components and other work, as
10 required in these specifications, on the drawings and as otherwise deemed necessary to complete
11 the work.
12

- 13 1. All materials and methods shall meet the City of Madison public works standards
14 Articles 701 thru 704.
15

16 **1.02 REFERENCE**
17

18 A. Applicable provisions of Division 1 shall govern all work under this Section.
19

20 **1.03 REFERENCE STANDARDS**
21

- 22 A. American Society for Testing and Materials (ASTM):
23 B88 Standard Specifications for Seamless Copper Water Tube
24 C504-00 Rubber-Seated Butterfly Valves
25 C509-01 Resilient-Seated Gate Valves for Water Supply Service
26 C515-01 Reduced Wall, Resilient Seated Gate Valves for Water Supply Service
27 C800-01 Underground Service Line Valves and Fittings
28

29 **1.03 SUBMITTALS**
30

31 A. Provide manufacturers product information (cut sheets) and O&M information for watermain
32 materials including:
33

- 34 1. Pipe
35 2. Fittings
36 3. Valves
37

38 B. Provide reports that document pressure and continuity testing procedures and results.
39

40 C. Provide copies of record drawings.
41

42 **1.04 QUALITY ASSURANCE**
43

44 A. Maintain and submit record drawings.
45

46 B. Conduct pressure testing, continuity testing and safe sampling as required in Part 3 – Execution.
47

48 **1.05 PERMITS/FEES**
49

50 A. Contractor shall be solely responsible for obtaining all permits necessary to complete the work.
51 Contractor shall pay all fees associated with obtaining permits. These include, but are not
52 limited to permits for work within public right-of-way, street opening permits, utility
53 connection permits, and plumbing permits.
54

55 **1.06 SURVEY AND STAKING**
56

57 A. Contractor shall be responsible for transferring benchmarks, control points, lines and grades
58 necessary to complete his work.

1
2 **1.07 RECORD DOCUMENTS**
3

- 4 A. Maintain record drawings that show the actual locations, sizes and types of utilities and other
5 features encountered.
6
7 1. Note any modifications to proposed watermain size, alignment, or grades.
8 2. Record any other deviations from the original design.
9

10
11 **PART 2 - PRODUCTS**
12

13 **2.01 Ductile Iron Pipe:**
14

- 15 A. Ductile iron pipe and accessories shall conform to the requirements of American National
16 Standard for Ductile Iron Pipe, Centrifugally Cast, for Water (ANSI/AWWA C151/A21.51 - latest
17 revision).
18
19 B. Pipe requirements:
20
21 1. Class 52 ductile iron.
22 2. Cement lined.
23 3. Push-on joint.
24 4. Furnished with all necessary accessories.
25 5. Bonding straps to provide electrical conductivity.
26

27 **2.02 Gaskets:**
28

- 29 A. Gaskets shall conform to the requirements of American National Standard for Rubber-Gasket
30 Joints for Ductile Iron Pressure Pipe and Fittings (ANSI/AWWA C111/A21.11 - latest revision).
31
32 B. Gasket Requirements:
33
34 1. Plain rubber gaskets.
35 2. Restrained-joint locking gaskets.
36 a. Use restrained joint locking gaskets when electing to or are otherwise required
37 to meet thrust-restraint requirements by means of restrained-joint pipe.
38 b. Restrained-joint locking gaskets must be certified as compliant for use with the
39 furnished pipe material by the pipe manufacturer.
40 c. Nitrile or Fluorocarbon gaskets may be required if water mains are near
41 contaminated soils.
42

43 **2.03 Polyethylene Encasement:**
44

- 45 A. Polyethylene encasement materials shall conform to the requirements of the American National
46 Standard for Polyethylene Encasement for Ductile Iron Pipe Systems (ANSI/AWWA C105/A21.5 -
47 latest revision).
48
49 B. Polyethylene Encasement Requirements:
50
51 1. 8-mil thickness (minimum).
52 2. Furnish in either tube or sheet form.
53

54 **2.04 Mechanical Joint Fittings:**
55

- 56 A. Mechanical joint fittings are to conform to the requirements of American National Standard for
57 Ductile Iron and Gray Iron Fittings, 3-inch through 48-inch, for Water (ANSI/AWWA C110/A21.10 -
58 latest revision).
59

- 1 B. Mechanical Joint Fitting Requirements:
 2
 3 1. Class 250 mechanical joint pipe fittings.
 4 2. Cement lined.
 5 3. All bells.
 6 4. Entire fitting tarred.
 7 5. Conductive mechanical joint (no lead)
 8 6. Furnished with all necessary accessories (rubber gaskets, flanges, bolts, etc.).
 9

10 **2.05 Mechanical Joint Restraints:**

- 11
 12 A. EBAA Iron Inc. - MEGALUG® Series 1100, or approved equal.
 13

14 **2.06 Nuts and Bolts:**

- 15
 16 A. Comply with AWWA C111/A21.11. - latest revision.
 17
 18 B. Ensure that bolts are of sufficient length such that a minimum of ½-inch of threads are exposed
 19 beyond the end of the nut when tightened.
 20
 21 C. Refer to the following table for the numbers, diameters, and lengths of bolts to be used:
 22

Pipe Dia (inches)	No Bolts	Bolt Dia (inches)	Bolt Length (inches)	Bolt Lenth for MEGALUG® (inches)
3	4	5/8	3	3-1/2
4	4	3/4	3-1/2	4
6	6	3/4	3-1/2	4

28
 29 **2.07 COPPER WATER SERVICE**

- 30
 31 A. Type K, soft copper tubing meeting the requirements of ASTM B88.
 32
 33 B. Copper watermain 1½" inch diameter and larger shall be provided in straight lengths, not roll
 34 stock.
 35

36 **2.08 SADDLES**

- 37
 38 A. Saddles are required at:
 39
 40 1. All 1-½-inch and 2-inch service lateral taps.
 41 2. All service lateral taps on PVC, HDPE, or CIPP-lined water mains.
 42
 43 B. Approved saddles:
 44
 45 1. Ford Series 202B double strap brass saddle.
 46 2. A.Y. McDonald - Series 3825 saddles (double strap).
 47

48 **2.09 COUPLINGS**

- 49
 50 A. Couplings shall be copper-to-copper fittings.
 51
 52 1. Compression couplings are only permitted when reconnecting existing copper tubing to
 53 new copper tubing.
 54
 55 B. Allowable couplings:
 56
 57 1. Mueller H15400.
 58 2. Mueller HI5405.
 59 3. Mueller H5403.

- 4. Mueller P15403.
- 5. Ford C44-33 / 44 / 66 / 77

2.10 CORPORATION STOPS & SERVICE FITTINGS

- A. 1½-inch and 2-inch diameter Service Fittings (1/8 bends):
 - 1. Mueller H – 15470.
- B. Supply all Service Fittings (1/8 bends) with a fiber gasket.

2.11 CURB STOPS

- A. 1 ½-inch and 2-inch diameter Curb Stops:
 - 1. Mueller H15201.

2.12 CURB BOXES

- A. Ensure that all curb boxes are complete, with covers marked "WATER".
 - 1. Mark cover for air blowout connection "AIR CONNECTION".
- B. Curb Box Assemblies shall include the following:
 - 1. Brass screws.
 - 2. 2½-inch new style flush fit cover.
 - 3. 54-inch rods and guide rings.
 - 4. 2½-inch screw type shaft.
 - 5. 37-inch bottom section.
 - 6. 29-inch top section.
 - 7. 16-inch center section.
- C. 1½-inch and 2-inch diameter Curb Boxes:
 - 1. Tyler or Bingham and Taylor (Standard Valve Box).
 - 2. No rods or rings.

2.13 DISINFECTION CHEMICALS

- A. Dry chemicals:
 - 1. Chloride of Lime.
 - 2. HTH.
 - 3. Pittchlor.
 - 4. Or equal (65 % available Chlorine), granular form only.
- B. Liquid:
 - 1. Only to be used with Engineer's written authorization.
 - 2. Sodium hypochloric.

2.14 BOARD INSULATION

- A. Rigid, closed-cell, extruded polystyrene insulation. Insulation shall be suitable for buried installation.
- B. Individual boards shall have minimum dimensions of 8'x4'x2".\

1 C. Dow Styrofoam, or approved equal.

2
3 **2.15 LOCATOR TAPE**

4
5 A. Detectable metallic locator tape, specifically manufactured for marking utilities.

6
7 B. Tape shall be a minimum of 6" wide and designed to be detectable at a depth of 18".

8
9 C. Tape shall be marked "WATER" and blue colored.

10
11 **2.16 PIPE JOINT LUBRICANT**

12
13 A. Petroleum free pipe lubricant formulated for use with potable water systems. Product shall meet
14 the requirements of ANSI/NSF Standard #61.

15
16
17 **PART 3 - EXECUTION**

18
19 **3.01 GENERAL**

20
21 A. Complete exploratory excavations at utility crossings as shown on the plans and as necessary to
22 complete the work.

23
24 B. Maintain clearances between watermains and existing or proposed sewer lines as follows:

- 25
26 1. 8' horizontal separation (measured center to center) between watermains and existing or
27 proposed sanitary or storm sewers.
28 2. 6" vertical separation (measured from outsides of pipes) where watermains cross over
29 sanitary or storm sewers.
30 3. 18' vertical separation (measured from outsides of pipes) where watermains cross under
31 sanitary or storm sewers.

32
33 C. Store and handle pipe in accordance with manufacturers recommendations. Keep pipes clean of
34 soil, debris and animals.

35
36 **3.02 EXCAVATION**

37
38 A. Construct water mains and appurtenances in open trenches and in a manner to protect the pipe and
39 appurtenances from unusual stresses at all times.

