

6. Fittings: Restrained.

D. Hangers, Supports and Miscellaneous:

1. Hanger rod: 1" diameter galvanized steel threaded rod, A36 steel, length as required.
2. Pipe Roller Hanger: Adjustable two-rod roller hanger equal to National Pipe Hanger Corporation.
3. Fasteners and accessories: As per the Drawings.
4. Spacing: As per the Drawings.
5. Sized for gravity sewer pipe and insulation.

2.02 PIPE EXPANSION JOINTS

- A. The pipe expansion joints shall be of a single-end, slip pipe and follower type that allows for concentrated pipe movement at buried and/or exposed pipe to bridge transitions unless otherwise noted.
- B. Packing shall consist of alternating layers of sealing rings and lubricating rings.
- C. Body shall be carbon steel.
- D. Ends preparation shall be flanged unless otherwise noted.
- E. Permitting ten inches of concentrated pipe movement.
- F. Meeting requirements of funding provisions of entire project.
- G. Equal to Dresser Style 63, Type 1. Coordinate with Division 15.

2.03 INSULATION

- A. Provide mechanical insulation system for all piping that is:
 1. Exposed to the atmosphere outside of the ground and suspended from a bridge, or

2. Buried on the earthen side of the bridge abutments to a distance of five (5) feet from the inside face of the abutment.
 - B. Pipe requiring insulation shall be thermally protected with a moisture resistant insulating system that absorbs moisture only on its surface cells when tested to ASTM C240 standards. Moisture absorption shall not exceed 0.2% by volume.
 - C. Insulation shall be resistant to acid and waste materials.
 - D. Noncombustible insulation material complying with ASTM E 136 is required.
 - E. Minimum density shall be 7.5 pounds/CF.
 - F. Flexural strength shall be at least 70 psi.
 - G. Coefficient of thermal expansion shall not exceed $(5.0)(10^{-5})/^{\circ}\text{F}$.
 - H. Shear strength shall be at least 50 psi.
 - I. Thermal conductivity shall be at 0.31 BTU-in/hr-SF- $^{\circ}\text{F}$ at 50 $^{\circ}\text{F}$.
 - J. Thermal diffusivity shall be 0.016 SF/hr.
 - K. Insulation sections shall be preformed to fit tightly around all pipes and fittings. Special insulation fittings will be fabricated for insulation around each required pipe fitting shown on the Drawings.
 - L. Equal to StrataFab Insulation system using FOAMGLAS insulation as provided by ERCO, Lewiston, Maine.

2.04 INSULATION WRAPPING JACKET FOR BURIED PIPE

- A. Provide flexible wrapping material around insulation layer of all buried pipes.
- B. Wrapping shall be self-sealing, non-metallic sheet which will seat on the insulation layer with manual pressure or heat sealing.
- C. Composition of wrapping material shall be special bituminous resin reinforced with woven glass fabric and covered with an aluminized mylar film and release paper.

- D. Thickness of wrapping material shall be 125 mils minimum.
- E. Tensile strength shall be at least 165 lbs/inch of width at 20°F.
- F. Weight shall be at least 66 lbs/100 SF.
- G. Application temperature shall be as low as 20°F.
- H. Permeability shall not exceed 0.002 per inch as measured by ASTM E-96.
- I. Equal to Pittwrap Insulation Jacketing as manufactured for compatible installation with FOAMGLAS systems.
- J. Coordinate with Section 02700.

2.05 INSULATION WRAPPING JACKET FOR EXPOSED NON-BURIED PIPE

- A. Provide rigid wrapping material around insulation layers of all exposed non-buried pipes.
- B. Wrapping shall be rolled or preformed corrugated aluminum jacket with integrally bonded moisture barrier for all surfaces in contact with insulation.
- C. Minimum aluminum thickness shall be 0.016-inch for pipe sizes less than 36" manufactured from 3003 or 3105 aluminum alloy with stucco embossed pattern. Include polysurlyn moisture barrier that is heat laminated in the factory over the interior surface of the aluminum roll jacketing.
 - 1. Equal to ITW Insulation Systems Pabco-Chiders Metals or Premetco International.
 - 2. Fastening hardware shall be equal to ITW Insulation Systems T-304 stainless steel ½" wide strapping and wing seals.
 - 3. Weather barrier coating shall be equal to Childers CP-11 Vi-Cryl water based, vinyl-acrylic mastic coating, metallic gray, with Childers Chil-Glas #5 glass fiber cloth membrane for use on exposed insulation at joint transitions.

- E. Provide aluminum or stainless-steel support bands at minimum one foot intervals.

2.06 INSULATION ACCESSORIES

- A. Adhesives to bond insulation to pipe or insulation sections to each other shall be as recommended by the insulation system manufacturer.
- B. Sealants for sealing joints between insulation sections and protrusions in metal jacketed joints and laps shall be as recommended by the insulation system manufacturer.
- C. Casing spacers compatible with insulation system and pipe.
- D. Urethane section with removable HDPE cover for use at expansion joint locations.
- E. Bonded polymer coating for exposed ends.
- F. Vapor retarder compatible with insulation system and pipe.
- G. Coordinate with Section 02700.

2.07 HEAT TRACING

- A. Heat Trace: Coordinate with Division 16.
- B. Power Requirements: as per the Drawings.
- C. Accessories: Provide all necessary accessories for power connection, end seal, taping, and pipe labels (“Electric Traced”) as recommended by the manufacturer to make a complete system.

PART 3 – EXECUTION

3.01 COORDINATION

- A. General: Prior to any work on the bridge, notify MaineDOT Maintenance and Operations Division and Engineer.

3.02 PIPING SYSTEMS

- A. All piping shall be cleaned of foreign substances and free of surface moisture prior to and during the application of insulation.
- B. All insulation materials shall be stored in an area protected from the weather and kept dry before and during application.
- C. Testing of the piping system shall be completed prior to application of the insulation.
- D. After the nominal system diameter is determined (pipe diameter plus insulation thickness), the trench shall be excavated to allow 6" minimum clearance in all directions around the final O.D. of the system.
- E. The bottom of the trench shall be graded to the design slope of the piping and to provide uniform bearing along its entire length. Where wet or unstable soils are encountered, such soil shall be removed to a sufficient depth and the trench backfilled with coarse sand or loose granular earth.
- F. Backfill shall be compacted to a density equal to that of the adjacent portions of the trench. Where excavation of rock is required, the rock shall be excavated to an over-depth of six inches (6") below the specified trench depth. Over depths in rock shall be backfilled with coarse sand and thoroughly compacted.
- G. In areas of high water table, adequate drainage shall be provided.
- H. All insulated piping shall rest in a six inch (6") layer of compacted sand. Excavation shall be kept free of standing water during insulation and jacketing application.
- I. FOAMGLAS insulation or equal shall be applied to the piping with butt joints staggered and tightly butted. Longitudinal and butt joints may be left dry.
- J. All joints shall be tightly fitted to eliminate voids by refitting or replacing sections of insulation.
- K. Each section of insulation shall be held in place by two wraps of strapping tape with a 50% overlap per wrap.

- L. FOAMGLAS insulation which has been pre-jacketed or equal with PITTWRAP or equal jacketing shall be applied joint-on-joint, with all joints tightly butted. Strapping tape may be used over the jacketing to temporarily secure the insulation until longitudinal laps are sealed and butt straps applied.
- M. Where conditions permit, FOAMGLAS insulation or equal and jacketing may be applied outside of the trench to sections of piping. Sections of pipe greater than 10 feet in length should be insulated in maximum 10 foot segments with 1 foot wide gaps between insulated segments.
- N. The un-insulated gaps will allow the placement of slings by which the pipe can be lifted into the trench.
- O. After the sections of pipe are in place in the trench and the ends of the pipe connected, insulation and jacketing shall be applied to the joint areas and gaps that were not insulated above ground. Adequate working space shall be maintained by the best available means.
- P. Apply the specified jacketing in strict accordance with the appropriate product data sheet. Seal all overlaps and butt strips as noted in the product data sheet to ensure that groundwater cannot penetrate the jacket system.
- Q. Uncoated, exposed insulation left at day's end shall be sealed with PITTSEAL 444N sealant or equal to prevent bulk water entry.
- R. All completed work shall be backfilled as soon as possible to prevent damage to the insulation system.
- S. At all irregular surfaces, such as elbows, tees, fitting covers, etc., the PITTWRAP or equal jacketing shall be precut to fit the contour of the surface to which it is to be applied. Precut sections shall allow for two inch (2") overlap. All laps shall be sealed.
- T. In addition to sealing the jacketing on these irregular surfaces, a coating of PITTCOTE 300 coating or equal shall be applied over the jacketing. Carefully burn away the exterior plastic film on the jacketing. Apply a glove coat of coating.
- U. While still tacky, embed a layer of reinforcing fabric in the coating. After one hour, apply a second coat of coating over the first coat. Total wet film thickness of the two coats shall be 1/8" minimum.

- V. If backfilling takes place less than 24 hours after coating is applied, roofing felt shall be placed over the coating before backfilling.
- W. The trench shall be carefully backfilled. Sand backfill shall be placed within 6" of the insulated pipe and shall be free of rocks, debris, or stones greater than 1/4" diameter. Care shall be taken not to damage the jacketing during backfilling. Backfill shall be applied in 6" lifts, tamping each lift, until a depth of one foot over the insulated pipe is reached. The remainder of the trench shall be backfilled in one foot lifts, with each lift tamped to the desired compaction.

3.03 EXPOSED EXTERIOR NON-BURIED PIPING SYSTEMS

- A. All piping shall be cleaned of foreign substances and free of surface moisture prior to and during the application of insulation.
- B. All insulation materials shall be stored in an area protected from the weather and kept dry before and during application.
- C. Testing of the piping system shall be completed prior to application of the insulation.
- D. After the nominal system diameter is determined (pipe diameter plus insulation thickness), the trench shall be excavated to allow 6" minimum clearance in all directions around the final O.D. of the system.
- E. FOAMGLAS insulation or equal shall be applied to the piping with butt joints staggered and tightly butted. Longitudinal and butt joints may be left dry.
- F. All joints shall be tightly fitted to eliminate voids by refitting or replacing sections of insulation.
- G. Each section of insulation shall be held in place by two wraps of strapping tape with a 50% overlap per wrap.
- H. FOAMGLAS insulation which has been pre-jacketed or equal with PITTWRAP or equal jacketing shall be applied joint-on-joint, with all joints tightly butted. Strapping tape may be used over the jacketing to temporarily secure the insulation until longitudinal laps are sealed and butt straps applied.

