Allied Engineering

Structural Mechanical Electrical Commissioning

66 Industrial Drive / Phase 2

State WIN # 020118.20

66 Industrial Drive, Augusta, Maine

Maine Department of Transportation

Issued for Bid

Volume 4 of 4

Divisions 26 through Maine DOT Backend

AEI 13-057

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VOLUME 1 OF 4 (MaineDOT Front End THROUGH 6)

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SECTION 26 01 00 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. State of Maine Department of Transportation, "Standard Specifications," Revision December 2002, and any corrections, additions and revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.
2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.2 SUMMARY

A. Section Includes:

1. General requirements applicable to all Division 26 sections.
2. Temporary power and lighting.
3. Allowances for Utility Construction Charges

1.3 TEMPORARY POWER AND LIGHTING

A. Provide a separately metered temporary electrical service for the construction area.

B. Power Distribution: Provide weatherproof, grounded circuits with ground-fault interruption features, with proper power characteristics and either permanently wired or plug-in connections as appropriate for intended use. Provide overload-protected disconnect switch for each circuit at distribution panel. Space 4-gang convenience outlets (20 amp circuit) so that every portion of work can be reached with 100' extension cord.

C. Temporary Lighting: Provide lighting of intensity and quality sufficient for proper and safe performance of the work and for access thereto and security thereof, minimum average illumination level in every room shall be 20 footcandles.

1.4 ALLOWANCES FOR UTILITY CONSTRUCTION CHARGES

A. Provide a $25,000 allowance as specified in Division 01 for electric utility company utility construction charges associated with the electric service.

B. Provide a $10,000 allowance as specified in Division 01 for telephone and cable utility company utility construction charges associated with the telephone, internet, and cable television services.

1.5 GENERAL REQUIREMENTS APPLICABLE TO ALL DIVISION 26 SECTIONS

A. Regulatory Requirements:

1. Conform to the requirements of all laws and regulations applicable to the work.
2. Conform to the requirements of Federal State and Municipal Building Codes.
3. Cooperate with all authorities having jurisdiction.
4. Compliance with laws and regulations governing the work on this project does not relieve the Contractor from compliance with more restrictive requirements contained in these specifications.
5. If the Contract Documents are found to be at variance with any law or regulation, the Contractor shall notify the Architect/Engineer promptly in writing. The Contractor shall assume full responsibility for any work contrary to law or regulation, and shall bear all costs for the corrections thereof.
6. Minimum Requirements: The more stringent of the 2011 National Electrical Code (NEC) or the edition enforced by the local Authority Having Jurisdiction, Underwriters Laboratories, Inc. (UL), the National Fire Codes, and National Fire Protection Association (NFPA) are a minimum requirement for work under this section. Design drawings and other specification sections shall govern in those instances where requirements are greater than those required by code.

B. REFERENCES

1. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

a. National Fire Protection Association (NFPA).
b. National Electrical Code (NEC)
c. National Electrical Safety Code (NESC)
d. Underwriters Laboratories, Inc. (UL)
e. American National Standards Institute (ANSI)
f. Certified Ballast Manufacturers Association (CBM)
g. National Electrical Manufacturers Association (NEMA)
h. International Municipal Signal Association (IMSA)
i. Institute of Electrical and Electronic Engineers (IEEE)
j. American Society for Testing Materials Specifications (ASTM)
k. National Bureau of Standards Handbook (NBS)
l. Occupational Safety and Health Administration (OSHA)
m. Americans with Disabilities Act (ADA)
n. Insulated Power Cable Engineers Association Specifications (IPCEA)

C. Permits, Fees, and Inspections:

1. Secure and pay for all permits, fees, licenses, inspections, etc., required for the work under Division 26.
2. Schedule and pay for all legally required inspections and cooperate with inspecting officers.
3. Provide Certificates of Inspection and Approval from all regulatory authorities having jurisdiction over the work in Division 26.

D. The Contractor shall study all drawings and specifications and acquaint itself with the existing conditions and the requirements of the plans and specifications. No claim will be recognized for extra compensation due to the failure of the Contractor to familiarize itself with the conditions and extent of the proposed work.

E. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

F. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

1.6 EFFICIENCY MAINE

A. This project intends to pursue Efficient Maine (EM) prescriptive and/or custom incentives. The contractor shall participate in the activities associated with Efficiency Maine incentive approval process including but not limited to; preparation and submission of required incentive application(s) and the tracking and submission of measure specific invoices to Efficiency Maine within 60 days of the completion of the work.

B. The contractor shall also:

1. Become familiar with the Efficiency Maine Business Program including available incentives and the application and review process.
2. Review plans and specifications for any and all incentive opportunities, prescriptive and custom.

C. The project schedule shall reflect and accommodate the time required to achieve application preapproval from EM. No equipment shall be purchased until preapproval is received from EM.