40
41 B. Trench Excavation:

- 42
43 1. All excavation, sheeting, shoring and bracing shall be done in accordance with the latest
44 edition OSHA regulations and any additional requirements specified in the Plans or
45 Contract Documents.
46 2. Provide all sheeting, bracing and/or shoring necessary to protect the work, existing
47 property, utilities, pavement, etc., and to provide safe working conditions in the trench.
48 All costs of sheeting, bracing and/or shoring is considered incidental to any work which
49 necessitates it.
50 3. When not in use, remove sheeting and bracing, unless permission to leave in-place has
51 been given in writing by the Engineer.
52 4. Excavate trenches in conformity with the required alignment and grades as shown on
53 the drawings and as laid out in the field by the Engineer.
54 5. Remove all vegetation and topsoil along the trench line to the width of the proposed trench
55 before beginning excavation.
56 6. Deposit material excavated from the trench on the sides of the trenches and excavations,
57 beyond the reach of slides. Transport material to spoil banks as an alternative.
58

- 1 C. Properly dispose of surplus material at no additional cost to the City. Surplus material
- 2 includes but is not necessarily limited to:
- 3
- 4 1. Vegetation from the trench line.
- 5 2. Excavated rock or cobbles in excess of 6-inches in diameter.
- 6 3. All other material from excavation not needed or suitable for backfilling trenches.
- 7
- 8 D. For water main construction, the width of the trench shall be such as to leave a clear space of not
- 9 less than 6-inches between the earth wall, or the supporting sheeting or bracing where such is
- 10 used, and the sides of the pipe. The trench width established by this pipe clearance, measured at
- 11 the spring line, shall be applicable to that portion of the trench from 1-foot above the top of the pipe
- 12 to the bottom of the trench.
- 13
- 14 E. On streets opened to traffic, on restricted easements, and other specified locations, minimize the
- 15 width of the trench at the ground surface to the extent possible to accommodate the pipe installation
- 16 and any necessary sheeting or bracing.
- 17
- 18 F. The Engineer reserves the right to limit the extent of excavation depending on the nature of the soil
- 19 and other conditions.
- 20
- 21 1. As ordered by the Engineer due to trees, fences, buildings, shrubs, etc., dig trenches by
- 22 hand.
- 23

24 **3.03 EXCAVATION IN POOR SOILS**

- 25
- 26 A. If, in the opinion of the Engineer, an artificial foundation is necessary because of the nature of the
- 27 excavated material, excavate the unsuitable material and replace with suitable specified material to
- 28 produce an acceptable pipe foundation.
- 29
- 30 B. The undercut depth shall be as directed by the Engineer but shall be a minimum of 1-foot below the
- 31 bottom of the pipe. Any work involved in forming a satisfactory foundation at depths of 1- foot or less
- 32 below the bottom of pipe will be considered to be incidental to the work.
- 33
- 34 C. Backfill this portion of the trench with specified approved bedding material and mechanically
- 35 compact the select fill prior to laying the pipe. Limit the width of the trench excavation to the outside
- 36 diameter of the pipe plus 2-feet, plus the amount necessary for sheeting and/or bracing.
- 37

38 **3.04 DEWATERING**

- 39
- 40 A. In accordance with these Specifications, remove by pumping, bailing, or otherwise, any water that
- 41 may accumulate or be found in the trenches and other excavations.
- 42
- 43 B. Form all dams, flumes or other works necessary to keep the trenches or excavations entirely clear
- 44 of water while the water mains and their appurtenances are being installed.
- 45
- 46 1. Direct all water from excavations, so as not to flow over or damage private or public
- 47 property.
- 48 2. All costs of dewatering are considered to be incidental to the associated work.
- 49

50 **3.05 BACKFILL REQUIREMENTS**

- 51
- 52 A. Backfill trenches and excavations immediately after the water main and appurtenances have been
- 53 installed.
- 54
- 55 B. Close trenches at the end of every day.
- 56
- 57 C. Backfill to the original surface elevation or otherwise specified elevation. In the event of a shortage
- 58 of material to perform this work, including replacement as may be required by rock excavation or
- 59 removal of boulders, provide the necessary fill material at no cost to the City.

- 1
- 2 D. Except as may be necessary in compacting and backfilling, do not walk or work on installed pipe
- 3 until the trench has been backfilled to an elevation at least 2-feet above the top of the pipe. Do not
- 4 take backfill material from trench walls below an elevation 2-feet above the top of pipe.
- 5
- 6 E. Evenly place backfill material so that no unbalanced pressures are placed upon the water system.
- 7 Backfill material may be dumped directly into the trench from trucks when the amount of material to
- 8 be dumped is controlled by proper equipment.
- 9
- 10 F. Deposit, spread and level backfill material in layers not exceeding 12-inches in thickness before
- 11 compacting. Compact each layer to the density specified herein before placing the succeeding
- 12 layer. When the material being compacted is of a granular nature and the compacting equipment
- 13 is adaptable for the purpose, the thickness of the layer may be increased to a maximum of 24-
- 14 inches at the Engineer's discretion, provided the required compaction density is obtained.
- 15
- 16 G. Only use heavy equipment in the trench for compaction or other purposes if the pipe is adequately
- 17 protected and the Engineer approves. Trucks, vehicles, or other equipment are not allowed within
- 18 the limits of the trench prior to the completion of the backfilling operations.
- 19
- 20 H. Dump imported backfill material along the top of the trench beyond the reach of slides. Do not store
- 21 imported material such that it increases the stresses on the trench section.
- 22
- 23 I. Carefully draw and remove any required sheathing and bracing such that it will not disturb the
- 24 completed work. Carefully fill and compact any voids created by the removal of sheathing and
- 25 bracing with approved backfill material.
- 26
- 27 J. Whenever possible, backfill trenches and other excavations with materials excavated during the
- 28 course of the work.
- 29
- 30 K. Do not include vegetation, stones, or fragments of broken rock in excess of 6-inches in any
- 31 dimension in the backfill.
- 32
- 33 L. Note that the Engineer may reject material due to:
- 34
- 35 1. Unacceptable moisture content.
- 36 2. Unacceptable gradation or composition
- 37 3. The presence of frozen material.
- 38 4. Remove all rejected materials from the site.
- 39

40 **3.06 CAMPACTION REQUIREMENTS**

- 41
- 42 A. Mechanically compact backfill layers in trenches and excavations to thoroughly consolidate the
- 43 material to the density specified and to not damage or disturb the pipe or other structures.
- 44
- 45 B. Begin mechanical compaction of the backfill material when the depth of the backfill material is 2-feet
- 46 above the top of the pipe. (In the case of structures, begin compaction of the backfill material with
- 47 the placing of the first layer of backfill material).
- 48
- 49 C. The Engineer will perform compaction testing as necessary to verify uniformity of compaction.
- 50
- 51 D. Compaction Density Requirements:
- 52
- 53 E. From 2-feet over the pipe to within 3-feet of the bottom of subgrade:
- 54
- 55 1. A minimum of 90% of maximum density.
- 56
- 57 F. Within 3-feet of the bottom of subgrade:
- 58
- 59 1. A minimum of 95% of maximum density.

- 1
2 G. Determine maximum density in accordance with the Standard Method of Test for the Moisture-
3 Density Relations of Soils, ASTM Designation: D 1557, Method D, latest revision. Replace the
4 fraction of material retained on a ¾-inch sieve, with No. 4 to ¾-inch material.
5
6 H. Determine the density of compacted backfill in accordance with one of the following: Test for
7 Density of Soil-in-Place by the Sand-Cone Method, ASTM Designation: D 1556, latest revision, or
8 Test for Density of Soil and Soil-Aggregate in Place by Nuclear Methods, ASTM Designation: D
9 2922, latest revision.
10
11 I. In the event that the material in the density sample differs in percentage of aggregate retained on a
12 No. 4 sieve from that in the sample upon which maximum density was determined, adjust the
13 maximum density in accordance with approved procedures.
14
15 J. In the event of inadequate moisture in the backfill materials, add water as necessary to obtain the
16 required compaction.
17
18 K. Whenever the work of installing water pipes takes place during freezing weather, follow the
19 specifications for trench compaction above, if practicable. If the specified compaction cannot be
20 achieved, and the Engineer determines that the work may not be suspended until more favorable
21 weather conditions exist, proceed as follows:
22
23 1. Remove all frozen material in the trench at the beginning of the day's work.
24 2. Do not compact frozen materials.
25 3. Compact material in 6-inch maximum lifts.
26 4. Compact to densities specified herein.
27
28 L. If the top 3-feet of material does not meet 95% of maximum density, remove the material and place
29 Select Fill using 6-inch maximum lifts and compact to 95% of maximum density.
30
31 M. As a guideline, no construction will be permitted when the temperatures are too cold to achieve the
32 specified compaction of the backfill. Ensure that temperatures are at least 15°F and rising, with
33 winds less than 10 mph, before considering working in freezing conditions.
34

35 **3.07 BEDDING AND INITIAL COVER**
36

- 37 A. Watermain and water service piping shall be provided with 4" of bedding material and 12" of
38 initial cover material (both measured at the bell of the pipe).
39
40 B. Bedding and cover material for various types of pipe shall consist of the following:
41
42 1. Copper Water Services: Bedding sand or crushed stone screenings.
43

44 **3.08 INSTALLING FITTINGS AND VALVES**
45

- 46 A. Install fittings and valves at locations shown on the drawings.
47
48 B. Unless otherwise shown, provide mechanical joint connections. Install materials in accordance
49 with manufacturer's recommendations.
50
51 C. Maintain electrical continuity through all fittings, valves and hydrants. Provide and install suitable
52 jumper cables for epoxy coated valves.
53
54 D. tall valve box so that bonnet rests on compacted initial backfill material at the same elevation as
55 the top of the valve stuffing box. Center the valve box over the valve nut.
56
57 E. Install valve box plumb and level, backfilling evenly. Extend valve box to proposed final grade;
58 provide valve box extensions as necessary. Valve boxes that shift during backfilling or restoration
59 shall be excavated and re-set.

1 **3.09 CONNECTING TO EXISTING WATER MAINS**

- 2
- 3 A. There are three types of connections to existing mains:
- 4
- 5 1. A plug-removal connection is a connection that requires the removal of a slip or
- 6 mechanical joint plug from an existing fitting or the end of a water main.
- 7 2. A cut-in connection is a connection that requires the installation of a new fitting or
- 8 valve in an existing water main.
- 9 3. A live-tap is a connection in which the main is tapped under pressure and in-service while a
- 10 tapping valve is installed by the City. Furnish the ditch as necessary for the City to make the
- 11 tap and perform the associated cut-off and cap of the existing water main. Isolate and
- 12 depressurize all live-tap connections on any PVC, HDPE and CIPP-lined water mains prior
- 13 to providing the ditch to the City.
- 14

15 **3.10 WATER MAIN SHUTOFFS**

- 16
- 17 A. Do not interrupt water service without prior notification to all affected residents and property owners.
- 18 Ensure that all street-facing and/or visible entrances and all addresses of multi-unit properties are
- 19 included separately in the notification distribution.
- 20
- 21 B. With notification distributions, it is recommended to include a request to avoid using water fixtures,
- 22 faucets or water-sensitive appliances during the service interruption, and then opening an outside
- 23 spigot or cold water faucet on the lowest level of the property after service has been restored.
- 24
- 25 C. When requested and furnished by the Engineer, post terrace signs as part of the notification
- 26 distribution. Carefully remove and return all posted terrace signs to the Engineer upon
- 27 completion of the service interruption.
- 28
- 29 D. In the case of an emergency or an unplanned shut-off, notify all affected residents and property
- 30 owners during or immediately after the water is turned off.
- 31
- 32 E. Minimum requirements for all planned shut-offs:
- 33
- 34 1. Provide 2 working days notice to affected water users.
- 35 2. The shut-off may not begin earlier than 8:00 AM.
- 36 3. The shut-off may not exceed 8-hours.
- 37
- 38 F. In the event a planned shut-off is anticipated to require more than 8-hours, re-notify all affected
- 39 water users prior to the expiration of the time limit listed on the original notification.
- 40
- 41 G. Perform all shut-offs as proposed in the Contract Documents. The proposed shut-offs are
- 42 provided for reference purposes to aide planning connection point isolation and preparing water
- 43 user notification lists for planned outages.
- 44
- 45 H. Obtain prior authorization from the Engineer and be responsible for all valve turnings. Be
- 46 properly equipped at all times for doing such work.
- 47
- 48 I. Any water service or plumbing problems which arise as a result of either planned or emergency
- 49 water main shutoffs or any associated work, are the Contractor's responsibility to promptly
- 50 resolve at no cost to the City or Madison Water Utility.
- 51
- 52 J. To reduce the likelihood of draining private water systems and/or associated private plumbing
- 53 problems, it is required to close all service valves and/or curb stops on all 1.5-inch or larger
- 54 laterals prior to removing the main from service.
- 55
- 56 K. Additionally, it is required to close all service valves and/or curb stops at properties without
- 57 accessible hose spigots or other outside plumbing connections.
- 58
- 59