- I. Apply the specified jacketing in strict accordance with the appropriate product data sheet. Seal all overlaps and butt strips as noted in the product data sheet to ensure that water cannot penetrate the jacket system.
- J. Uncoated, exposed insulation left at day's end shall be sealed with PITTSEAL 444N sealant or equal to prevent bulk water entry.
- K. At all irregular surfaces, such as elbows, tees, fitting covers, etc., the PITTWRAP or equal jacketing shall be precut to fit the contour of the surface to which it is to be applied. Precut sections shall allow for two inch (2") overlap. All laps shall be sealed.
- L. In addition to sealing the jacketing on these irregular surfaces, a coating of PITTCOTE 300 coating or equal shall be applied over the jacketing. Carefully burn away the exterior plastic film on the jacketing. Apply a glove coat of coating.
- M. While still tacky, embed a layer of reinforcing fabric in the coating. After one hour, apply a second coat of coating over the first coat. Total wet film thickness of the two coats shall be 1/8" minimum.
- N. Aluminum jacketing shall be applied with all laps positioned to shed water. All laps shall be a minimum of 2".
- O. Aluminum jacketing shall be secured using bands and seals as specified.
- P. Band spacing shall be two bands equally spaced per section of insulation and no greater than every 12" O.C. apart.

3.04 INSTALLATION

- A. Heat Tracing:
 - 1. To be installed by a licensed electrician.
 - 2. Heat tracing shall not be in contact with protection saddles.
 - 3. Layout as per the Drawings and Specification Section 16898.
- B. Steel and Pipe Supports: All structural steel and pipe supports shall be galvanized steel and shall be installed as required by manufacturer.

- C. Existing and Temporary Bridge Structures: Care shall be taken to ensure and maintain the structural integrity of all members of the existing and temporary bridges. Any damage to the bridge structure due to construction shall be repaired to match existing to the approval of the ENGINEER and MaineDOT.
- D. Alignment: All gravity sewer pipe and fittings shall be aligned to conform to the lines and grade as shown on the Drawings. Each pipe and fitting shall be laid to form a closed joint with the previously laid pipe or fitting and bring the pipe to the required grade by adjustment of the pipe supports.
- E. Cleanup: On completion, the area of the bridge crossing shall be restored to its original condition.

3.05 TESTING OF SEWER CROSSINGS OF BRIDGE

- A. Testing of temporary and permanent systems shall be in accordance with Section 02700.

END OF SECTION

SECTION 02717

MANHOLE RIM ADJUSTMENT

SECTION 02717 – MANHOLE RIM ADJUSTMENT

PART 1 – GENERAL

1.01 SUMMARY OF WORK

- A. This specification defines the Work required to adjust existing manhole rims to-grade including, but not limited to:
 - 1. Removal and replacement of adjacent pavement surfaces.
 - 2. Removal and adjustment to new grades of manhole rims indicated by drawings or by Engineer as requiring adjustment.
 - 3. Earthwork as required to locate existing manhole covers and to repair excavated areas adjacent to manhole.

1.02 SUBMITTALS

- A. Submit shop drawings for precast structures. Show components to be used.
- B. Provide manufacturers' product data and installation instructions for frames, covers, and precast items.
- C. Field confirm finished grade elevation prior to work.

1.03 QUALITY ASSURANCE

- A. Provide precast risers capable of supporting AASHTO H-20 loading.
- B. All precast concrete shall comply with ASTM C913 “Standard Specification for Precast Concrete Water and Wastewater Structures”.

PART 2 – PRODUCTS

2.01 MANHOLE FRAMES AND COVERS

- A. Reuse existing manhole frames and covers.

2.02 RISER RINGS TO GRADE

- A. Provide reinforced riser rings to grade.

- B. Use number of rings required to achieve grade elevation.
- C. Seal all joints with bitumastic sealant.
- D. Ring inside diameter shall be largest compatible with existing structure.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Field locate existing manhole covers using metal detectors and test pits where buried.
- B. Clearly mark all manhole locations to be adjusted using fluorescent marking paint.

3.02 SITE CLEARING

- A. Remove existing pavements to the limits shown on the Drawings, or if not shown, to the minimum extent possible to perform the work.
- B. Saw-cut asphalt paved surfaces before removal. Use a saw which will cut a neat, and straight joint line.
- C. Remove manhole frames, covers, and risers where indicated on the Drawings or as directed by the Engineer.
- D. Excavate adjacent roadway base as required to perform Work.

3.03 INSTALLATION OF PRECAST STRUCTURES

- A. Place riser and top sections in the appropriate height combinations.
- B. Follow manufacturer's instructions for sealing joints between frame and riser rings. Provide two rings of 1-inch diameter butyl rubber sealant.
- C. Point joints inside and out with butyl caulk.
- D. Set frames and covers to 1/2" below final pavement grade or as shown on the Drawings in paved areas.
- E. Provide adequate temporary covers to prevent accidental entry until final placement of frame and cover is made.

- F. Provide downward force to frame so as to compress the joint and provide a watertight seal and prevent future settlement.
- G. Set frames and covers to final grade only after pavement base course has been applied, or after final grading of gravel roads.

3.04 SITE CLEANUP

- A. Remove excess excavated material not wanted by the Owner and dispose of it off Owner's property.
- B. Grade material to the satisfaction of the Owner of the property on which the material is deposited. Keep roads free of debris. Use suitable watertight vehicles for hauling wet materials over roads and streets.
- C. Clean up materials dropped from or spread by vehicles promptly or when directed by the Engineer.
- D. Dispose of materials in accordance with all applicable regulations.

END OF SECTION

SECTION 02720

PRECAST CONCRETE SEWERAGE STRUCTURES

SECTION 02720 - PRECAST CONCRETE SEWERAGE STRUCTURES

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Provide precast concrete structures as shown on the Drawings and as specified.
This section includes:

Precast standard sanitary manholes and all accessories
Precast concrete riser rings
Frames, covers, and grates
Masonry materials
Installing boots for new pipes in existing manholes
Manhole accessories
Seals for pipe penetrations into pump station

1.02 RELATED SECTIONS

- A. Section 02200 - Earthwork.
B. Section 02700 – Buried Sewerage.
C. Section 02701 – Sewer Crossing of Bridge.

1.03 QUALITY ASSURANCE

- A. Provide precast structures, risers, and covers capable of supporting AASHTO H-20 loading.
B. All precast concrete shall comply with ASTM C913 "Standard Specification for Precast Concrete Water and Wastewater Structures."

1.04 SUBMITTALS

- A. Submit shop drawings for precast structures. Show components to be used, elevations of top and base of precast sections, base and pipe inverts, location of pipe penetrations and steps for each precast concrete item.
B. Provide manufacturers' product data and installation instructions for frames, covers, grates, precast items, sleeves, joint sealants, and frost barrier.

- C. Field confirm finished grade elevation prior to ordering precast concrete structures.

PART 2 – PRODUCTS

2.01 PRECAST CONCRETE REQUIREMENTS

- A. General: Cast-in-place concrete according to ACI 318, ACI 350R, and the following
 1. Cement: ASTM C 150, Type II.
 2. Fine Aggregate: ASTM C 33, sand.
 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 4. Water: Potable.
- B. Structures: Portland-cement design mix, 3000 psi minimum at 28 days, with 0.45 maximum water-cement ratio.
 1. Reinforced Fabric: ASTM A 185, steel, welded wire fabric, plain.
 2. Reinforcement Bars: ASTM A 615, Grade 60 (ASTM A 615M, Grade 400), deformed steel.
- C. Structure Channels and Benches: Factory or field formed from concrete. Portland-cement design mix, 3000 psi minimum, with 0.45 maximum water-cement ratio.
- D. Include channels and benches in both sanitary sewer and drain manholes.
- E. Manhole Channels: Concrete invert, formed to same width as connected piping, with height of the vertical sides to 3/4 of the pipe diameter. Form curved channels with smooth, uniform longest possible radius and slope.
 1. Invert Slope: 1.2 inches through manhole, unless otherwise indicated on Drawings.
- F. Manhole Benches: Concrete, sloped to drain into channel.
 1. Slope: 1 inch per foot.

2.02 MANHOLES

- A. Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for rubber gasket joints meeting AASHTO H-20 loading.
- B. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
- C. Base Section: Minimum thickness for floor slab, as shown on plans, and minimum thickness for walls and base riser section, as shown on plans, and having a separate base slab or base section with integral floor.
- D. Riser Sections: Minimum thickness, as shown on plans, 48 inch minimum diameter, or as shown on plans, and lengths to provide depth indicated.
- E. Top Section: Eccentric cone type, unless concentric cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
- F. Sealants: ASTM C 443 butyl rubber, two rings sealant around each joint for watertight connection.
- G. Steps: Provide steps for manholes greater than four feet deep.
 - 1. ASTM C 478 individual steps or ladder.
 - 2. Aluminum alloy 6061-T6 or copolymer polypropylene plastic with 1/2" Grade 60 reinforcing bar meeting ASTM D4101 Type II and ASTM A 615.
 - 3. Meet all OSHA requirements.
 - 4. Minimum width 14".
 - 5. Maximum spacing 12" on center.
 - 6. Coat with bitumastic paint where cast in concrete.
- H. Pipe Connections:
 - 1. Pipe sizes 6" or larger: Flexible manhole sleeves equal to CP series manufactured by Interpace Corp. size to fit diameter and type of pipe without use of gaskets.

2. Pipe sizes less than 6": Flexible Manhole sleeves as above or, thermoplastic pipe sleeve equal to "Link-Seal Century Line" model CS100 by Thunderline Corp. with sleeve seal equal to "Link-Seal" by Thunderline Corp.
3. As specified on drawings if in conflict with above.

2.03 PROTECTIVE COATINGS

- A. Include factory or field applied protective coatings to structures and appurtenances according to the following:
 1. Coating: Two coats, coal-tar epoxy, bitumastic, or Conseal coating, each coat 15 mil minimum thickness, except where otherwise indicated.
 2. Manholes: On exterior surface, bitumastic, PPS 922 superseal or equal.

2.04 RISER RINGS TO GRADE

- A. Provide reinforced riser rings to grade.
- B. Use number of rings required to achieve grade elevation.
- C. Seal all joints with bitumastic sealant.
- D. Ring inside diameter shall be twenty four inches.

2.05 MANHOLE FRAMES AND COVERS

- A. Fully machined frame and cover.
- B. Gray cast iron construction meeting ASTM A48 Class 30.
- C. Rated for H-20 wheel loading.
- D. Diamond pattern on cover.
- E. Lettering on cover should be 3" high and marked as "SEWER".
- F. Minimum weight shall be 330 pounds.
- G. Minimum flange width: 4" with reinforcing webs and 4 anchoring holes.

- H. Minimum frame height: 6”.
- I. Minimum inside frame diameter: 26 1/4 inches.
- J. Minimum cover diameter: 26”.
- K. Minimum clear frame opening diameter: 24”.
- L. Equal to East Jordan Iron Work frame and covers.
 - 1. Frame E.J. Prescott No. 65058.
 - 2. Sewer E.J. Prescott cover No. 65305.

2.06 FROST BARRIERS

- A. Frost Barrier: U.V. Resistant, high grade polyethylene, minimum thickness 6 mils.

2.07 MISCELLANEOUS

- A. Manhole cover lifting tools: Provide 2 lifting tools similar to Neenah cover lift compatible with manhole covers provided.

2.08 MORTAR MATERIALS:

- A. For mortar mix: Conform to requirements of ASTM C 270, Type S using Portland cement.
- B. Portland Cement: Natural color ASTM C 150, Type I, except Type III may be used for cold weather construction.
- C. Hydrated Lime: ASTM C270, Type S.
- D. Aggregate for Mortar: ASTM C 144, except for joints less than 1/4” use aggregate graded with 100% passing the No. 16 sieve.
- E. Aggregate for Grout: ASTM C 404.
- F. Water: Clean potable.

- G. Cold Weather Admixture: Nonchloride, noncorrosive accelerating admixture complying with ASTM C 494 Type C.
- H. Premixed mortars shall be as recommended by premix manufacturer and approved by Engineer.

PART 3 - EXECUTION

3.01 INSTALLATION OF PRECAST STRUCTURES

- A. Place bases on compacted bedding material so precast structure is plumb and pipe inverts are at proper elevations.
- B. Place riser and top sections in the appropriate height combinations.
- C. Plug all lifting holes inside and out with non-shrink grout.
- D. Follow manufacturer's instructions for sealing joints between precast sections. Provide two rings of 1-inch diameter butyl rubber sealant.
- E. Point joints inside and out with butyl caulk.
- F. Set frames and covers to 1/2" below final pavement grade or as shown on the Drawings in paved areas. Set 2" below finish grade in unpaved roads or set at 24" above grade in cross country runs.
- G. Provide adequate temporary covers to prevent accidental entry until final placement of frame and cover is made.
- H. Use two rings of 1-inch diameter butyl rubber sealant between frame and riser rings.
- I. Provide downward force to frame so as to compress the joint and provide a watertight seal and prevent future settlement.
- J. Point compressed joint with butyl rubber caulk sealant.
- K. Set frames and covers to final grade only after pavement base course has been applied, or after final grading of gravel roads.
- L. Install seals at each joint if specified.

3.02 FROST BARRIERS

- A. Wrap each installed precast structure to the maximum excavation depth or not less than 7 feet below grade, with a minimum of four layers of 6 mils each of polyethylene plastic.
1. Clean manhole exterior of all dirt and remove any protrusions.
 2. Apply a 6 inch wide vertical strip of bituminous waterproofing adhesive from the top of manhole to the bottom of the plastic wrap depth.
 3. Start poly wrap at adhesive strip and proceed around manhole continuously, overlapping adhesive strip a minimum of 24 inches on the final layer.
 4. Tuck and pleat poly at top in a continuous manner, minimizing size of folds. Extend poly past top of manhole frame and temporarily tuck remainder inside frame, until final backfill and paving.
 5. Paved areas: Cut poly flush with manhole rim after pavement is in place.
 6. Unpaved areas: Pull loose ends of poly together, remove excess air and tie off end with galvanized wire. Bury with manhole below grade.

3.03 LEAKAGE TESTING - MANHOLES

- A. Tests must be observed and certified by the Engineer. Manholes and wet wells must be complete including backfill for final test acceptance except for shelf and invert brickwork. Plug all pipes and other openings in the manhole walls prior to test.
- B. Exfiltration Test:
1. Plug pipes into and out of manhole and secure plugs.
 2. Lower groundwater table (GWT) to below manhole. Maintain GWT at this level throughout test. Provide means of determining GWT level at any time throughout test.
 3. Fill manhole with water to top of cone.
 4. Allow a period of time for absorption (determined by Contractor).

5. Refill to top of cone.
 6. Determine volume of leakage in an 8 hour (min) test period and calculate rate.
 7. Acceptable leakage rate: Not more than 1 gallon per vertical foot per 24 hours.
- C. Manhole Vacuum Test: The manhole or wet well being tested must not be backfilled or wrapped with vapor barrier. The test is passing if the manhole or wet well can sustain 10 inches of Mercury vacuum for 3 minutes, with 1 inch of Mercury loss allowable.

3.04 REPAIRS TO NON-CONFORMING NEW MANHOLES

- A. Determine causes of all leaks and repair them. Perform earthwork required if manhole has been backfilled.
- B. Perform repairs using methods and materials approved by the Engineer. Remove and replace or reconstruct manhole if necessary. Remove and replace defective sections if required by Engineer.

END OF SECTION

DIVISION 3
CONCRETE

SECTION 03300

CAST-IN-PLACE CONCRETE

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Provide all cast-in-place concrete work, including:

Concrete slabs
Pipe bollard fill
Grout

1.02 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of following codes, Specifications and standards, except where more stringent requirements are shown or specified:

ACI "Manual of Concrete Practice".
Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice".
ANSI or ASTM standards for concrete as referenced or appropriate.
ACI 301 "Specification for Structural Concrete"
ACI 318 "Building Code Requirements for Structural Concrete"
ACI 315 "Details and Detailing of Concrete Reinforcement"

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's product data with application and installation instructions for proprietary materials and items, including:

1. Reinforcement.
2. Intended method of supporting rebar and forming accessories.
3. Admixtures.
4. Patching compounds.
5. Curing compounds.
6. Others as requested by Engineer.

B. Shop Drawings, Reinforcement:

1. Submit Shop Drawings for fabrication, bending, and placement of concrete reinforcement according ACI 315.
2. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement.
3. Comply with all reinforcing requirements on Drawings and in this Specification.

C. Material Certificates:

1. Provide materials certificates in lieu of materials laboratory test reports when permitted by Engineer.
2. Material certificates shall be signed by manufacturer and Contractor certifying that each material item complies with, or exceeds, specified requirements.

D. Laboratory Test Reports and Mix Designs:

1. Submit laboratory test reports for concrete materials for all products to be incorporated into work and mix design tests as specified.
2. Testing shall be conducted within twelve months of material use.

PART 2 - PRODUCTS

2.01 FORM MATERIALS

A. Forms for Exposed Finish Concrete:

1. Construct formwork for exposed concrete surfaces with acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces.
2. Provide form material with sufficient stiffness to withstand pressure of newly-placed concrete without bow or deflection (per ACI 301).

- B. All Forms: The type, size, shape, quality and strength of all materials of which the forms are made shall be subject to the review of the Engineer, but the responsibility for their adequacy shall rest with the Contractor.

2.02 REINFORCING MATERIALS

- A. Reinforcing Bars: ANSI/ASTM A 615, Grade 60, deformed.
- B. Supports for Reinforcement:
 - 1. Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars in place.
 - 2. Use wire bar type supports complying with CRSI recommendations, unless otherwise acceptable.

2.03 CONCRETE MATERIALS

- A. Portland Cement: ANSI/ASTM C 150, Type II. Use one brand of cement throughout project, unless otherwise acceptable to Engineer.
- B. Normal Weight Aggregates:
 - 1. ANSI/ASTM C 33, and as herein specified.
 - 2. Provide aggregates from a single source for exposed concrete.
 - 3. Local aggregates not complying with ANSI/ASTM C 33, but which have shown by special test or actual service to produce concrete of adequate strength and durability, may be used when acceptable to the Engineer.
- C. Water: Potable.
- D. Air-Entraining Admixture: ANSI/ASTM C 260.
- E. Water-Reducing Admixture: ANSI/ASTM C 494, Type A, and containing not more than 1% chloride ions.
- F. High Range Water Reducing Admixture (Super Plasticizer): ASTM C 494, Type F or Type G and containing not more than 1% chloride ions.

G. Calcium chloride not permitted.

2.05 RELATED MATERIALS

A. Non-Shrink Grout:

1. CRD-C 621 (ASTM C1107), factory pre-mixed grout with minimum 1000 psi compressive strength in 1 day and 5000 psi compressive strength in 28 days as tested per ASTM C109.
2. Equal to Sikagrout 212, or Masterflow 928.

2.06 PROPORTIONING AND DESIGN OF MIXES

A. Prepare design mixes by either laboratory trial batch or field experience methods as specified in ACI 301.

1. If trial batch method used, use an independent testing facility acceptable to Engineer for preparing and reporting proposed mix design.
2. Test data provided shall be no more than one year old and shall be conducted on materials to be incorporated into work.

B. Design mixes to provide normal weight concrete with the following properties.

1. General Use Concrete:

- Type II Portland Cement.
- Min. 28 day compressive strength: 4000 psi.
- Max. water/cement ratio: 0.45.
- Min. cement content: 564 lbs per cubic yard.
- Slump: Concrete for general use: not less than 1", not more than 4".
- Sloping surfaces: slump not more than 3".
- Concrete with high range water reducer (HRWR) admixture: not more than 8".
- Max. aggregate size: 3/4".
- Air Content: 6% +/- 1% by volume for 3/4" aggregate.
- Flyash shall be Class F and shall not exceed 10% cement content, meeting ASTM C618.

- C. Concrete for bollard fill shall have a minimum 28-day compressive strength of 3000 psi.