1 **3.11 MECHANICAL JOINT PIPE AND FITTINGS.**

- 2
- 3 A. A mechanical pipe joint is made by compressing a rubber gasket between a bell, cast on the end
- 4 of one pipe, and a gland that slides along the plain end of the pipe to be joined. The joints are
- 5 tightened using nuts and bolts.
- 6
- 7 B. Assemble mechanical joints in accordance with AWWA C600 – latest revision.
- 8
- 9 C. Restrained joints using MEGALUG® Series 1100 or approved equal mechanical joint-restraint
- 10 retainer glands shall have bolts tightened in accordance with the manufacturer’s installation
- 11 specifications.
- 12
- 13 D. Before slipping the gland and the gasket onto the plain end for joint assembly, lubricate both the
- 14 gasket and the plain end of the pipe with an approved pipe lubricant meeting the requirements of
- 15 ANSI/AWWA C111/A21.11 - latest revision.
- 16
- 17 E. Place the gland on the plain end with the lip extension toward the joint, followed by the gasket with
- 18 the narrow edge toward the joint. Insert the pipe into the bell and press the gasket firmly and evenly
- 19 into the gasket recess in the bell keeping the joint straight during assembly. Push the gland toward
- 20 the bell and center it around the pipe, with the flange lip against the gasket. Insert bolts and hand
- 21 tighten nuts. Deflect pipe after assembly, but before tightening bolts.
- 22

23 **3.12 INSTALLATION OF COPPER WATER SERVICES AND BRASS FITTINGS**

- 24
- 25 A. Connect copper water service piping to watermain, wellhouse, or other supply as shown on the
- 26 drawings.
- 27
- 28 B. Watermain taps shall be made under pressure using a tapping machine specifically designed to
- 29 tap and install corporation stops. Dry watermain taps are not allowed.
- 30
- 31 C. Service saddles shall be installed on services where the corporation stop is 1 ½” nominal diameter
- 32 or greater.
- 33
- 34 D. Provide a horizontal offset adjacent to the main for all copper services. Comply with pipe
- 35 manufacturer’s requirements with respect to minimum radius on bends.
- 36
- 37 E. Install curb stops as shown on the drawings. If specific curb stop location is not shown on the
- 38 plans, consult with DFD Construction Representative to determine acceptable location prior to
- 39 installing.
- 40
- 41 F. Place curb stop box on a 4”x8”x8” solid concrete masonry unit set on compacted ground. Orient
- 42 box so that no portion of the box bears on the water service or curb stop.
- 43
- 44 G. Install curb stop box plumb and level, backfilling evenly. Extend curb stop box to proposed final
- 45 grade; provide extensions as necessary. Curb stop boxes that shift during backfilling or restoration
- 46 shall be excavated and re-set.
- 47
- 48 H. Mark all curb stop boxes with a steel “U” fence post to protect them from damage.
- 49
- 50 I. Install copper water service as shown on the drawings. Limit the number of water service joints,
- 51 using full lengths of pipe whenever possible.
- 52
- 53 J. Prepare copper pipe joints in accordance with pipe and fitting manufacturer recommendations.
- 54 Cut pipe squarely, remove burrs and round ends as necessary.
- 55
- 56 K. Install fittings in accordance with manufacturers recommendations. Torque compression
- 57 connections to recommended tightness; do not over-tighten compression joints.
- 58

- 1 L. Provide dead-end copper water services with compression connectors fitted with plugs. Do not tap
2 he ends of copper water services shut. Mark the location of dead-end services with an 8' long
3 4x4 timber and steel "U" fence post.
4

5 **3.13 COPPER SERVICE LATERALS**
6

- 7 A. Provide and install saddles on all 1-1/2-inch and 2-inch services and at all service lateral taps on
8 new or existing PVC, HDPE, or CIPP-lined water mains. Use a standard valve box in lieu of a curb
9 box, with no rod or rings required, for all 1-1/2-inch and 2-inch services.
10
11 B. Use a pipe cutter to cut all copper tubing. Hacksaws or other such devices to cut copper tubing are
12 not permitted.
13
14 C. Excavate and expose the area on the water main for new service connections, as noted on the
15 drawings or as otherwise instructed by the Engineer. Maintain a separation distance of at least 18-
16 inches between adjacent service taps and between a service tap and a pipe joint or fitting. Locate
17 the tap on the upper half of the main at a 45° angle from the vertical plane, perpendicular to the
18 water main and on the side of the main to which the service extends.
19
20 D. Tap the water main and install the corporation stop using a tapping machine specifically designed to
21 tap water main under pressure. No other method of tapping the water main will be allowed. Repair
22 and replace any cut or removed polyethylene encasement following the tap to ensure that the water
23 main is fully protected.
24
25 E. After the tap has been made and the corporation stop and bend have been inserted, loop the
26 copper tubing out and then back toward the main, then back away from the main to form the shape
27 of a vertical "S". Ensure that the "S" loop is of sufficient size so that it uses a minimum of 2-feet of
28 copper tubing. Ensure that the highest portion of the loop is not higher than the top of the water
29 main.
30
31 F. Lay the service flat to the property line or otherwise indicated point of termination. Provide a
32 minimum of 6-feet of cover below finished grade.
33
34 G. Place at least 1-foot of approved bedding material around the copper service pipe. The bedding
35 material is considered incidental to the cost of backfilling the service lateral trenches. Protect all
36 laterals and appurtenances from damage when backfilling. Stones 3-inches in diameter or larger
37 are not allowed within 18-inches of the copper service. Backfill containing rocks 3-inches or larger
38 may not be placed around curb boxes.
39
40 H. Restore any disturbed terrace or turf areas associated with the lateral installation work. Any terrace
41 or turf restoration work is considered incidental to any work associated with service laterals.
42
43 I. Coordinate with property owners to allow for flushing service laterals both prior to and immediately
44 after any work impacting a service. Resolve any problems with property owners, including but not
45 limited to problems regarding discolored water or low/no water flow.
46

47 **3.14 FILLING WATERMAIN**
48

- 49 A. Fill watermain after main has been installed and completely backfilled.
50
51 B. Fill main slowly to limit entrapped air and evenly distribute calcium hypochlorite. Open all
52 hydrants completely to allow air to escape and monitor filling.
53
54 C. Once main is full, allow a minimum of 48 hours time for disinfection to occur before flushing.
55

56 **3.15 PRESSURE TESTING**
57

- 58 A. Pressure test all watermain and copper water services.
59

- 1 B. Provide all valves fittings, joint restraints, hoses, compressors, and water and power supply as
2 necessary to complete pressure testing. Utilize testing apparatus that is fabricated specifically for
3 testing watermains. Calibrate pressure gauges as necessary.
4
- 5 C. Flush main as necessary to remove air prior to testing. Comply with the requirements of this
6 section with respect to flushing.
7
- 8 D. For longer installations or installations consisting of watermain and copper water service, the
9 Contractor may elect to pressure test the system in short segments.
10
- 11 E. All pressure testing shall be conducted in the presence of the Owner's representative. Provide
12 minimum of 48 hours advanced notice of testing.
13
- 14 F. Conduct a combined pressure/leakage test for 1 hour at a pressure equal to 150% of system
15 normal operating pressure (as measured at the lowest point in the system), or a minimum
16 pressure of 150 psig.
17
- 18 G. When conducting test, pressure test equipment shall be set-up as close to the highest point in the
19 line as possible.
20
- 21 H. Make-up water for the test shall be clean potable water supplemented with ½ oz of dry calcium
22 hypochlorite per 35 gallons of water.
23
- 24 I. Leakage for test shall not exceed gallons per hour as allowed by the attached formula:
25
26
$$G = (ND\sqrt{P})/7400$$

27
28 Where: G= Allowable leakage (gallons per hour of test)
29 N=Number of joints under test
30 D=Nominal diameter of main (inches)
31 P=Average pressure during test (psig)
32
- 33 J. Record and document pressure test by recording the following information:
34
35 1. Date of test
36 2. Section tested
37 3. Diameter and length of main under test
38 4. Number of fittings, valves hydrants, etc.
39 5. Results of test including test length, pressure, actual water loss
40 6. Calculation of allowable leakage
41 7. If a failed test, describe actions taken to eliminate leaks and results of re-testing
42
- 43 K. Submit reports documenting pressure testing.
44

45 **3.16 CONTINUITY TESTING**
46

- 47 A. At the request of the Owner's Representative, conduct continuity test on all ductile iron watermain
48 and copper water services.
49
- 50 B. The continuity test shall be performed using an multi-meter to verify electrical continuity of the
51 watermain system.
52
- 53 C. The Contractor shall furnish all labor and equipment necessary to conduct the continuity test.
54
- 55 D. Document continuity testing by recording the following information:
56
57 1. Date of test
58 2. Test methods and equipment
59 3. Section tested

- 1 4. Diameter and length of main under test
- 2 5. Number of fittings, valves hydrants, etc.
- 3 6. Results of test including resistance
- 4 7. If a failed test, describe actions taken to eliminate leaks and results of re-testing
- 5
- 6 E. Submit reports documenting continuity testing.
- 7

8 **3.17 DISINFECTION/FLUSHING**

- 9
- 10 A. After filling the main, allow a minimum of 48 hours time for disinfection to occur before flushing.
- 11
- 12 B. Flush all sections of watermain and water service. When possible, utilize hydrants or other
- 13 large diameter orifices to complete flushing and achieve 2.5 fps water velocity. If needed, utilize
- 14 services or temporary connections to complete flushing.
- 15
- 16 C. All watermain and services shall be flushed for a minimum of 10 minutes, or as necessary to
- 17 obtain a sediment-free and bacteriologically safe sample.
- 18
- 19 D. Utilize diffusers, hoses, settling basins and other devices as necessary to limit erosion and other
- 20 damage to the site and downstream areas.
- 21
- 22 E. Contractor shall be responsible for providing all necessary fitting, valves, joint restraints, hydrants
- 23 and other materials necessary to conduct flushing.
- 24
- 25 F. Submit reports documenting disinfection and flushing.
- 26

27 **3.18 BACTERIOLOGICAL SAMPLE**

- 28
- 29 A. Following all pressure testing and flushing, the contractor shall collect a sample from the newly
- 30 installed watermain or water service(s). Samples shall be submitted to the State Laboratory of
- 31 Hygiene, or other licensed testing laboratory for bacteriological (colliform bacteria) analysis.
- 32
- 33 B. The Contractor shall be responsible for all costs associated with sample collection(s) and analysis.
- 34
- 35 C. Document bacteriological sample collection and analysis by recording the following information:
- 36
 - 37 1. Date of sample collection
 - 38 2. Sample collection methods and equipment
 - 39 3. Person collecting the sample
 - 40 4. Location(s) sample was collected
 - 41 5. Results of sample analysis
 - 42
- 43 D. If sample results indicate water is “Unsafe – Colliform Bacteria Present”, Contractor shall re-
- 44 disinfect watermain and water services by introducing additional chlorine into the line and re-
- 45 flushing the main. This process shall be repeated as necessary until a clean sample is obtained.
- 46 The Contractor shall be responsible for all costs associated with all efforts necessary to obtain a
- 47 “Safe – Coliform Bacteria Not Present” sample.
- 48
- 49 E. Submit reports documenting bacteriological sample collection and analysis.
- 50
- 51

END OF SECTION

1 **SECTION 33 30 00 - SANITARY SEWERAGE UTILITIES**

2
3
4 **PART 1 - GENERAL**

5
6 **1.01 SCOPE**

7
8 A. The work under this section shall consist of providing all work, materials, labor, equipment, and
9 supervision necessary to provide for the sanitary sewer work required in these specifications and
10 on the drawings. This specification shall apply to all sanitary sewer work beginning at a point five 5'
11 outside of the building wall, unless otherwise specified. Included are the following topics:

- 12
13 1. All materials and methods shall meet the City of Madison public works standards
14 Articles 501 thru 509.