2.07 CONCRETE MIXING

A. Job-Site Mixing:

1. Mix materials for concrete in appropriate drum type batch machine mixer.
2. For mixers of one cu. yd., or smaller capacity, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
3. For mixers of capacity larger than one cu. yd., increase minimum 1-1/2 minutes of mixing time by 15 seconds for each additional cu. yds., or fraction thereof.

B. Maximum Delivery Time:

1. 1 1/2 hours below 85°F, or
2. When air temperature is between 85° F and 90° F, reduce mixing and delivery time from 1 1/2 hours to 75 minutes, or
3. When air temperature is above 90° F, reduce mixing and delivery time to 60 minutes.
4. Calculation of delivery time shall start at the point that water is first added to the mix.

PART 3 - EXECUTION

3.01 PREPARATION OF FORM SURFACES

- A. Coat contact surfaces of forms with a form-coating (form-release) compound before reinforcement is placed.
- B. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of form-coating compound manufacturer's directions.

1. Do not allow excess form-coating material to accumulate in forms or to come into contact with concrete surfaces against which fresh concrete will be placed.
 2. Apply in compliance with manufacturer's instructions.
- C. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.02 FORMWORK

- A. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure.
- B. Construct and select formwork so concrete members and structures are of correct size, shape, alignment, elevation, position, deflection, and have correct finish.
- C. Design formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.
1. Formwork tolerances shall be such that final concrete work complies with Table 3 at end of this section.
 2. If release agents are used, apply prior to assembly of formwork. Do not spray release agents onto rebar surfaces.
- D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, and recesses for easy removal.
- E. Chamfer exposed corners and edges as indicated, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- F. Cleaning and Tightening:
1. Thoroughly clean forms and adjacent surfaces to receive concrete.

2. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed.
3. Retighten forms and bracing after concrete placement to eliminate mortar leaks and maintain proper alignment.

3.03 PLACING REINFORCEMENT

- A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.
- C. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.
- D. Tolerances for placing reinforcement are given in Table 1 at the end of this section.
- E. Place reinforcement to obtain at least minimum coverages for concrete protection as indicated on Table 2 at end of this section or as shown on Drawings.
 1. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations.
 2. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- F. Reinforcing bars shall not be field bent without approval by the Engineer.

3.04 ADMIXTURES

- A. General: Comply strictly with manufacturer's instructions for use of admixtures.
- B. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) meeting ASTM C-494 in concrete, as required, for placement and workability.

- C. Use accelerating admixture meeting ASTM C 494 in concrete slabs placed at ambient temperatures below 50° F (10° C).
- D. Use air-entraining admixture meeting ASTM C-260 in all concrete. Add air-entraining admixture at six percent or manufacturer's prescribed rate to result in concrete at point of placement having air content within limits stated above.

3.05 CONCRETE PLACEMENT

A. General:

1. Comply with ACI 301, and these specifications.
2. Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in.
3. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.

B. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

C. Cold Weather Placing:

1. Comply with ACI 306 Cold Weather Concreting. When air temperature has fallen to or is expected to fall below 40°F (4°C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50°F (10°C), and not more than 80°F (27°C) at point of placement.
2. Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures.
3. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
4. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators.

D. Hot Weather Placing:

1. Comply with ACI 305R when hot weather conditions exist that would impair quality and strength of concrete.
2. Maintain concrete temperature at time of placement below 90°F (32°C).
3. Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing.
4. Cover reinforced steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature before embedment in concrete.
5. Wet forms and rebar thoroughly before placing concrete. Remove standing, free, or otherwise excess water before concrete placement.
6. Use water-reducing retarding admixture (Type D) when required by high temperatures, low humidity, or other adverse placing conditions.

E. Wet Weather Placing:

1. Do not place concrete in any wet weather event with the exception of light mist or drizzle where, in the opinion of the Engineer, vibration of the concrete might incorporate falling rain into the concrete mixture.
2. Contractor is responsible to assure weather is appropriate prior to concrete pour.
3. Cover and protect placed concrete from precipitation and flooding.
4. Remove all concrete placed in wet weather as directed by Engineer.

3.06 FINISH OF FORMED SURFACES

A. Rough Form Finish:

1. Provide rough form finish for formed concrete surfaces not exposed-to-view unless otherwise indicated.

2. Retain concrete surface having texture imparted by form facing material used.

3.07 CONCRETE CURING AND PROTECTION

A. General:

1. Comply with ACI 301.
2. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
3. Start curing as soon as free water has disappeared from concrete surface after placing and finishing.
4. Where water cure is utilized, keep continuously moist for not less than 7 days or until 70% of design strength is attained.
5. Where curing compounds are utilized, begin curing procedures immediately following final finishing procedures and before concrete has dried.

B. Curing Methods: Perform curing of concrete by one of the following methods or by combinations thereof:

1. Provide moisture curing with added water by following methods.
 - a) Keep concrete surface continuously wet by covering with water.
 - b) Continuous water-fog spray.
 - c) Provide absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.
2. Provide moisture retaining cover curing as follows:
 - a) Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive.

- b) Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Provide curing compound as follows:
- a) Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours).
 - b) Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions.
 - c) Recoat areas subjected to heavy rainfall within 3 hours after initial application.
 - d) Maintain continuity of coating and repair damage during curing period.
 - e) Do not use non-dissipating curing compounds on surfaces which are to be covered with concrete or to receive subsequent application of grout, waterproofing, adhesive, or other treatments.
 - f) If dissipating curing compounds are used, remove prior to applying future surface treatments in accordance with manufacturer's requirements.
 - g) Do not allow curing compound to contact reinforcing steel and waterstops.
4. Provide curing with forms left in place:
- a) Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces with forms in place for full curing period or until forms are removed.
 - b) If forms are removed, continue curing by methods specified above, as applicable.

3.08 CONTINUING WORK ON OR NEAR NEWLY PLACED CONCRETE

- A. Prior to beginning new work on top of newly poured concrete, the following criteria must be met:
1. For equipment pads, wait at least 7 days, or achieve 70 percent of design strength prior to beginning work or placing equipment in service. Verification of strength will be at Contractor's expense by independent laboratory tested cylinders which have been cured on site adjacent to concrete pour area.

3.09 CONCRETE SURFACE REPAIRS

- A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Engineer. Surface defects include color and texture irregularities, crazing, cracks greater than 0.05" wide, popouts, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations and other objectional conditions that cannot be removed by cleaning.
1. Cut out honeycomb, rock pockets, voids over 1/4" in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1".
 2. Make edges of cuts perpendicular to the concrete surface.
 3. Thoroughly clean, dampen with water and brush-coat the area to be patched with specified bonding agent.
 4. Mix dry pack mortar, consisting of one part portland cement to 2 1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.
 5. Place patching mortar after bonding compound has dried.
 6. Cure in same manner as adjacent concrete.

TABLE 1

TOLERANCES FOR PLACING REINFORCEMENT

Clear distance to formed surfaces	+/- 1/4 in.
Minimum spacing between bars:	- 1/4 in.
Top bars in slabs:	
Members 8 in. deep or less:	+/- 1/4 in.
Members more than 8 in. but not over 2 ft. deep:	+/- 1/2 in.
Members more than 2 ft. deep:	+/- 1 in.
Crosswise of members:.....spaced evenly within	2 in.
Lengthwise of members:	+/- 2 in.

TABLE 2

MINIMUM CONCRETE COVERAGES OVER REINFORCEMENT BAR

<u>Cover</u>	<u>Minimum Inches</u>
a. Concrete cast against earth	3
b. Concrete exposed to earth or weather or on the interior face of exterior walls, columns and sandrel beams of buildings with wet processes	
#6 through #18 bars	2
#5 bar and smaller	1 1/2

END OF SECTION

DIVISION 5

METALS

SECTION 05120
STRUCTURAL STEEL

SECTION 05120 - STRUCTURAL STEEL

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. This Section includes structural steel as follows:

Steel beams
Beam connections
Base plates
Galvanizing of structural steel

1.02 SUBMITTALS

- A. Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

1. Product data for each type of product specified.
2. Shop Drawings detailing fabrication of structural steel components.
 - a) Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - b) Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
 - c) Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify high strength bolted slip-critical, direct-tension, or tensioned shear/bearing connections.
3. Mill test reports signed by manufacturers certifying that their products, including the following, comply with requirements.
 - a) Structural steel, including chemical and physical properties.
 - b) Bolts, nuts, and washers, including mechanical properties and chemical analysis.

- c) Direct-tension indicators.
- d) Shop primers.

1.03 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed structural steel work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.
- C. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC's "Code of Standard Practice."
 - 2. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
 - 3. AISC's "Specifications for Structural Joints Using A 325 or A 490 Bolts."
 - 4. ASTM A 6 (ASTM A 6M) "Specifications for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use."
 - 5. Research Council on Structural Connections' (RCSC) "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code - Steel."
 - 1. Present evidence that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver structural steel to Project site in such quantities and at such times to ensure continuity of installation.
- B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.
 - 1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
 - 2. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.05 SEQUENCING

- A. Supply anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Structural Steel Shapes: As follows:
 - 1. Steel plates and shapes: ASTM A 36 (ASTM A 36M) or A992.
 - 2. Finish: Hot dip galvanized (ASTM A992). May be double dipped.
- B. Connectors: As per the Drawings.

2.02 FABRICATION

- A. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this Section and in Shop Drawings.
 - 1. Camber structural steel members where indicated.

2. Identify high-strength structural steel according to ASTM A 6 (ASTM A 6M) and maintain markings until steel has been erected.
 3. Mark and match mark materials for field assembly.
 4. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
1. Plane thermally cut edges to be welded.
- C. Finishing: Accurately mill ends of columns and other members transmitting loads in bearing.
- D. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed stud shear connectors according to AWS D1.1 and manufacturer's printed instructions.

2.03 SHOP CONNECTIONS

- A. Shop install and tighten high-strength bolts according to RCSC's "Specification of Structural Joints" using ASTM A 325 or A 490 bolts.
- B. Connection Type:
1. Bearing type connection with threads included in shear plane as per A 325 N.
 2. Unless otherwise shown on the drawing, all connections are to be designed for reaction shears only using AISC beam load tables for weld or bolt shop connections.
 3. Bolts shall be ASTM A 325 high strength unless otherwise indicated.
- C. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.

2.04 GALVANIZING

- A. Hot Dip Galvanized Finish: Apply zinc coating by the hot dip process to structural steel indicated for grade 50, ASTM A992.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Before erection proceeds, and with the steel erector present, verify elevations of concrete and masonry bearing surfaces and locations of anchorages for compliance with requirements.
- B. Do not proceed with erection until satisfactory conditions have been verified.

3.02 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads equal in intensity to design loads.
- B. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.
- C. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.03 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section.
- B. Base and Bearing Plates: Clean concrete and masonry bearing surfaces of bond reducing materials and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
 1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.

2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
3. Pack grout solidly between bearing surfaces and plates so no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
 - a) Comply with manufacturer's instructions for proprietary grout materials.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.04 FIELD CONNECTIONS

- A. Install and tighten high-strength bolts as per the Drawings.
- B. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.
 1. Comply with AISC specifications referenced in this Section for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

3.05 TORQUE REQUIREMENTS

- A. Use an approved calibrated manual or power torque wrench to obtain proper torque and tension as recommended by the bolt manufacturer for all A 325 bolts.
- B. Use tension control bolts as alternative to torque wrench.

3.06 CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint according to ASTM A 780.

END OF SECTION

SECTION 05500

METAL FABRICATIONS

SECTION 05500 - METAL FABRICATIONS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Metal fabrications includes items made from aluminum and steel shapes, plates, bars, strips, tubes, pipes and castings which are not a part of structural steel or other metal systems specified elsewhere.
- B. Provide metal fabrications for:
 - Miscellaneous connections and connectors
 - Miscellaneous control panel supports
 - Pipe supports
 - Anchor bolts

1.02 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of following, except as otherwise indicated:
 - 1. AISC "Code of Standard Practice for Steel Buildings and Bridges".
 - 2. AISC "Specifications for Structural Joints using ASTM A325 or A 490 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.
 - 3. AWS D.1.2 "Structural Welding Code".

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications, anchor details and installation instructions for products used in miscellaneous metal items, including paint products and grout.
- B. Shop Drawings: Submit shop drawings for fabrication and erection of miscellaneous metal fabrications including layout, bracing details, anchorage recommendations and tolerances.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Metals: For fabrication of miscellaneous metal work use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks.
1. Steel Plates, Shapes and Bars: As per the Drawings.
 2. Stainless Steel: Type 316.
 3. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.
- B. Fasteners: Provide zinc-coated fasteners except where indicated on Drawings as stainless steel fasteners.
1. Steel Bolts and Nuts: As per the Drawings.
 2. Stainless Steel Bolts and Nuts: As per the Drawings.
 3. Expanding Anchors: Equal to Hilti Kwik-Bolt, stainless steel as required.
 4. Nylon Washers: Provide to separate steel from aluminum at connections.

2.02 GENERAL FABRICATION

- A. Workmanship:
1. Use materials of size and thickness indicated on Drawings or, if not indicated, as required to produce strength and durability in finished product for intended use.
 2. Work to dimensions shown or accepted on Shop Drawings, using proven details of fabrication and support.
 3. Use type of materials shown or specified for various components of Work.

- B. Form exposed Work true to line and level with accurate angles and surfaces and straight sharp edges.
 - 1. Ease exposed edges to a radius of approximately 1/32", unless otherwise shown.
 - 2. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing Work.
- C. Weld corners and seams continuously, complying with AWS recommendations. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces.
- D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type shown or, if not shown, Phillips flat-head (countersunk) screws or bolts.
- E. Provide for anchorage of type shown, coordinated with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.
- F. Cut, reinforce, drill and tap miscellaneous metal Work as indicated to receive finish hardware and similar items.

PART 3 - EXECUTION

3.01 Preparation: Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.02 INSTALLATION

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction, including stainless steel fasteners for concrete and masonry inserts, through-bolts, and other connectors as required.
- B. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Set Work accurately in

location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items which are to be built into concrete, masonry or similar construction.

- C. Field Welding: Comply with AWS Code for procedures of manual-shielded metal-arc welding, appearance and quality of welds, and methods used in correcting welding work.

END OF SECTION

SECTION 05501

MISCELLANEOUS METALS

SECTION 05501 - MISCELLANEOUS METALS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Miscellaneous metals work to be provided includes the following:

Pipe bollards.

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications for products.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Metal pipe for pipe bollards shall be carbon steel, Schedule 80 thickness in diameters and lengths shown on Drawings.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Coordinate embedment of bollards with other work so that buried items are installed prior to finish work.

3.02 INSTALLATION

- A. Install pipe bollards as indicated on Drawings and as follows:

1. Pipe bollards shall be set in concrete anchors at a minimum embedment depth of 5 feet.

END OF SECTION

DIVISION 7

THERMAL AND MOISTURE PROTECTION

SECTION 07200

INSULATION

SECTION 07200 - INSULATION

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Install insulation as shown on Drawings and indicated by provisions of this section. Insulation specified in this section includes the following:

Rigid foam insulation for pipe trenches

1.02 QUALITY ASSURANCE

- A. Thermal Conductivity: Thicknesses indicated for board insulation are for thermal conductivity (k-value at 75°F or 24°C) specified for each material. Provide adjusted thicknesses as directed for equivalent use of material having different thermal conductivity.

1.03 PRODUCT HANDLING

- A. General Protection: Protect insulations from physical damage and from becoming wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.

1.04 SUBMITTALS

- A. Product data for each type of insulation proposed.
- B. Technical data showing thermal properties of product.

PART 2 - PRODUCTS

2.01 INSULATION

- A. Rigid Board-Type Insulation for Trenches and Pipe Insulation: Closed-cell rigid foamed polystyrene, equal to "Styrofoam" HI-60, by Dow Chemical, or Owens Corning Foamular 600. Thickness as shown.

1. Thermal resistance: Aged R-value = 5 per inch of 75°F mean temperature.
2. Compressive strength ≥ 60 psi.
3. Flexural strength ≥ 75 psi.
4. Minimum density 1.60 PCF.
5. Water adsorption ≤ 0.1 percent by volume.
6. Coefficient of linear thermal expansion: maximum 3.5×10^{-5} in/ °F.
7. Complies with ASTM C578 Type VII.

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION

- A. Clean substrates of substances harmful to insulations or vapor and moisture barriers, including removal of projections which might cause punctures.

3.02 INSTALLATION OF RIGID BOARD INSULATION

A. General:

1. Comply with manufacturer's instructions for particular conditions of installation in each case. If printed instructions are not available or do not apply to project conditions, consult manufacturer's mechanical representative for specific recommendations before proceeding with work.
2. Extend board insulation full thickness as shown over entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections which interfere with placement.
3. Apply a single layer of board insulation of required thickness, unless otherwise shown or required to make up total thickness.
4. For pipe trench insulation, provide to the extent practical, full sheets of insulation over trench width to minimize the number of openings between

sheets. Add 2' long piece of insulation over each joint. Use four foot minimum width sheets centered on pipe(s), and add additional width to fill trench as necessary, or as directed by Engineer.

5. Over or adjacent to precast concrete structures, provide 4' wide sheets over structure and extend outside structural wall a minimum of 2' for full perimeter.

3.03 INSTALLATION OF BURIED PIPE INSULATION

- A. According to manufacturer's recommendations and as shown on Drawings.

END OF SECTION

DIVISION 11
EQUIPMENT

SECTION 11325

**BASE MOUNTED HORIZONTAL SUCTION
DUPLEX PUMP STATION
CONTROL PANEL**

SECTION 11325 – BASE MOUNTED HORIZONTAL SUCTION DUPLEX PUMP
STATION CONTROL PANEL

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Work defined in this section includes but is not limited to:

1. Provide a new duplex pump station control panel to replace the existing control panel for the Town of Mount Desert, Maine, Gorman Rupp Babson Creek Pump Station, Serial No. 95-4319-AM, No Substitutions.
2. Provide a primary level pressure transducer.
3. Provide back-up floats with weight and chain.
4. Provide a level control junction box with terminal strip and conduit sealing bushings in coordination with the pressure transducer and back-up floats installation within the existing wet well.

1.02 RELATED SECTIONS

A. Division 16 – Electrical

B. Electrical Drawings

1.03 SUBMITTALS

- A. Shop drawings of proposed control panel and components/accessories showing all important details of construction, dimensions, and field connections.
- B. Manufacturer's specifications and product data for electrical equipment and components.
- C. Wire schematics.
- D. Installation requirements, operation and start-up procedures, and minimum testing procedures.

- E. Certified statement that all specifications have been met or statement listing all exceptions taken to specifications including any credit in price offered if Owner accepts the exception.

1.04 STORAGE AND HANDLING OF EQUIPMENT

- A. The Contractor shall store and temporarily support equipment prior to installation in strict accordance with the manufacturer's recommendations and instructions and including the following requirements:
 - 1. Protect all exposed surfaces.
 - 2. Store control panel in buildings or trailers which have a concrete or wooden floor, a roof, and fully enclosed walls on all sides.
 - 3. Protect the control panel from being contaminated by dust, dirt, vibration, and moisture.
- B. The Contractor shall be responsible for control panel, installation and other related materials until inspected, tested, and finally accepted.

1.05 QUALITY ASSURANCE

- A. Control panel shall be a duplex pump station control panel as manufactured by Gorman Rupp and specifically for the Town of Mount Desert, Maine, Gorman Rupp Babson Creek Pump Station, Serial No. 95-4319-AM. No Substitutions.

PART 2 – PRODUCTS

2.01 CONTROL EQUIPMENT

- A. Provide the following controls:
 - 1. Mounted within a NEMA 4X, 304 stainless steel control enclosure with the following features:
 - a. Dead front door type, hinged and sealed with a neoprene gasket and equipped with captive closing hardware.
 - b. Control components mounted on a removable steel back panel secured to enclosure with collar studs.
 - c. Control devices and instruments mounted using threaded fasteners, and clearly labeled.