15
16 **1.02 REFERENCE**

17
18 A. Applicable provisions of Division 1 shall govern all work under this section.

19
20 **1.03 REFERENCE STANDARDS**

21
22 A. Where these specifications do not cover portions of the work to be undertaken, the Standard
23 Specifications for Sewer and Water Construction in Wisconsin, current edition, shall govern the
24 work.

25
26 B. American Society for Testing and Materials (ASTM):

- 27 D1784-03 Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds
28 and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
29 D2564-04 Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC)
30 Plastic Piping Systems
31 D2680-01 Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and
32 Poly(Vinyl Chloride) (PVC) Composite Sewer Piping
33 D3034-04a Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer
34 Pipe and Fittings
35 D3212-96a(2003)e1 Standard Specification for Joints for Drain and Sewer Plastic Pipes Using
36 Flexible Elastomeric Seals
37 D3350-05 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
38 D4673-02 Standard Classification System for Acrylonitrile-Butadiene-Styrene (ABS)
39 Plastics and Alloys Molding and Extrusion Materials
40 F477-02e1 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic
41 Pipe
42 F679-03 Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter
43 Plastic Gravity Sewer Pipe and Fittings
44

45 **1.04 SUBMITTALS**

46
47 A. Provide manufacturers product information (cut sheets), shop drawings and O&M information for
48 sewer materials including:

- 49
50 1. Pipe
51 2. Fittings

52
53 B. Provide reports documenting pressure testing, mandreling, and televising.

54
55 C. Provide copies of record drawings.

56
57 **1.05 RECORD DRAWINGS**

- 1 A. Maintain record drawings that show the actual locations, sizes and types of utilities and other
2 features encountered.
- 3
- 4 B. Note any modifications to proposed sewer system size, location or elevation. Record any
5 other deviations from the drawings.
- 6
- 7

8 **PART 2 - MATERIALS**

9

10 **2.01 GENERAL**

- 11
- 12 A. Conform all materials to the size and type shown on the plans or as called for in the
13 specifications and to applicable Laws, Codes, and Ordinances.
- 14
- 15 B. All products and materials are to be new, undamaged, clean, and in good condition. Existing
16 products and materials are not to be reused unless specifically indicated.
- 17
- 18 C. Be responsible for the safe storage and handling of all materials utilized in the work. Store all
19 materials in areas designated by the Construction Representative in cooperation with the Owner.
- 20
- 21 D. Perform all work in accordance with any applicable manufacturer's instructions.
- 22

23 **2.02 PIPE**

- 24
- 25 A. Provide the size, type and class/schedule of pipe as indicated on the drawings.
- 26
- 27 B. Use only pipe supplied from the same manufacturer, and of the same type, unless otherwise
28 specified or approved in advance by the Engineer.
- 29
- 30 C. Only pipe, joints, material and installation approved by Wisconsin Department of Natural
31 Resources and/or the Department of Commerce for the intended use in the State of Wisconsin shall
32 be used.
- 33

34 **2.03 PVC PIPE**

- 35
- 36 A. Conform to ASTM D-3034 with solvent weld or elastomeric joints. Pipe shall be SDR-35, unless
37 otherwise noted. Pipe over 15 inches in diameter shall meet the requirements of ASTM F679-03.
38 Do not mix different manufacturer's products, or fittings.
- 39
- 40 B. PVC fitting joint type and SDR shall be same as the pipe that the fitting is connected to.
- 41

42 **2.04 HDPE PIPE**

- 43
- 44 A. Conform to ASTM D-3350 for PE material with a cell classification of 335434C or better. Pipe
45 shall be SDR 11, unless otherwise noted. Joints shall be thermal butt fusion in accordance with
46 the manufacturer's recommendation.
- 47
- 48 B. HDPE pipe fittings shall be thermal fusion weld type of the same or greater SDR as the pipe that
49 the fitting is connected to. Provide transition fittings when connecting to existing piping, or
50 where shown on the drawings.
- 51

52 **2.05 CONNECTIONS FOR DISSIMILAR PIPE MATERIALS**

- 53
- 54 A. Where new sewer connects to an existing dissimilar pipe, the connection shall be made with a
55 no hub type coupling meeting the requirements of CISPI 310. Couplings shall have neoprene
56 gaskets with stainless steel shield, and multiple stainless steel clamps with worm gear tightening

1 device. The couplings shall be made specifically for the type and size of pipe materials being
2 connected. Couplings shall be Fernco Husky or approved equal.
3

4 **2.06 PIPE INSULATION**

- 5
6 A. Rigid, closed-cell extruded polystyrene insulation. Insulation shall be suitable for buried insulation.
7
8 B. Individual boards shall have dimensions of 8'x4'x2".
9 Dow Styrofoam, or approved equal.
10

11 **2.07 SANITARY LATERAL ELECTRONIC MARKERS**

- 12
13 A. Effective Dec. 31, 2006, Act 425, Chapter 182.0175 (2r) of the Wisconsin State Statutes requires
14 that all non-metallic building sewers (including sanitary laterals, private sanitary sewers and storm
15 sewer laterals) installed within the City Right of Way, shall be accompanied by a means of locating
16 the newly installed underground pipe. Sewer mains that have manhole or inlet structures on both
17 ends within the City Right of Way are considered exempt from this legislation.
18
19 B. The City of Madison has selected a marker system that includes the installation of extended
20 range ball markers over the sanitary sewer facilities, which after construction provide a signal that
21 can be located by the city's utility locator after construction is complete.
22
23 C. The 3M ScotchMark Electronic Ball Marker System Extended Range Marker (model #1404-XR)
24 shall be considered an acceptable marker device for this specification. If an alternate equivalent
25 marker is selected, contractor shall provide specifications and data sheets of the selected device to
26 City Engineering prior construction in order for the City to confirm that the proposed marker device
27 is compatible with the City's marking equipment.
28
29 1. Markers shall be installed per manufacturer's written instruction. Electronic marker
30 balls shall be installed in the trench directly above the sewer pipe.
31 2. The key constraint is the maximum depth of the marker. The signal range of the
32 3M™ Electronic Marker System (EMS) 4" EXTENDED RANGE 5' BALL MARKER -
33 WASTEWATER (MODEL 1404-XR) is 5 feet. However, electronic marker balls shall
34 be installed at 4 feet from finished grade.
35
36 D. The City shall provide the Contractor with the required number of electronic markers for City
37 bid public works contracts. The Contractor shall be responsible for picking up the markers at
38 the Engineering Service Building, 1602 Emil Street in Madison, Wisconsin.
39
40 1. Upon completion, the City will test each electronic marker to confirm that it is installed
41 and functioning properly. If it is determined that the marker has not been installed
42 correctly and/or is not functioning properly, the Contractor shall be responsible for all
43 work associated with the installation of a properly functioning marker. This work shall
44 be done with the approval of the Construction Engineer and with no additional
45 reimbursement to the Contractor.
46

47 **2.08 SEWER STRUCTURES**

- 48
49 A. Castings General: Gray iron castings used in the work shall conform to the requirements of
50 the Specifications for Gray Iron Castings, ASTM A 48, Class 35B except as noted.
51
52 1. The castings for sewer access structures, catchbasins, and inlets shall be in accordance
53 with the designs, dimensions, and details shown on the Standard Detail Drawings for the
54 installation named, unless otherwise specified.
55 2. Frames and lids for sewer access structures and catchbasins shall be machined and fitted
56 so that rocking and chattering will be eliminated.
57 3. The lids installed on sanitary sewers shall have the self-sealing gaskets firmly glued in
58 place at the factory. All cleanouts shall conform to the requirements in the Wisconsin

1 Plumbing Code. The type of cleanout cap shall be approved in advance by the field
2 engineer.
3

4 B Sewer Access Structures. The following lists of Neenah Foundry castings are acceptable for City
5 construction and are further detailed in Standard Detail Drawing 5.7.16 & 5.7.16A, SAS Frame and
6 Cover. Substitutions shall be approved by the Engineer prior to delivery to the job site.
7

- 8 1. R-1550: Heavy-duty R-1050 frame, w/logo lid 1550-0054, nine (9) inch high, non-rocking
9 sewer access structure frame and Type "B" non-rocking self-sealing sewer access structure
10 lids with concealed pick holes. EJ Co. 1078Z frame, w/logo lid 1078ATGS shall be
11 considered an approved equal.
- 12 2. R-1689: Heavy-duty, w/logo lid 1550-0054, four (4) inch high, non-rocking sewer access
13 structure frame and Type "B" non-rocking self-sealing sewer access structure lids with
14 concealed pick holes. EJ Co. 1078Z1 frame, w/ logo lid 1078ATGS shall be considered an
15 approved equal.
- 16 3. R-1916C: Heavy-duty, sewer access structure frame and self-sealing lid with
17 Type "F" locks and concealed pick holes and 41" anchor holes.
18

19 **2.09 SEWER STRUCTURE CONSTRUCTION METHODS**

- 20
21 A. General: The construction of concrete sewer access structures, catchbasins, and inlets shall
22 conform to the pertinent portions of Part 3, Concrete and Concrete Structures of these
23 Specifications, and the applicable Standard Detail Drawings for the structure involved. Sewer
24 access structures, cleanouts, catch basins and inlets shall be of a size and type specified in the
25 contract, and shall be constructed at the location and to the elevation shown on the plans, or as
26 directed by the Engineer. Cleanouts shall be constructed in accordance to the Wisconsin Plumbing
27 Code.
28
- 29 B. Unless otherwise specified, all sanitary sewer access structures shall be constructed of precast
30 units of reinforced concrete provided they meet all the precast requirements. Sewer access
31 structures and inlets for storm sewers may be either cast-in-place or precast concrete structures. If
32 the plans specifically require a field poured structure, then the structure shall be cast-in-place
33 with no exception. If the structure is not specifically required to be field poured, a precast structure
34 may be substituted for a cast-in-place structure provided they meet all the precast requirements and
35 approval is granted by the Engineer.
36
- 37 C. Cast-in-place structures shall be constructed as detailed in the Standard Detail Drawings. The
38 bases of all structures which are cast-in-place shall be poured prior to pouring the walls of the
39 structures, unless otherwise ordered or allowed by the Engineer.
40