- d. Electrical distribution equipment components and associated circuit devices shall be sized as required for existing pump station HP and electrical operating loads.
- B. Branch components shall be of the highest industrial quality, secured to the sub-plate with machine screws and lockwashers. Mounting holes shall be drilled and tapped. Self-tapping screws shall not be used.
- C. Circuit breakers and operating mechanisms:
1. Heavy duty circuit breaker with RMS interrupting for each pump motor.
 2. An operating mechanism installed on each motor circuit breaker shall penetrate the control panel door. A pad lockable operator handle shall be secured on the exterior surface. Interlocks shall prevent opening the door until circuit breakers are in "OFF" position.
 3. Operator interface shall be Gorman Rupp Integrinex Controller.
 4. Overload relays shall be block-type with melting alloy spindles, having visual trip indication with trip-free operation. Resetting the overload reset lever shall cause a snap-action control contact to reset, thus re-establishing a control circuit. Overload relays shall be manual reset only. Trip settings shall be governed by the heater element only. Heater elements shall provide NEMA class 20 trip times.
 5. An overload reset pushbutton, mounted through the control panel door, shall permit resetting the overload relays without opening the control panel door.
 6. Magnetic Starter for each pump shall be open frame, across-the-line, NEMA rated, under-voltage release and overload protection on all three phases. Power contacts shall be double-break type of cadmium oxide silver. Coils shall be epoxy molded for protection from moisture and corrosive atmosphere. Each starter shall have a metal mounting plate for durability. Existing motors are 208V, 3-Phase, 15 HP.

D. Control Circuit

1. Circuit breaker shall be normal duty thermal-magnetic to protect all control circuits.
2. Pump mode selector switches shall permit the manual start or stop of each pump, or the automatic operation under control of the liquid level control system. Manual operation shall override all shutdown systems, except the motor overload relays. Selector switches shall be heavy duty, oil-tight design with contacts rated NEMA A300 minimum.
3. Pump alternator relay shall be electro-mechanical industrial design. Relay contacts shall be rated 10 amperes minimum at 120 volts non-inductive. A switch shall permit the station operator to select automatic alternation of pumps.
4. Total running time of each pump shall be displayed by a six-digit elapsed time meter (non-reset type) connected to each motor. An integral pilot light shall be wired in parallel to indicate that the motor is energized and should be running.
5. Provide power failure/phase failure detection with true off time delay relays. When voltage is supplied to the input terminals, the relay energizes. When voltage is removed, the OFF delay begins. Upon completion of the delay period, the relay de-energizes. Reset is accomplished by reapplying voltage to the input terminals. NOTE: If voltage is reapplied during the delay period, the relay remains picked up and the timer resets to zero. Voltage must be applied for a minimum of 0.5 seconds to assure proper operation.

E. Liquid level control shall include the following features:

1. Primary Pressure Transducer System
 - a. Primary level control shall be a submersible pressure transducer for installation in stainless steel transducer sleeve located within the wet well with intrinsically safe circuit.
 - b. Wet well elevations are shown on Drawings.
 - c. Maximum head band is shown on Drawings.
 - d. Output shall be 4-20 mA with 120 VAC power supply loop in unit.

- e. Water level variations from maximum head band feet above zero point.
- f. Span adjustment: Coarse and fine from 100% to 15% range.
- g. Offset adjustments: Coarse and fine from 0 to 75% of range.
- h. Accuracy: +/- 0.25% of full span.
- i. Temperature range: -20°C to 60°C with less than 0.1% temperature error.
- j. Relative Humidity Range: 0 to 95%.
- k. Compatible for use in wastewater solution containing methane, hydrogen sulfide and salt water.
- l. Mounting shall be vertical and suspended to bottom of wet well within stainless steel carrier pipe as shown on the drawings.
- m. Teflon faced bottom diaphragm.
- n. Cable shall be polyurethane jacketed.
- o. Solid state internal pressure transducer mechanism.
- p. Wetted materials shall be 316 SS body for resistance to wastewater, and head pressure sensing Teflon elastomeric diaphragm with precision gauge pressure transducer assembly.
- q. Provide explosion proof Class I, Division I rating.
- r. Provide lifetime lightning protection.
- s. Transducer equal to Keller LevelRat submersible transducer, or equivalent Omega model.
- t. The primary level control system shall provide the following level control settings:
 - i. Low-level alarm.
 - ii. Pump off.
 - iii. Lead pump on.
 - iv. Lag pump on.
 - v. High-level alarm.

2. A backup displacement switch system shall be provided to operate the pumps and signal an alarm should the controller fail. The standby system shall have the following features:
 - a. Level sensing shall be by non-mercury, mechanical wide angle SPDT polypropylene float switches equal to CSI Controls Inc. Model TF-D-10.
 - b. Activate automatically.
 - c. Provide “ON-OFF” control for both pumps.
 - d. Standby system shall provide level control settings identical to the primary level control as detailed above. The design intent of the redundant float system is to have it function identical in every way to the primary level control with the Interginex operator interface and submersible pressure transducer system.
 - e. Systems that do not provide 100% standby will not be acceptable.
 - f. Intrinsically safe relays shall be supplied for float switches and listed as intrinsically safe by a nationally recognized testing laboratory.
 - g. Provide weighted anchor and PVC chain for float switches as shown on Drawings.
3. Liquid level controller shall have the following characteristics:
 - a. The solid-state pump controller shall incorporate a microprocessor capable of controlling the operation of the two pumping units.
 - b. Grease, sludge or biological growth shall not affect the accuracy or reliability.
 - c. Level alarms: Total of 8.
 - d. Pump start delay of 5 seconds.
 - e. Memory: non-volatile (Lithium battery) backup.
 - f. Back lighted LCD: with 2 lines, 20 characters.
 - g. Enclosure: NEMA 4X with polycarbonate face and stainless-steel case.

- h. Controller shall be Gorman-Rupp Integrinex.
- 4. The level control system shall include junction box with barrier strip for installation on the exterior of the pump station enclosure and termination of the pressure transducer and float wiring and include conduit sealing bushings equal to O-Z Gedney for sealing pressure transducer cable and float cables at the junction box and from the wet well.
- F. Time delay relays (two minutes) adjustable shall be provided for the backup displacement switch system to prevent the transducer system and the displacement switch system from interfering with each other under normal operation.
- G. Wet well level adjustments including alarms shall be changed using an operator keypad, accessible on the front cover of the panel and independent of the wet well or transducer line system.
- H. Continuous readouts of the wet well liquid level as well as the state of the control and alarm outputs shall be displayed on an easy-to-read backlighted digital panel.
- I. An automatic alternator with a manual selector switch shall be provided to change the sequence of operation of the pumps.
- J. The system control shall include the following features:
 - 1. Wet well liquid level indication in inches of water.
 - 2. All set points programmable from the front of the control panel.
 - 3. All set points shall be maintained in non-volatile memory.
 - 4. A lock function provided to lock the set points against unwanted tampering.
 - 5. Plug-in printed circuit board construction for easy repair.
 - 6. Hand-Off-Auto pump selector switch.
 - 7. Pump alternation.
 - 8. Lag pump time delay on start.
 - 9. Wet well level simulating test valve.

10. Transducer function to full depth of wet well.

K. Status indicating lights shall include the following:

1. Pump No. 1 run.
2. Pump No. 2 run.
3. Lead pump called.
4. Lag pump called.
5. High level alarm.
6. Controller failure alarm (backup floats activated).
7. Pump station enclosure low temperature alarm.
8. Low level alarm.
9. Pump high temperature switch alarm for each pump.
10. Pump motor current overload alarm for each pump.
11. 3Ø voltage monitor trip.
12. Heat trace low temperature alarm.

L. A 120VAC alarm light device shall be provided loose for remote mounting on electrical service cabinet and include a sunlight visible LED alarm light with vapor proof fixture, flashing LED light bulb and red globe. Equal to Ingram Products, Inc., Sunlight Visible LED Alarm Light, Part No. SunBurst II: SBN120AC. Light shall be mounted in a weather tight box. Provide wiring and alarm hook up and following equipment and/or feature to complete alarm system.

1. Alarm acknowledge-silence switch in the station.
2. Manual alarm reset after the fault condition is cleared.
3. Alarm activation for all the alarm conditions as noted below.

M. The control panel shall be wired with auxiliary dry contacts for integration with the existing Zetron alarm processor to send separate alarms for the following conditions. Please note that alarms will be combined in the field into common alarm outputs in coordination with limited alarm inputs at the existing alarm processor. Reference and coordinate with the Electrical Drawings.

1. Controller - low water alarm.
2. Back up float – low water alarm.
3. Controller - high water alarm.
4. Back up float – high water alarm.
5. Controller failure (back up floats activated).
6. Loss of power.
7. Pump station enclosure low temperature alarm.
8. Pump high temperature switch alarm for each pump.
9. Pump motor current overload alarm for each pump.
10. 3Ø voltage monitor trip.
11. Heat trace low temperature alarm.

N. Running time meters shall be provided for each pump and shall have the following characteristics:

- A. Display the number of hours of operation.
- B. Enclosed in a dust and moisture proof molded plastic case.
- C. Flush mounted dial registering in hours and tenths of hour up to 9999.9 hours before repeating.
- D. Suitable for operation from a 115 volt and 60 cycle supply.

P. Duplex GFI receptacle shall be provided.

Q. Auxiliary Power Transformer for converting three-phase power to single phase supply and for single phase circuit requirements.

R. Provide battery backup for alarm system.

- S. Provide transient voltage surge suppressor voltage monitor and power transformer.
- T. Provide thermostat mounted externally onto the control panel with pump station enclosure low temperature alarm pre-wired to the control panel.
- U. Provide dry contact input and associated alarm circuits to monitor a heat trace low temperature alarm input from the Heat Trace Control Panel. The design intent is to monitor the heat trace alarm input, provide a heat trace low temperature alarm light on the control panel face, provide an auxiliary heat trace low temperature alarm contact for coordinated annunciation to the alarm processor and coordinate the heat trace low temperature alarm input with the station alarm beacon and to turn on the alarm light for the heat trace alarm.

PART 3 – EXECUTION

3.01 FACTORY TESTING:

- A. Pump control panel shall be given a factory operational test to check for:
 - 1. Correct operation of automatic control equipment.
 - 2. Correct annunciation for all status and alarms.
 - 3. A representative or factory service technician shall inspect the completed installation, correct, or supervise the correction of any defect or malfunction, and instruct operating personnel in the proper operation and maintenance of the new control panel and associated equipment. During the field startup, the following services shall be provided:
 - 1. Check each pump control circuit for proper operation in both manual and automatic operation.
 - 2. Check each level control circuit for proper operation in automatic operation.
 - 3. Check all status and alarms.
 - 4. Run through all control, status and alarm features.