41 **2.10 PRECAST REQUIREMENTS**

- 42
43 A. Precast Sewer Access Structures (SAS) and inlets, generally referred to as precast structures, shall
44 be of reinforced concrete and shall conform to the specifications of Precast Reinforced Concrete
45 Manhole Sections, ASTM C 478. Joints shall meet the requirements for circular reinforced concrete
46 pipe as specified in these Specifications.
47
- 48 B. Precast structures for storm sewer may be furnished with steps. Precast structures for sanitary may
49 be furnished with steps in the barrel sections only. If steps are used in the cone sections to facilitate
50 construction, they shall be removed prior to acceptance.
51
- 52 C. Precast structures of reinforced concrete may be substituted for cast-in-place structures provided
53 they can meet all of the following criteria and the conditions of the contract and approval is granted
54 from the Engineer. No precast structures shall be brought to the job site until approval is granted
55 from the Engineer. Any precast structure not meeting these criteria shall be replaced by a
56 cast-in-place structure or a precast structure satisfying these criteria at the Contractor's expense.
57
- 58 D. Sanitary Sewer: The following precast requirements shall be met for all precast SAS for sanitary
59 sewers:

- 1
- 2 1. Precast SAS shop drawings for public works reconstruction projects shall be approved prior
- 3 to fabrication and delivery to the site.
- 4 2. Precast SAS shop drawings for private developments are not required.
- 5 3. Spreader bars shall be used if "lift eyes" are utilized for movement and placement of the
- 6 precast structure.
- 7 4 Each precast structure on the plan shall be custom manufactured with factory-made cores
- 8 for sanitary sewer connections.
- 9 5 The total height of adjustment shall be a minimum of three (3) inches and a maximum of
- 10 nine(9) inches.
- 11 6 The base shall be precast integral to the precast structure. The invert and bench may be
- 12 either field poured concrete or precast and shall be such that the invert provides positive
- 13 flow through the structure and the height of the bench shall match the top of the discharge
- 14 pipe.
- 15
- 16 E. A base section with a precast bench and invert may be provided, subject to the following
- 17 requirements:
- 18
- 19 1. The concrete of all inverts shall be finished with a steel trowel to produce a smooth flowline.
- 20 Inverts which are brushed and/or have a rough flowline may be rejected by the Engineer in
- 21 the field.
- 22 2. The Contractor shall provide for a tight joint between all pipes entering or leaving the
- 23 structure and the precast invert such that there is no abrupt change in the grade of the
- 24 flowline through the joint. Any grinding or grouting of the invert which is required to produce
- 25 a tight joint shall be considered incidental to the installation of the precast structure.
- 26 3. The precast bench shall extend to a height of 3/4 of the diameter of the pipe, at a minimum.
- 27 4. All inlet flowlines shall be poured with gentle sweeps through the structure towards the
- 28 outlet flowline such that cleaning and televising equipment can pass easily along the
- 29 flowlines.
- 30

31 2.11 CASTINGS

- 32
- 33 A. Castings shall be installed to the grades shown on the plans or as directed by the Engineer. Sewer
- 34 Access Structure (SAS) castings shall be installed 1/4 inch below the final grade. SAS castings that
- 35 are 3/4 inch, or more, below the final grade shall be repaired.
- 36
- 37 1. Inlet castings shall be set to grade prior to and separate from the pouring of the concrete
- 38 curb and gutter. It is expected and required that three (3) feet of concrete curb and gutter on
- 39 either side of the inlet shall be poured by hand, not through the use of a curb machine.
- 40 2. The inlet casting shall be set to grade on a bed of mortar, which shall be a minimum of 2-
- 41 1/4 inches thick.
- 42 3. The inlet shall be placed on the mortar bed and shall be adjusted to grade by applying
- 43 direct pressure to the casting. Once the casting adjustment is complete, three (3) feet of
- 44 curb and gutter on either side of the inlet casting shall be poured by hand. The inlets shall
- 45 be placed in accord with the appropriate Standard Detail Drawing.
- 46

47 2.12 SEWER CONNECTIONS

- 48
- 49 A. The connections of new pipes at new structures are detailed in the respective sewer type Sections
- 50 with the exception of sanitary sewer drop inlets which are defined in this Subsection.
- 51
- 52 B. When a structure is to be constructed at an existing pipe, the Contractor shall sawcut the existing
- 53 pipe in the required location to accommodate the placement of the new structure. If the Contractor
- 54 deems it more suitable to remove the existing pipe to a full joint, the additional pipe and connection
- 55 required to reconnect the sewer shall be the Contractor's responsibility.
- 56
- 57 C. The following requirements are specific for sanitary sewer and storm sewer connections.
- 58

1. Sanitary Sewer: Whenever shown on the plans, or directed by the Engineer, the Contractor shall install outside drop inlets in conjunction with the installation of sanitary sewer access structures as detailed in the Standard Detail Drawings. The pipe and fittings to be used in the construction of the outside drop inlets shall be of the same material as the sewer main. The pipe and fittings shall be securely anchored to the sewer access structure to prevent displacement during the placement of the concrete encasement.
2. A Sanitary Sewer Tap shall include the connection of an existing lateral or main to a new structure. A coupling (SDD 5.3.3) shall be provided and used by the Contractor to connect the existing pipe to any new pipe that is required to make the connection to the structure as detailed in Standard Detail Drawing 5.7.31, Flexible Pipe to SAS connector. Any new pipe that is installed by the Contractor to reconnect the existing sewer main or lateral shall be considered incidental to this bid item.
3. The newly installed pipe shall match the existing pipe's diameter or be of the next larger diameter. If the existing lateral is to be replaced, the new pipe shall be compensated under the corresponding sanitary sewer lateral bid item. The pouring and construction of concrete benches and flowlines in new sewer access structures for the inlet or outlet pipes shall not be considered a part of this work.
4. The Contractor shall be responsible for maintaining the normal flow of wastewater during tapping of the sewer access structure.

D. New Pipe Connections

1. Where any type of new public storm pipe is being tapped into an existing concrete structure or pipe the connection shall be made in a workmanship like manner to assure the structural integrity of the tapped structure or pipe once the connection is made. It is required, and this item includes, the use and provision of a concrete collar to complete and seal the connection between the existing structure or pipe and the new pipe. The work completed shall be in accord with Standard Detail Drawing

2.13 EXTERNAL SEWER ACCESS STRUCTURE JOINT SEAL

- A. Where called out by for on the plan or by the Engineer, barrel joints shall be sealed on sanitary sewer structures around the outside circumference of the Sewer Access Structure. Manhole joint seal shall be minimum of nine (9) inches wide. The seal shall consist of flexible rubberize seal conforming to ASTM C923 held in place with stainless steel compression bands or butyl adhesive tape conforming to ASTM C877 or heat shrink sleeve over visco-elastic adhesive sealant.
- B. Acceptable products and manufacturers are the following:
 1. Mac Wrap, Mar Mac Manufacturing Company, Inc.
 2. NPC External Joint Seal, NPC, Inc.
 3. EZ-Wrap, Press-Seal Gasket Corporation
 4. Riser-Wrap, Pipeline Seal and Insulator
 5. Alternate manufacturers and products not listed above are subject to pre-approval by the Engineer.

PART 3 - EXECUTION

3.01 NOTIFICATION

- A. Contractor, prior to excavation work, shall notify all utilities, governmental agencies, or entities, known to, or which can reasonably be assumed to, have above or below ground pipe, conduit cables, structures or similar items within limits of project, to locate and mark location of such items. The Contractor shall expose potential pipe conflicts prior to installation of sewers to allow for any field changes to the design to be made.

3.02 GENERAL INSTALLATION OF SEWER PIPE

- 1 A. Install all pipe in accordance with ASTM specifications which pertain to the specified type of pipe
2 material and the installation situation.
3
4 1. Do not use any pipe or fittings cracked in cutting or handling or otherwise not free
5 from defects.
6 2. Clean all pipe of any dirt and/or debris both inside and out prior to placing in the
7 trench.
8
9 B. Make joints in accordance with manufacturer's directions with due care to avoid damaging pipe
10 and/or disturbing previously laid pipe.
11
12 C. Cut pipe only according to manufacturer's directions.
13
14 D. Lay all sewer pipes to horizontal alignment and grade shown on the plans with bell ends up hill.
15 Establish and maintain horizontal alignment using total station, transit or theodolite. Use pipe
16 laser or level to establish and maintain grade of pipe. Discrepancies from the required horizontal
17 alignment or grade at any location shall not be greater than 0.10' or 0.05', respectively.
18
19 E. Do not exceed specified trench widths.
20

21 **3.03 TRENCH EXCAVATION**

- 22
23 A. Unless otherwise provided in the contract or permitted by the Engineer, the work of constructing
24 sewers and allied works shall be done in open trenches and in a manner to protect the pipe lines or
25 sewers from unusual stresses. When provided in the contract or permitted by the Engineer, the
26 construction of sewers may be done by tunneling and/or jacking in lieu of open trenching; details of
27 construction shall be indicated on the plan, specified in the contract, or established by the Engineer
28 prior to beginning the work of tunneling and/or jacking. All of the work of constructing sewers shall
29 be done in accordance with the applicable provisions of the "Wisconsin Administrative Code".
30
31 B. The trenches shall be excavated in conformity with the required alignment and grades as shown
32 on the plans and as laid out in the field by the Engineer. It shall be understood that the elevations
33 for sewers, as shown on the plans, are subject to such revisions as may be necessary to fit field
34 conditions and that the Engineer reserves the right to adjust the profile grades from those shown
35 on the plan. No adjustment in compensation will be made for the grade adjustments not in excess
36 of one(1) foot above or below the elevations shown on the plans.
37
38 C. The Contractor shall remove all vegetation along the trench line to the width of the proposed
39 trench before beginning excavation. Vegetation removed shall not be used as backfill in the
40 trench, but shall be disposed of by the Contractor at no additional cost to the City. If the trench
41 line is finished with pavement or other structures, removal of those items shall be completed as
42 specified in Article 203 – Removal of Miscellaneous Structures with the exception that the sawcut
43 shall be incidental to the trench excavation.
44
45 D. The materials excavated from the trench shall be deposited on the sides of the trenches and
46 excavations, beyond the reach of slides, or transported to spoil banks. For pipe sewers, the width of
47 the trench shall be such as to leave a clear space of not less than six (6) inches nor more than
48 twelve(12) inches between the earth wall, or the supporting sheeting or bracing where such is used,
49 and the sides of the pipe. The trench width established by this pipe clearance, measured at the
50 spring line, shall be applicable to that portion of the trench from one (1) foot above the top of
51 the pipe to the bottom of the trench. On streets opened to traffic, on restricted easements, and in
52 such other locations as the Engineer directs, the width of the trench at the surface of the ground
53 shall be limited to the outside diameter of the pipe plus two (2) feet plus the amount necessary for
54 sheeting or bracing.
55
56 E. Surplus material shall be considered to include vegetation from the trench line, excavated rock or
57 boulders larger than six (6) inches in diameter, and all other material from excavation not needed or
58 suitable for backfilling trenches. Unless otherwise specified, surplus material shall be the property
59 of the Contractor, and shall be disposed of at no additional cost to the City. Unless otherwise

1 provided, the Contractor shall provide all the sheeting or bracing needed to protect the work,
2 existing property, utilities, pavement, etc., and to provide safe working conditions in the trench.
3 Such sheeting and bracing shall be according to the Contractor's design and shall comply with the
4 "Wisconsin Administrative Code". Removal of any sheeting or bracing from the trench shall be
5 accomplished in such a manner as to fulfill the above requirements. Sheeting and bracing shall be
6 removed unless specific permission is given by the Engineer to leave it in place. Costs of this work
7 shall be at the Contractor's expense.
8

9 F. The Engineer reserves the right to limit the extent of excavation in advance of pipe laying and
10 backfilling depending on the nature of the soil and other conditions affecting the work.

11
12 G. The Engineer reserves the right to order additional excavation where unsuitable foundation
13 conditions exist. When this condition arises, the excavation shall be carried to such depth as
14 directed by the Engineer. The maximum width of the extra trench excavation shall be the outside
15 of the proposed structure plus two (2) feet plus the amount necessary for sheeting or bracing.
16 Mechanically compacted crushed stone and/or washed gravel shall be installed to replace the
17 excavated materials to subbase grade.
18

19 H. When directed by the Engineer, the Contractor shall uncover utility lines within the proposed
20 construction limits in advance of the construction as specified in Article 508. Work necessary to
21 expose existing underground facilities that are part of the Contractor's statutory obligation during
22 the normal storm sewer, sanitary sewer, electrical conduit or water main installation shall be
23 considered as incidental to those respective items and will not be paid for as utility line openings.
24

25 **3.04 ROCK EXCAVATION**

26
27 A. Rock excavation shall include all hard, solid rock in ledges, bedded deposits and unstratified
28 masses and all conglomerate deposits or any other material so firmly cemented as to present all
29 the characteristics of solid rock; which material is so hard or so firmly cemented that, as
30 determined by the Engineer, it is not practical to excavate and remove same with a power shovel
31 except after thorough and continuous drilling and blasting. Power shovels as referred to above
32 shall be taken to apply to a modern power shovel or backhoe of not less than three-quarters cubic
33 yard manufacturer's rated capacity, having adequate power and being in good running condition in
34 the hands of an experienced operator. Rock excavation shall also include all rock boulders
35 necessary to be removed having a volume of one (1) cubic yard (9 cubic feet) or more. Rock
36 excavation shall not apply to plain or asphaltic bound bases or surface courses of macadam,
37 gravel, or broken stone.
38

39 B. Rock excavation shall be carried to a depth of six (6) inches below the outside of the sewer, and to
40 a width limited to the outside diameter of the pipe plus two (2) feet. Rock excavation shall be carried
41 to a depth of eight (8) inches below the outside of the sewer for sewer access structures up to ten
42 (10) feet deep and twelve (12) inches below the outside of the sewer for sewer access structures
43 over ten feet deep. The horizontal limit for rock excavation shall be the outside dimensions of the
44 sewer access structure plus two (2) feet.
45

46 **3.05 DEWATERING**

47
48 A. The Contractor shall provide and maintain ample means and devices with which to promptly
49 remove all water entering excavations, trenches, and other parts of the work and shall keep said
50 excavations dry until the structures to be built therein are completed. No masonry shall be
51 installed in water nor shall water be allowed to rise over masonry and concrete until the mortar
52 and concrete have attained final set. In no event shall water be allowed to rise over masonry or
53 concrete if there is danger of flotation or of setting up unequal pressures in the concrete until the
54 concrete has set at least twenty- four (24) hours and any danger of flotation has been removed.
55

56 **3.06 BEDDING OF SEWER PIPES**

57
58 A. The bedding, or foundation, for sewer pipes shall be constructed to prevent settlement of the
59 pipes and to avert excessive pressure on the pipes in order to avoid rupture, leakage or

1 deformation of the pipes. Unless otherwise specified in the Special Provisions of the contract, all
2 sanitary and storm sewer pipes, including sanitary sewer laterals and storm sewer leads, shall be
3 constructed with the type of bedding that is specified for the type of pipe installed, as shown on
4 the Standard Detail Drawing 5.2.1, Storm and Sanitary Sewer Beddings.
5

- 6 B. The width of the bedding shall be equal to the width of the trench. The depth of the bedding shall
7 extend from an elevation at least six (6) inches below the bottom of the pipe to an elevation at
8 least twelve (12) inches above the top of the pipe. All bedding shall be mechanically compacted,
9 including crushed stone and washed gravel. Sand or limestone screenings used for bedding
10 shall conform to the following gradation:

11
12 Passing 3/4" sieve 100%
13 Passing #200 sieve 0-10%
14

- 15 C. Washed gravel and crushed stone used for bedding shall conform to the following gradation:
16

17
18 Passing 1" sieve 100%
19 Passing 1/2" sieve 35-60%
20 Passing #200 sieve 0-10%
21

- 22 D. Washed gravel or crushed stone shall be used for all pipe sizes over ten (10) inches in diameter,
23 and for smaller sizes when directed by the Engineer. With the approval of the Engineer, the
24 maximum size of the washed gravel or crushed stone may be increased, and screened crushed
25 stone may be substituted for washed gravel.
26

27 **3.07 BACKFILLING EXCAVATIONS AND COMPACTION OF BACKFILL**

- 28 A. Unless otherwise provided, all trenches and excavations shall be backfilled immediately after the
29 sewers and appurtenances have been constructed therein. In covering the sewers and filling
30 around structures, the backfill material shall be brought up evenly on all sides so that no
31 unbalanced pressure is brought to bear upon the pipe and masonry.
32

- 33 B. The Contractor shall be required to backfill all excavations to the original ground elevation unless
34 otherwise specified in the contract or ordered by the Engineer. In the event of a shortage of
35 material to perform this work, including replacement as may be required by rock excavation or
36 removal of boulders, the Contractor shall provide the necessary material at no additional cost to
37 the City.
38

- 39 C. Walking or working on the completed pipe sewers, except as may be necessary in compacting
40 and backfilling, shall be prohibited until the trench has been backfilled to an elevation at least two
41 (2) feet above the top of the pipe. No trucks, vehicles, or other equipment shall be allowed within
42 the limits of the trench prior to the completion of the backfilling operations, unless authorized by
43 the Engineer for compaction or other purposes.
44

- 45 D. Backfill material hauled to the project shall be dumped along the top of the trench beyond the
46 reach of slides and placed in the trench with the proper backfilling equipment. Backfill material
47 may be dumped directly into the trench from trucks when the amount of material to be dumped is
48 controlled by partially opening the tailgates, and only when authorized by the Engineer.
49

- 50 E. Trenches shall be hand backfilled to an elevation at least one (1) foot above the top of the pipe.
51 The material for this portion of the backfill shall not contain stones, or hard or frozen lumps of
52 earth. For plastic sewer pipes, this material shall be the same classification as the bedding. The
53 equivalent of hand backfill may be accomplished by lowering a clam bucket or material to a point
54 immediately above and approximately one (1) foot from the sewer and slowly releasing the fill; for
55 reinforced concrete pipe or corrugated metal pipe, the material may be deposited on a slope,
56 equal to the angle of repose of the material, and allowed to flow progressively forward in such a
manner as to avoid impact on the pipe and to avoid uneven pressures on either side of the pipe
which may disturb its grade or alignment. Backfill material shall not be taken from trench walls
below an elevation of two feet above the top of the pipe. The remainder of the trench shall then

1 be filled carefully in a manner satisfactory to the Engineer. The compaction sections are detailed in
2 Standard Detail Drawing 5.2.2, Typical Trench Compaction & Standard Detail Drawing 5.2.3,
3 Typical Trench Compaction (Greenway/Park).
4

5 F. All corrugated metal culverts shall be hand backfilled and mechanically tamped to an elevation at
6 least one (1) foot above the top of the culvert. Extreme care shall be taken so as to assure
7 complete filling and compaction under the culvert and between the culvert and the walls of the
8 trench. If trucks or other heavy equipment used on the project are to travel over the newly
9 installed culvert, then the Contractor shall place a minimum cover of twelve (12) inches of fill over
10 the culvert to protect it during this period. This protective layer of fill shall be thoroughly
11 mechanically compacted.
12

13 G. In the event that excavations have been sheathed or braced, the Contractor shall carefully draw
14 and remove the sheathing and bracing in a manner which will not disturb the completed work. All
15 openings left in removing sheathing and bracing shall be carefully filled with approved backfill
16 material and properly compacted.
17

18 H. Where the grade of the sewer is such that, in the opinion of the Engineer, the top surface of the
19 sewer shall require protection, an embankment of earth or other material, satisfactory to the
20 Engineer, shall be constructed over the sewer by the Contractor. The height of the embankment
21 shall be one (1) foot above the top of the pipe unless otherwise specified or directed by the
22 Engineer. The width at the top of the embankment shall be not less than two (2) feet wider than
23 the external width of the sewer. The sides of the embankment shall slope from the top of the
24 embankment to the existing ground surface in a ratio of not less than two (2) feet horizontally to
25 one (1) foot vertically. The material used to construct the embankment shall be such surplus
26 material excavated from trenches as shall be approved by the Engineer. Such selected material
27 shall be furnished and placed in the embankment by the Contractor at no extra cost to the City.
28 Should more material be needed to complete the embankment than can be obtained from surplus
29 material excavated, such material shall be furnished by the Contractor, and will be paid for as
30 provided herein. The material shall be compacted as provided in Subsection 202.3(b) – Standard
31 Compaction of these Specifications.
32

33 I. All material used for backfilling trenches and other excavations shall be subject to the approval of
34 the Engineer. Unless otherwise specified or directed by the Engineer, the Contractor shall backfill
35 trenches and other excavations with materials excavated in the course of the work. Whenever
36 specified in the contract or directed by the Engineer, trenches and other excavations shall be
37 backfilled with Select Fill. Vegetation and stones or fragments of broken rock in excess of six (6)
38 inches in any dimension shall not be included in the backfill. In the event the Engineer rejects the
39 excavated materials for backfilling due to the character of the material, including excess moisture
40 content, gradation, composition, frozen material, or for whatever cause, the Contractor shall
41 backfill the trenches and other excavations in the specified manner with Select Fill. In the event of
42 lack of moisture in the backfill materials, the Contractor shall add water in quantities deemed
43 necessary to secure the required compaction. In the event the excavated materials contain excess
44 moisture, the Contractor shall, as directed by the Engineer:
45

- 46 1. Suspend all work on the project for that period of time as may be necessary to allow the
47 backfill materials to dry sufficiently prior to backfilling and compacting the backfill
48 material, during which time work days shall not be charged against the Contractor, or
- 49 2. Replace the excavated materials, in whole or in part, with Select Fill.
50