4. Instruct the operating and maintenance personnel on the proper method of pump station control panel operation and the recommended maintenance procedures.

3.02 OPERATIONS AND MAINTENANCE MANUALS

A. Provide four (4) sets of operation and maintenance manuals. The manuals shall include:

1. Name, address, and telephone number of the nearest competent service representative who can furnish parts and technical service.
2. Descriptive literature, including illustrations, covering the operational features of the equipment, specific for the particular installation, with all inapplicable information omitted or marked out.
3. Operating, maintenance, and troubleshooting information.
4. Complete maintenance parts list.
5. Complete connection, interconnecting, and assembly diagrams.
6. Approved shop drawings.

3.03 WARRANTY

A. The equipment supplier shall warrant that its equipment shall be free from defects in material and workmanship and that it will replace or repair, F.O.B. its factory, any part or parts returned to it which have failed under normal use and service within 12 months of startup.

END OF SECTION

DIVISION 13

SPECIAL CONSTRUCTION

SECTION 13831

PLASTIC BOLLARD COVERS

SECTION 13831 – PLASTIC BOLLARD COVERS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Provide plastic bollard covers over exterior of concrete filled steel bollards.

1.02 RELATED SECTIONS

- A. Section 02200 - Earthwork.
- B. Section 05501 – Miscellaneous Metals.

1.03 SUBMITTALS

- A. Provide manufacturer's product data including cut sheets, materials, installation instructions and past project references.

PART 2 – PRODUCTS

2.01 PLASTIC BOLLARD COVERS

- A. Provide plastic covers to protect exterior surfaces and top of all concrete filled steel pipe bollards as follows:
 - 1. Provide heavy duty HDPE pipe bollard cover for each pipe bollard shown on the Drawings.
 - 2. HDPE material shall be made with UV protection additives.
 - 3. Cover wall thickness shall be 1/8” minimum.
 - 4. Color shall be bright OSHA yellow with safety red reflective strips.
 - 5. Pipe cover sizes shall be as required for bollard sizes as shown on the Drawings.
 - 6. Equal to Lindo Liner bollard cover as manufactured by Eberl Iron Works, Inc. Traffic Safety Products.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's requirements:

END OF SECTION

DIVISION 15
MECHANICAL

SECTION 15125

PIPE EXPANSION JOINTS

SECTION 15125 - PIPE EXPANSION JOINTS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes pipe expansion joints, guides, and anchors for mechanical piping systems.

1.02 RELATED DOCUMENTS

- A. Section 02701 – Sewer Crossing of Bridge

1.03 PERFORMANCE REQUIREMENTS

- A. Compatibility: Provide pipe expansion joints and pipe alignment guides, suitable for piping system fluids, materials, working pressures, soil conditions and temperatures.
- B. Fabricate and install expansion system capable of sustaining forces generated by gravity, thermal movement, and seismic event.

1.04 SUBMITTALS

- A. Product data for each type of pipe expansion joint and pipe alignment guide specified.
- B. Pipe expansion joint schedule showing manufacturer's figure number, size, location, and features for each required expansion joint.
- C. Assembly-type shop drawings for each type of pipe expansion joint and pipe alignment guide indicating dimensions, weights, required clearances, and methods of component assembly.

PART 2 - PRODUCTS

2.01 PIPE EXPANSION JOINTS

- A. The pipe couplings shall be as per Specification Section 02701.

2.02 REQUIRED PIPE ENDS AT COUPLING EXPANSION JOINTS

- A. The pipe shall be furnished with plain ends for couplings in accordance with AWWA specifications for tolerances.
- B. The pipe shall be smooth and round for a distance of 8" from each end. The maximum plus or minus variation from nominal outside diameters for each size shall not exceed:

<u>SIZE</u>	<u>MAXIMUM VARIATION</u>
3" to 16"	.06"
18" thru 24"	.08"

- C. The maximum outside pipe diameter shall be such as to permit the passing of a ring gauge having an internal bore not greater than .01" larger than the maximum allowable outside diameter of the pipe. This ring gauge shall go over the end of the pipe for a distance of 8" for all sizes up to and including 24", and for a distance of 12" on sizes 24".
- D. The minimum outside diameter shall be determined by the use of a steel tape circumferentially applied to prevent the shipment of undersize, out-of-round pipe which, if measured diametrically through the maximum diameter or checked with a No-Go ring gauge, might appear within the specified tolerance.

2.04 EXPANSION JOINTS

<u>TAG NO.</u>	<u>SIZE</u>	<u>LOCATION</u>	<u>TYPE</u>
EJ-101	8"	Temporary Sewer	Compatible with proposed system.
EJ-102	8"	Temporary Sewer	Compatible with proposed system.
EJ-103	8"	Permanent Sewer	Dresser Style 63, Type 1 or equal.
EJ-104	8"	Permanent Sewer	Dresser Style 63, Type 1 or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install pipe expansion joints according to manufacturer's written instructions.
- B. Align expansion joints to avoid end-loading and torsional stress.

END OF SECTION

15125-3

SECTION 15145

PIPE HANGERS, SUPPORTS, ANCHORS, AND SEALS

SECTION 15145 - PIPE HANGERS, SUPPORTS, ANCHORS, AND SEALS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Types of supports, anchors and seals specified in this section include the following:

Vertical-Piping Clamps
Anchors
Pipe Sleeves
Link Seals

- B. Supports, anchors, and seals furnished as part of factory-fabricated equipment, are specified as part of the equipment assembly in other sections.

1.02 RELATED SECTIONS

- A. Section 02700 – Buried Sewerage.
- B. Section 02701 – Sewer Crossing of Bridge.
- C. Section 11325 – Base Mounted Horizontal Suction Duplex Pump Station Control Panel.

1.03 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of supports, anchors and seals, of types and sizes required, whose products have been in satisfactory use in similar service.
- B. Code Compliance: Comply with applicable plumbing codes pertaining to product materials and installation of supports, anchors and seals.
- C. MSS (Manufacturer's Standardization Society) Standard Compliance:
1. Provide pipe hangers and supports of which materials, design and manufacture comply with ANSI/MSS SP-58, Pipe Hangers and Supports - Materials, Design, and Manufacture.

2. Select and apply pipe hangers and supports, complying with MSS SP-69, Pipe Hangers and Supports - Selection and Application. Fabricate and install pipe hangers and supports, complying with MSS SP-89.
3. Terminology used in this section is defined in MSS SP-90.

1.04 SUBMITTALS

- A. Product Data: Submit catalog cuts, specifications, installation instructions, dimensioned drawings and certifications for each type of support, anchor and seal.

PART 2 - PRODUCTS

2.01 GENERAL MATERIALS

- A. Carbon steel shall be used in all dry, non-corrosive environments.
- B. Galvanized steel or 304 stainless steel shall be used in all wet or damp, non-corrosive environments.
- C. 316 stainless steel shall be used in all corrosive or submerged environments.
- D. Dissimilar metals shall not come in contact with each other to eliminate the possibility of galvanic corrosion. If dissimilar metals must make contact insert spacer material such as neoprene, rubber or corrosion protection tape between the two metals.

2.02 VERTICAL-PIPING CLAMPS

- A. General: Except as otherwise indicated, provide factory-fabricated vertical-piping clamps complying with ANSI/MSS SP-58, of one of the following types listed, selected by Contractor to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe.
- B. Two-Bolt Riser Clamps: National Pipe Hanger Corporation fig. 420, National Pipe Hanger Corporation fig. 410 (MSS Type 8) or equal.
- C. Four-Bolt Riser Clamps: MSS Type 42.

- D. Corrosive or submerged environments requires all 316 stainless steel clamp and components and hardware.

2.03 ATTACHMENTS

- A. General: Except as otherwise indicated, provide factory- fabricated building attachments complying with ANSI/MSS SP-58, of one of the following MSS types listed, selected by Contractor to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods.
- B. Expansion Anchors: Equal to Hilti Kwik-bolt, sized as required for proper support.
- C. Corrosive or submerged environments requires all 316 stainless steel support and components and hardware.

2.04 MISCELLANEOUS HANGERS

- A. As approved by the Engineer or as shown on the plans.

2.05 CORROSIVE OR SUBMERGED ENVIRONMENTS

- A. Corrosive or submerged environments requires all 316 stainless steel hanger, components and hardware.

2.06 CORED PENETRATIONS

- A. Unless otherwise indicated, all process piping penetrations of slabs which are existing work may be made by coring a smooth bore hole through the existing concrete and sealing the annular space between process pipe and hole using rubber multi-link type seals. On exterior walls below grade or walls of tanks holding liquids, two such seals are to be used. Cored hole diameters are to be as required by the seal manufacturer for the size process pipe and seal required.

2.07 SLEEVES & SEALS

A. Concrete Tank Walls:

1. Steel pipe with 1" x 1/8" thick welded fin in middle, hot-dip galvanize after fabrication.
2. Schedule of pipe and size of pipe as required by seal manufacturer.
3. Rubber link compression seal.

B. Bridge Abutments:

1. Ductile Iron sized to accommodate sewer pipe, insulation, and accessories.

C. Rubber Link Seals:

1. Multi-rubber link type with pressure plates, bolts, nuts and sealing element providing a leakproof seal. All hardware to be stainless steel.
2. General Service:
 - a. Delrin plastic pressure plate
 - b. Stainless steel nut and bolt
 - c. Sealing element: EPDM rubber
 - d. -40° to 250°F rating
3. Corrosive Service:
 - a. Use: In all protrusions through walls
 - b. Pressure plate: Delrin plastic
 - c. Bolt and nut, 18-8 stainless steel
 - d. Sealing element: EPDM rubber
4. For PE Pipe Service:
 - a. Link seals shall be as described for General Service with Low Durometer rubber rated specifically for HDPE pipe.

5. Acceptable Manufacturers:

- a. Link Seal by Thunderline Company or Innerlynx by Advance Products & Systems, Inc.
- b. Or approved equal

PART 3 - EXECUTION

3.01 INSTALLATION OF ATTACHMENTS

- A. Install attachments at required locations within concrete. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping.

3.02 INSTALLATION OF HANGERS AND SUPPORTS

- A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.
- B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.
- C. Set all inserts before the concrete is placed.
- D. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units. Lateral movement of piping shall be controlled along straight runs.