51 J. Where the moisture content of the excavated materials is such that drying or adding water is
52 necessary prior to backfilling and compaction, the Contractor may furnish acceptable materials for
53 the backfill and dispose of the excavated materials, all at no additional cost to the City.
54

55 K. Select Fill for backfilling trenches and other excavations shall be material as defined in
56 Subsection 202.2(b) – Select Fill of these Specifications and shall be measured and paid as
57 defined in Subsection 502.2(g) – Select Backfill for Sewer of these Specifications. Excess
58 excavated material resulting from the above work may be used in backfilling other trench areas,
59 unless the material is declared unsuitable for backfill by the Engineer, in which case the material

1 shall be considered surplus material and shall be disposed of by the Contractor at no additional
2 cost to the City.
3

4 L. Unless otherwise specified or directed by the Engineer, the backfill in all trenches and
5 excavations shall be mechanically compacted in such a manner as to thoroughly consolidate the
6 backfill material and not injure or disturb the pipe or other structure. The compaction of the
7 backfill material shall be in accordance with the following requirements:
8

9 1. The material for the backfill shall be deposited, spread and leveled, as herein before
10 provided, in layers generally not exceeding twelve (12) inches in thickness before
11 compaction, except that when the material being compacted is of a granular nature and
12 the compacting equipment is adaptable for the purpose, the thickness of the layer may be
13 increased to a maximum of twenty-four (24) inches provided the required density is
14 obtained. Each layer of the spread and leveled material shall be compacted, by means of
15 suitable compaction equipment, to not less than the specified density before the
16 succeeding layer is placed.
17

18 2. All Pipe Trenches shall be compacted in conformance of Standard Detail Drawings 5.2.2
19 Typical Trench Compaction and 5.2.3 Typical Trench Compaction (Greenway Park).
20 Compaction of the backfill material shall not begin until the depth of the backfill material is
21 two (2) feet above the top of the pipe. In the case of structures, compaction of the backfill
22 material shall begin with the placing of the first layer of backfill material. Backfills of three
23 feet or less in depth below the proposed or existing subgrade shall be compacted to at
24 least ninety-five (95) percent of maximum density for their full depth.
25

26 In city right of ways or as called for by the construction engineer, backfills over three (3)
27 feet in depth below the proposed or existing subgrade shall have the top three (3) feet
28 below the proposed or existing subgrade compacted to not less than ninety-five
29 (95) percent of maximum density, and those portions more than three (3) feet below the
30 proposed or existing subgrade shall be compacted to at least ninety (90) percent of
31 maximum density.
32

33 In greenways and parks, in accordance to Standard Detail Drawing 5.2.3, backfills over
34 three(3) feet in depth below the proposed or existing subgrade shall be compacted to at
35 least ninety (90) percent of maximum density. If the proposed pipe is located horizontally
36 within 15' of an existing or proposed asphalt or concrete surface, then the pipe
37 compaction shall be completed in conformance of Standard Detail Drawing 5.2.2.
38

39 3. The maximum density shall be determined in accordance with the Standard Method of
40 Test for the Moisture-Density Relations of Soils, ASTM Designation: D 1557, Method D,
41 with replacement of the fraction of material retained on 3/4-inch sieve with No. 4 to 3/4-
42 inch material. The density of compacted backfill material shall be determined in
43 accordance with the Test for Density of Soil-in-Place by the Sand-Cone Method, ASTM
44 Designation: D 1556, the Test for Density of Soil and Soil-Aggregate in Place by Nuclear
45 Methods, ASTM Designation: D 2922, or by other approved methods.
46

47 4. In the event the material in the density sample differs in percentage of aggregate retained
48 on a No. 4 sieve from that in the sample upon which maximum density was determined,
49 the maximum density shall be adjusted in accordance with approved procedure.
50

51 5. The foregoing density requirements will not apply to portions of backfills constructed of
52 materials which, because of numerous large stones or high percentages of material
53 retained on the No. 4 sieve, cannot in the determination of the Engineer be accurately
54 tested in accordance with the above procedures for determining maximum or in place dry
55 density.
56

57 M. Whenever the work of installing sewers takes place during cold weather, the specifications for
58 trench compaction above shall be followed if practicable. If the specified compaction cannot be

1 achieved, and the Engineer directs that the work may not be suspended until more favorable
2 weather conditions exist, then the following procedures shall be followed:
3

- 4 1. All frozen material in the trench shall be removed before beginning the day's work. As a
5 method to achieve this, trenches shall be closed overnight.
- 6 2. Materials shall be unfrozen when being compacted.
- 7 3. The material shall be compacted in six (6) inch lifts in a manner normally done during
8 warm weather construction and to a minimum density of ninety (90) percent compaction
9 below the three (3) foot depth.
- 10 4. If the top three (3) feet of material does not meet ninety-five (95) percent compaction,
11 then pit run sand (hailed in if necessary) shall be compacted in the normal manner using
12 six(6) inch lifts.
- 13 5. The Engineer will have tests performed as necessary to provide uniformity of compaction.
- 14 6. As a guideline, construction should cease when the temperatures are too cold to achieve
15 the above. At least 15F and rising is a reasonable temperature if it is not extremely windy.

16 17 **3.08 LAYING PIPE**

- 18
19 A. The pipe, fittings and accessories shall be of the size, class, type, and design; and shall be laid at
20 the locations and to the required lines and grades; all as shown on the plans, required by the
21 contract, or directed by the Engineer. Wherever the word "pipe" appears in this Subsection, it
22 shall be understood to include pipe, fittings, and accessories.
23
- 24 B. The proper installations of structures and fittings, whose locations are shown on the plans and
25 laid out by the Engineer shall be accomplished by the use of random lengths of pipe furnished by
26 the Contractor. All field cuts of all types of pipe, except reinforced concrete pipe, shall be made
27 with an approved mechanical pipe cutter or with a power saw in order to make a straight, true cut
28 without chipping and cracking the pipe. In the event the Contractor is unable to obtain a certain
29 size pipe, as specified on the plans or in the contract, the Contractor shall promptly inform the
30 Engineer, and with the approval of the Engineer, the Contractor will be allowed to furnish and
31 install a larger size pipe. In such case, the additional cost resulting from such substitution shall
32 be at the Contractor's expense and no adjustment in compensation will be allowed.
33
- 34 C. A flexible watertight connections shall be used for plastic sewer pipe connections to structures as
35 detailed in Standard Detail Drawing 5.7.31, Flexible Pipe to SAS Connector. For concrete pipe
36 connections, a mechanical vibrator shall be used during placement of the concrete collar to
37 assure complete exterior seal of concrete pipes to the new structure.
38
- 39 D. The laying of pipes in finished trenches shall commence at the lowest point and shall proceed
40 towards the upper end, and the pipe shall be laid so that the spigot or tongue ends point in the
41 direction of flow.
42
- 43 E. Jointing surfaces shall be carefully cleaned before pipes are lowered into trenches. The pipes
44 shall be lowered so as to avoid unnecessary handling in the trench. Each section shall have a
45 firm bearing throughout its length and shall be true to the line and grade required.
46
- 47 F. The method of shoving or pulling the pipes together shall be such that there will be no injury to
48 the pipes, and the joints will be properly adjusted and will not be excessively large. The pipes
49 shall be fitted and matched so that when set firmly to line and grade they will form a sewer with a
50 smooth and uniform invert.
51
- 52 G. After the pipe is installed, lift holes shall be sealed with suitable concrete or other approved plugs.
53
- 54 H. The pipe shall not be laid within ten (10) feet of the excavating nor within forty (40) feet of blasting
55 operations. The pipe shall not be laid in water or on frozen trench bottoms, or when, in the
56 opinion of the Engineer, the trench conditions or weather are unsuitable for the proper
57 performance of the work.
58
59

- 1 I. No length of pipe shall be laid until the previously laid length of pipe has been sufficiently backfilled
2 to hold it securely in place during the jointing operation. If, in making a joint, any previously laid pipe
3 is disturbed, such pipe shall be removed and relaid. Adequate backfill shall be placed on the pipe to
4 prevent floating. Any pipe which has been floated shall be removed and relaid at the expense of
5 the Contractor.
6
- 7 J. The Contractor shall furnish suitable lifting and handling devices designed to distribute the weight of
8 the pipe over the length of the pipe and prevent high stresses over small areas.
9
- 10 K. All water must be kept out of the bell hole of the pipe until the joint is completed and water shall
11 not be allowed to rise in or about the pipe until the trench is filled at least one (1) foot above the
12 top of the pipe.
13
- 14 L. Before leaving the work for the night, or during a storm, or for any reason, care must be taken
15 that the unfinished end of the sewer is securely closed with a tightly fitting iron or wooden plug.
16 Any earth or other materials that may find entrance into the sewer shall be removed by the
17 Contractor at no additional cost to the City.
18

19 **3.09 SANITARY SEWER LATERALS**

20 **A. General.**

- 21
- 22
- 23 1. Installation of sanitary sewer laterals shall comply with all the requirements set forth
24 herein for the installation of the sewer main, including excavation, backfilling, bedding,
25 laying and jointing pipe. Sanitary sewer laterals shall be laid with a maximum grade of
26 one-half (1/2) inch per foot and a minimum grade of one-fourth (1/4) inch per foot. Unless
27 otherwise specified, sanitary sewer laterals shall be of the same material as the sewer
28 main pipe. Where laterals are to be connected to risers the Contractor shall furnish and
29 install the required fittings.
30
- 31 2. The typical locations of sanitary sewer laterals to be installed in new developments are
32 detailed in Standard Detail Drawing 5.3.2, Location of Sanitary Laterals. A separate
33 sanitary sewer lateral shall be installed between the public sewer main and the property
34 line to each unit of a split two-family dwelling (i.e., duplex unit).
35
- 36 3. For reconstruction of existing sanitary sewer, the connection of a lateral to a new
37 structure shall be completed under Sanitary Tap and to a new main under Reconnect.
38 For those laterals to be reconnected to a main, the first five (5) feet of the lateral and
39 backfill from the main shall be included in the Reconnect and shall not be included in this
40 item. The trench shall be backfilled with select backfill and shall be completed under
41 Select Backfill for Sewers.
42
- 43 4. For laterals that are in close proximity to terrace trees (as determined by the Engineer),
44 the situation shall be reviewed on a case by case basis by the Engineer and the City
45 Forester. The Contractor shall use construction methods and equipment to minimize
46 tree damage as directed by the Engineer and in accordance with section 107.13 Tree
47 Protection Specification. In extreme cases the Engineer may elect to terminate lateral
48 installation prior to conflict with the tree.
49
- 50 5. The estimated location of the laterals will be marked by the City of Madison on the
51 sidewalk; however, Contractors are encouraged to start at the sanitary main. If the
52 Contractor elects to start at the property line, it shall be at their own risk. No Utility Line
53 Openings will be granted for the inability to locate the lateral at the property line.
54
- 55 6. Prior to the abandonment of any lateral, the Contractor shall definitively prove to the
56 satisfaction of the Construction Engineer that the lateral is not currently in use and has no
57 potential future use. The state of the lateral shall be determined by dye testing, the use of
58 a push camera, the use of Sonde equipment, or other equipment that will determine

1 where the lateral terminates. Lamping the lateral will only be an acceptable method if a
2 cap or plug is visible.

3
4 B. Size. When the lateral size is not specified, the following guidelines shall be used:

- 5
6 1. For the installation of new lateral in the public right-of-way, unless otherwise
7 specified in the plans or directed by the Engineer, the size of a newly constructed
8 sanitary sewer lateral to be installed between the public sanitary sewer main and
9 the property line shall be four (4) inches in diameter. The Engineer may require the
10 size of the lateral to be six (6) inches or greater depending on the lot size or
11 proposed land use.
12
13 2. For the reconstruction, repair or replacement of sanitary sewer laterals in the public right-
14 of- way, unless otherwise specified in the plans, when a portion of a sanitary sewer
15 lateral in the public right-of-way is to reconstructed, repaired or replaced, the inside
16 diameter of the new lateral to be installed shall match that of the lateral which is being
17 replaced. For purposes of this requirement, all five (5) inch laterals shall be considered to
18 be six (6) inches in diameter. It shall not be permissible, in any event, to decrease the
19 diameter of a sanitary sewer lateral in the direction of flow.

20
21 C. Alignment. Where a sanitary sewer lateral is being relaid in the public right-of-way and bends
22 are required to reconnect the new lateral to the ends of the existing lateral or sewer main, the
23 Contractor may use standard Poly (Vinyl Chloride) (PVC) bends that provide a change in
24 the direction of flow of 22.5 degrees or less. Bends placed in a lateral shall be separated by
25 straight pieces of pipe such that any two bends are separated by a distance of two (2) feet
26 or more, measured from the center of each bend. The use of 45 degree bends shall be
27 allowed only in connecting to a 45 degree wye at the sewer main in order to orient the
28 lateral perpendicular to the sewer main.
29

30 D. Couplings. Where a lateral is being relaid in the public right-of-way and connected to pipes of
31 differing materials and/or sizes, couplings (SDD 5.3.3) shall be used. The couplings to be used
32 shall provide for a tight fit around the outside diameter of each pipe and shall be securely
33 fastened with two stainless steel clamps at each pipe end. Couplings which reduce the pipe
34 cross sectional area in the direction of the flow shall not be allowed.
35

36 E. Reconnect. Reconnect shall include reconstructing sanitary sewer lateral connections that shall
37 be reconnected to the sanitary sewer main. This item shall include necessary wyes or fittings and
38 PVC pipe, 4" or larger, for the connection of the lateral and shall not exceed a length of five (5)
39 feet. All new laterals shall be a minimum of four (4) inches in diameter. Under no circumstances
40 shall the new lateral be smaller than the existing. Plugging the existing lateral, select backfill and
41 bedding required for the reconnection are included in this item. Sewer laterals that are to be
42 reconnected to new sewer access structures shall be completed as a Sanitary Tap as specified in
43 Subsection 507.3(d) – Sewer Connections. The Contractor shall be responsible for maintaining
44 the normal flow of wastewater during reconnection of the laterals.
45

46 3.10 SANITARY LATERAL ELECTRONIC MARKERS

- 47
48 A. Each sanitary lateral shall have a minimum of 2 electronic markers: one shall be located above
49 the wye on the sewer main and one shall be located above the lateral at the property line.
50 Additional markers shall be placed at each change in horizontal direction.
51
52 B. Sewer access structures are required on the City's sanitary sewer main on every instance that a
53 lateral diameter is 8" or larger or if the proposed lateral size is of equal or larger size than the
54 City's sanitary sewer main.
55

56 3.11 JOINTS

57
58 A. New Pipe to New Pipe.
59

1. Joints shall not be made until the pipe is in the trench and set to true line and grade. Lengths of pipe which are joined together outside of the trench shall be removed from the project immediately.
2. Prior to making joints, the jointing surfaces shall be inspected for chips, cracks, or other defects in the joints and jointing materials. The jointing surfaces shall be carefully cleaned and lubricated with a vegetable lubricant or a lubricating adhesive. Lubricant shall be applied to both the bell and spigot surfaces of the joint. The lubricant shall be that recommended by the gasket manufacturer for the particular type of gasket being installed.
3. Care shall be taken when shoving or pulling the pipes together in order not to damage the pipe or the joints and jointing materials. The pipes shall be in proper alignment and to the proper grade prior to applying the pressure necessary to make the joint.
4. Rubber gaskets for reinforced concrete storm sewer pipe shall be assembled as follows:
 - a. When air temperature is below 32F, gaskets shall be applied one and one-half (1-1/2) hours before installation of the pipe.
 - b. When air temperature is above 32F, gaskets shall be applied fifteen (15) minutes before installation of the pipe.
5. The temperature referred to pertains to the prevailing air temperature at the point of application of the gaskets. This shall be taken to mean the air temperature, either indoor or outdoor, at the time and place the gaskets and cement are being applied to the pipe. It does not refer to the temperature in the trench, or of the bonding cement, or of the pipe.
6. In making mechanical joints, the bolts shall be installed with the heads in reverse direction. The nuts shall be turned on only as far as they can be by using the wrench with one hand, with no extensions on the wrench to give greater leverage. Care shall be taken not to over-tighten the bolts. The bolts shall be tightened equally and diametrically in order to apply the proper pressure on the gasket and joint.

B. New Pipe to Existing Pipe.

1. A coupling shall be required at the junction of a new pipe to an existing pipe as specified on the plan set or as required in the field by the Engineer.
2. It is expected that the Contractor shall saw cut the existing main at the location shown to accommodate a clean joint for the installation of the compression couplings. If the Contractor for his/her convenience deems it more suitable to remove the existing pipe to a full joint, the additional pipe required to connect the new pipe is to be the Contractors responsibility and shall not be compensated.
3. The coupling shall be placed as shown on the plan or as directed by the Engineer and shall be constructed per Standard Detail Drawing 5.3.3, Coupling Details.

3.12 CONNECTIONS TO EXISTING STRUCTURES

- A. Make all necessary openings into existing structures or sewers including the reconstruction of existing inverts or benches, as necessary. Patch all openings permanently watertight with concrete brick and mortar, or hydraulic cement and waterstops, or for sanitary sewers, hydraulic cement and flexible watertight boots.

3.13 PIPE INSULATION

- A. Provide insulation when indicated on the drawings, or where depth of cover is less than 6'. Unless otherwise noted, install 2" thick polystyrene boards insulation.
- B. Install insulation on compacted initial cover material, 6" above the top of the pipe. Stagger joints where more than one layer of insulation is required. Provide insulation with a minimum of 1' of initial cover material. Place cover and backfill material in manner that does not damage insulation; replace any damaged insulation.

3.14 DEFLECTION TESTING

- 1 A. Test all PVC sewer pipe in the presence of the DSF Construction Representative by a "go-no-go"
2 deflection test mandrel furnished by the Contractor. Do not perform deflection testing any sooner
3 than 30 days following the installation of the PVC pipe. Pull the mandrel by hand, or hand
4 operated winch so as to avoid any damages to the pipe that may be caused by mechanized
5 pulling equipment.
6
- 7 B. Size the to test the pipeline for a maximum allowable internal deflection of the pipe (in any
8 direction) of not to exceed five (5) percent of the original internal diameter for the pipelines tested,
9 regardless of how long after installation the testing takes place.
10
- 11 C. Deflection testing may be done concurrently with any necessary televising of the sewers. When
12 done concurrently with sewer televising, the mandrel may be pulled by mechanized equipment,
13 provided the mandrel is visible in the television picture during the testing and the operation of the
14 mandrel can be quickly halted before damage to the pipe occurs.
15
- 16 D. Where poor trench soils conditions require the pipe excavation to be undercut and/or over
17 excavated, the Construction Representative reserves the right to require an additional deflection
18 test prior to the expiration of the Contractor's one year performance guarantee.
19 Remove and replace all pipe that fails to pass the five (5) percent vertical deflection testing until
20 the pipe passes the deflection test.
21

22 **3.15 LEAKAGE TESTING**

- 23
- 24 A. All new sanitary sewer lines shall be leakage tested in accordance with Chapter 3.7.0 of Standard
25 Specifications for Sewer and Water Construction.
26

27 **3.16 MANHOLES**

- 28
- 29 A. Contractor shall determine the proper location, size, elevation, and orientation of all pipes entering
30 new manholes before ordering. Do not connect abandoned pipes to new manholes. Manholes
31 having improper location and/or orientation of the pipe connections will be rejected. Field repairs or
32 adjustments of connection points are not permitted.
33
- 34 B. Limit the excavation for manholes so as to provide only the necessary amount of space to
35 sufficiently prepare the subgrade, set the base, set the manhole or structure, and lay pipe. Provide
36 a minimum of 1' of clearance between structure and trench wall for adequate backfilling and
37 compaction.
38
- 39 C. Where excavation occurs below the bottom elevation of the structure's base, bring the excavation to
40 the required elevation by the use of compacted crushed stone bedding. A minimum of 8 inches of
41 compacted Crushed Stone Bedding shall be placed below manhole base.
42
- 43 D. Set manhole base in accordance with elevation and location as indicated on the plans. Install base
44 plumb and level. Install subsequent pre-cast manhole sections in accordance with shop drawing
45 layout. Provide watertight gaskets between each manhole section.
46
- 47 E. Pour inverts with smooth surface draining to downstream pipe. Where two or more lines meet at an
48 angle, provide curved channel. Slope manhole bench at 2 inches/ft towards flow channel.
49
- 50 F. Manholes shall be provided with between 4" and 8" of adjusting rings, with the top adjusting ring
51 being 2" thick. Provide butyl sealant material between rings. Once rings are in place, tuck point the
52 exterior joint and provide the entire exterior surface of the adjusting ring riser with a coating of
53 mortar.
54
- 55 1. When indicated on the drawings, the manhole frame shall be set with a Type I
56 frame/chimney joint as specified in the Standard Specifications for Sewer and Water

- 1 2. Construction in Wisconsin, latest edition. The frame and adjusting rings shall be sealed
- 2 with an internal rubber sleeve as detailed in File 12A of the Standard Specifications.
- 3 3. Drop manholes shall be constructed in accordance with File No. 19 of the Standard
- 4 Specifications.

5
6 **3.17 CASTING INSTALLATION**

- 7
- 8 A. Install casting type as indicated on the plans or in the specifications.
- 9
- 10 B. Provide butyl sealant material between last adjusting ring and casting base. Adjust casting
- 11 elevation and slope to match adjacent proposed grades.
- 12

13 **3.18 CONNECTIONS TO EXISTING STRUCTURES**

- 14
- 15 A. Make all necessary openings into existing structures or sewers including the reconstruction of
- 16 existing inverts or benches, as necessary. Patch all openings permanently watertight with concrete
- 17 brick and mortar, or hydraulic cement and waterstops, or for sanitary sewers, hydraulic cement and
- 18 flexible watertight boots.
- 19

20 **END OF SECTION**

21