- E. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- F. Except as otherwise permitted, make provisions for vertical adjustment of all hangers after installation.
- G. Provide additional guides or supports at offsets in piping as necessary to prevent deflection of pipe axis due to expansion or pressure forces except where right angle bends are utilized to compensate for expansion.
- H. Spacing:
 - 1. Install hangers and supports at sufficiently close intervals to maintain alignment and prevent sagging.
 - 2. Maximum spacing of hangers and supports:

<u>Pipe Size (inches)</u>	<u>Spacing (feet)</u>
1 & smaller	6
1-1/4 to 2	9
2-1/2 to 3	11
4 and larger	

As per the Drawings

3.03 INSTALLATION OF PIPE SLEEVES

A. New Construction:

- 1. Sleeves: Install wall sleeves of types indicated where piping passes through concrete abutment. Install accurately centered on pipe runs. Size sleeves so that piping and insulation (if any) will have free movement in sleeve, including allowance for thermal expansion; but not less than 2 pipe sizes larger than piping run. Install length of sleeve equal to thickness of construction penetrated. Provide temporary support of sleeves during placement of concrete and other work around sleeves, and provide temporary closure to prevent concrete and other materials from entering sleeves or wall pipes.

END OF SECTION

DIVISION 16
ELECTRICAL

SECTION 16030

ELECTRICAL PROVISIONS OF EQUIPMENT WORK

SECTION 16030 - ELECTRICAL PROVISIONS OF EQUIPMENT WORK

PART 1 - GENERAL

1.01 WORK INCLUDED IN EQUIPMENT SECTIONS

- A. All pump station equipment to be supplied complete with integral controls.

1.02 WORK INCLUDED IN ELECTRICAL SECTIONS

- A. Provide main supply power for all pump station equipment under Section 16100.
- B. All control and alarm wiring shall be supplied and installed under Section 16100.

1.03 RESPONSIBILITY

- A. It is the intent of these specifications that each trade be thoroughly familiar and responsible for the electrical operation of their entire mechanical system. This does not preclude the use of electrical tradesmen by each mechanical trade for their portion of the wiring but they must be sufficiently familiar with the electrical operation and wiring of their systems so that the Owner can expect single source responsibility for the repair and maintenance of those systems.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Pump Station Control Panel, Sensors & Float Switch equipment to be supplied under Equipment Sections. Existing Service Cabinet and Radio Telemetry Equipment to be reused.

PART 3 - EXECUTION

3.01 COORDINATION

- A. Coordinate under Section 16100 for main power to pump station equipment.
- B. Coordinate under Section 16620 for emergency power to automatic transfer switch and pump station equipment.
- C. Coordinate with supplied pump station equipment for control wiring requirements.
- D. Supplied systems must be complete, functional and serviceable.

3.02 INSTALLATION

- A. The Contractor must utilize skilled tradesmen to install all electrical systems and must meet all applicable NFPA National Electrical Codes and all applicable Federal, State and Local Codes. Meet all requirements of Division 16 Electrical Sections.

*** END OF SECTION ***

SECTION 16045
ELECTRICAL RELATED WORK

SECTION 16045 - ELECTRICAL RELATED WORK

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Coordinate excavation, cutting, patching, painting and other ancillary services necessary to complete work specified elsewhere.
- B. Drawings and Specifications are provided to show general arrangement and extent of work to be performed. Verify all scale measurements on plans with existing work and conditions found at the site and accommodate work thereto. Exact locations are to be determined on site as work progresses, and shall be subject to approval. Sizes with general arrangements as well as methods of connecting all piping, valves, equipment, etc. shall be as indicated so as to meet the requirements of the project. It is not the intent that the drawings shall show every pipe fitting, offset, run, control conductor, appliance, etc. but it shall be a requirement to furnish all material and labor necessary to finish the system in accordance with the best practice of the trade and to provide a system which is complete and serviceable.

1.02 WORK NOT INCLUDED

- A. All excavation shall be supplied under Division 2.
- B. Concrete pads shall be supplied under Division 3.

1.03 REFERENCES

- A. All work shall conform to the National Fire Protection Association Codes and all Federal, State and Local codes as applicable.
- B. Fire barrier seals shall be Factory Mutual approved for intended application.

1.04 SUBMITTALS

- A. Supply all information necessary to update "record" drawings.

PART 2 - PRODUCTS

2.01 None required

PART 3 - EXECUTION

3.01 COORDINATION

- A. Coordinate excavation and backfill for underground utilities, conduits, etc. with other excavation work for all other trades.
- B. Coordinate installation of conduit risers in Generator pad before concrete pour as required by Engineers.

*** END OF SECTION ***

16045-2

SECTION 16050
TEMPORARY POWER

SECTION 16050 - TEMPORARY POWER

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish all labor, materials, and equipment necessary to complete all work as shown on drawings and specified. This work is to include but not limited to the following:
1. Supply temporary power for project.
 2. Provide temporary service and starting/protection equipment for operational systems during the dismantling and installation of new service equipment, power panels and distribution wiring. This may require providing a temporary enclosure for protection of exterior mounted service equipment.
 3. Provide temporary wiring as needed during service changeover. Note that the existing service is 120/208V, 3Ø, 100A.
 4. Contractor may reuse existing equipment for temporary service where reuse is practicable.
- B. Pump Station must remain operational during construction either by temporary power or temporary pumping.
- C. There is no existing generator on site.

1.02 WORK NOT INCLUDED

- A. Any temporary electrical entrance shall be supplied under Section 01500.
- B. Cost of additional wiring for welding and larger motors or unusual lighting, such as area floodlights, shall be at the expense of the trade requesting such service.
- C. Temporary electrical power may be obtained from existing panels when practical.

1.03 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 16045 - Electrical Related Work
- B. Section 16400 – Electrical Service & Distribution

C. Section 16620 - Standby Power Generation Systems

1.04 REFERENCES

- A. All work shall conform to all NEC Codes, OSHA standards and all Federal, State and Local Codes as applicable.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. All temporary wiring and devices shall be of such type and so installed as to meet the requirements of the National Electrical Code, and those of any other body or agency having jurisdiction.
- B. All equipment and fixtures shall be OSHA approved for intended use.

PART 3 - EXECUTION

3.01 COORDINATION

- A. Coordinate all work to provide temporary power during disassembly of pump station service equipment and systems and reconstruction of new equipment.
- B. Existing pump station must remain fully operational or be bypassed as necessary during construction.

3.02 INSTALLATION

- A. Check phase rotation before energizing new temporary power equipment.
- B. Protect temporary power and facilities from possibility of damage as necessary.
- C. Remove temporary electrical equipment as soon as permanent equipment is in operation and temporary wiring is no longer necessary. All temporary wiring shall be removed prior to acceptance of the completed project.

*** END OF SECTION ***

SECTION 16100

BASIC ELECTRICAL SYSTEMS

SECTION 16100 - BASIC ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish all labor, materials, and equipment necessary to complete all work as shown on drawings and specified. This work is to include but not limited to the following: Supply and install all load wiring, boxes, conduits, receptacles, devices, etc.
- B. Provide installation of Control Panels and connection of all external wiring.
- C. Supply control wiring for all pump station equipment.
- D. Supply and label circuit tags, labels, etc.
- E. Reconnect existing circuits as necessary.
- F. All discontinued wiring and equipment to be removed, complete.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 11325 - Base Mounted Horiz. Suction Duplex Pump Station Control Panel
- B. Section 16030 - Electrical Provisions of Equipment Work
- C. Section 16045 - Electrical Related Work
- D. Section 16050 - Temporary Power
- E. Section 16195 - Electrical Identification
- F. Section 16400 – Electrical Service & Distribution
- G. Section 16620 - Standby Power Generation Systems
- H. Section 16795 - Remote Telemetry Systems
- I. Section 16898 - Electric Protective Heating Cables

1.03 REFERENCES

- A. All work shall conform to the NFPA National Electrical Code and all Federal, State and Local Codes and Utility Company Regulations as applicable.
- B. All equipment shall be UL listed.

1.04 QUALITY ASSURANCE

- A. Demonstrate the correct operation of all installed equipment and circuits to the satisfaction and requirements of the Engineers.

1.05 CONTRACTOR QUALIFICATIONS

- A. The workman responsible for wiring controls shall have a minimum of five years experience in wiring systems for sewerage treatment plants, municipal wastewater pump stations or other similar relevant experience in industrial facilities.

1.06 SUBMITTALS

- A. Supply all information necessary to update "record" drawings.
- B. Submit shop drawings for the following:
 - Receptacles
 - Plates
 - Equipment
- C. This project will require a State of Maine electrical permit.

PART 2 - PRODUCTS

2.01 WIRE

- A. Individual conductors in conduits shall be copper with THHW, THWN or XHHW insulation. Conductors in exterior or below grade conduits shall be THWN or XHHW.
- B. Load and branch circuit conductors shall be soft drawn copper with 98% of conductivity of pure copper. In no case shall aluminum conductors be used for load or branch circuits.

- C. Field instrumentation shielded twisted pair (STP) signal cable for 4-20mA current loop is 18-gauge, 2 conductor CU with 100% shield, copper drain wire and overall PVC jacket equal to Belden 8760.
- D. Minimum wire size for power circuits shall be #12 AWG. Except where noted otherwise, minimum wiring for control circuits shall be #14 AWG with appropriate circuit protection.
- E. Color code conductors as per the following service voltage with permanent color markings:

Conductor	120/240V	120/208V
Phase A	Black	Black
Phase B	Red	Red
Phase C		Blue
Neutral	White	White
Ground	Green	Green

- F. Wire larger than #8 AWG shall be stranded.
- G. Insulation shall be rated for 600V and shall be stamped with the manufacturer's name, size, voltage, type, temperature rating and UL listing.

2.02 CONDUITS AND WIREWAYS

- A. All wiring will be enclosed in metallic raceways, GRS or EMT conduit, or flexible metallic wireways.
- B. Except as noted on drawings material selections for process wiring shall be as follows:

GRS:

1. Exterior underground conduits shall be GRS.
2. Explosion hazard areas such as wet wells, and other areas designated on drawings shall be rated assemblies of GRS conduits or equal.
3. All electrical conduits cast in concrete shall be GRS.

PVC:

4. Main grounding conduits to ground rods and rebar shall be protected with non-metallic PVC as noted to prevent a reactive choke during lightning strikes.