D. All invoices shall be forwarded to EM within 60 days of the completion of work. This deliverable shall be shown on the project schedule as a milestone date and coordinated with all contractors to assure compliance with this requirement.

E. Efficiency Maine is available to assist in the application process and can be reached at 866-376-2463

1.7 COORDINATION

A. Coordinate the work of Division 26 with other Divisions, the Owner, and utility companies.

B. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

C. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

D. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08.

E. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07.

PART 2 - PRODUCTS – Not Used

PART 3 - EXECUTION – Not Used

PART 4 - PAYMENT PROCEDURES

4.1 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments. Payment shall be based on percentage of work completed and cost of materials and equipment.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

B. Stored Materials: Include in Application for Payment amounts applied for acceptable, non-perishable materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

END OF SECTION 26 01 00

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. State of Maine Department of Transportation, "Standard Specifications," Revision December 2002, and any corrections, additions and revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.
2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.2 SUMMARY

A. Section Includes:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.3 DEFINITIONS

A. VFC: Variable frequency controller.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Alpha Wire.
2. Belden Inc.
3. Encore Wire Corporation.

4. General Cable Technologies Corporation.
5. Southwire Incorporated.

B. Aluminum and Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2, Type XHHW-2, and Type SO.

D. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for metal-clad cable, Type MC and type SO with ground wire.

2.2 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Hubbell Power Systems, Inc.
2. Ideal Industries, Inc.
3. Ilsco; a branch of Bardes Corporation.
4. NSi Industries LLC.
5. O-Z/Gedney; a brand of the EGS Electrical Group.
6. 3M; Electrical Markets Division.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

1. Compression pin terminal adapters shall be used at terminations for aluminum conductors.

B. Branch Circuits: Copper. Solid or stranded for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN-2-THWN-2, single conductors in raceway.

B. Exposed Feeders: Type THHN-2-THWN-2, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-2-THWN-2, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-2-THWN-2, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions:

1. Type THHN-2-THWN-2, single conductors in raceway

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.

H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

I. VFC Output Circuits: Type XHHW-2 in metal conduit.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 26 05 33 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Support cables according to Section 26 05 29 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 26 05 53 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly using materials listed for that purpose and installed according to their listing.

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and emergency system feeder conductors for compliance with requirements.
2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

B. Test and Inspection Reports: Prepare a written report to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

C. Cables will be considered defective if they do not pass tests and inspections.

PART 4 - PAYMENT PROCEDURES

4.1 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments. Payment shall be based on percentage of work completed and cost of materials and equipment.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.

2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

B. Stored Materials: Include in Application for Payment amounts applied for acceptable, non-perishable materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

END OF SECTION 26 05 19

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SECTION 26 05 23 - CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. State of Maine Department of Transportation, “Standard Specifications,” Revision December 2002, and any corrections, additions and revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.
2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.2 SUMMARY

A. Section Includes:

1. RS-485 cabling.
2. Low-voltage control cabling.
3. Control-circuit conductors.
4. Identification products.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

C. Plenum: A space forming part of the air distribution system to which one or more air ducts are connected. An air duct is a passageway, other than a plenum, for transporting air to or from heating, ventilating, or air-conditioning equipment.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.

B. Source quality-control reports.

C. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 PERFORMANCE REQUIREMENTS

A. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262 by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.

1. Flame Travel Distance: 60 inches (1520 mm) or less.
2. Peak Optical Smoke Density: 0.5 or less.
3. Average Optical Smoke Density: 0.15 or less.

B. Flame Travel and Smoke Density for Riser Cables in Non-Plenum Building Spaces: As determined by testing identical products according to UL 1666.

C. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.

2.3 RS-485 CABLE

A. Standard Cable: NFPA 70, Type CMR.

1. Paired, two pairs, twisted, No. 22 AWG, stranded (7x30) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1685.

2.4 LOW-VOLTAGE CONTROL CABLE

A. Paired Cable: NFPA 70, Type CMR.

1. Multi-pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1685.

2.5 CONTROL-CIRCUIT CONDUCTORS

A. Manufacturers: Subject to compliance with requirements available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Encore Wire Corporation.

2. General Cable Technologies Corporation.
3. Southwire Company.

B. Class 1 Control Circuits: Stranded copper, Type THHN-2-THWN-2, in raceway, complying with UL 83.

C. Class 2 Control Circuits: Stranded copper, Type THHN-2-THWN-2, in raceway, complying with UL 83.

D. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type THHN-2-THWN-2, in raceway complying with UL 83.

E. Class 2 Control Circuits and Class 3 Remote-Control and Signal Circuits That Supply Critical Circuits: Circuit Integrity (CI) cable.

1. Smoke control signaling and control circuits.

PART 3 - EXECUTION

3.1 INSTALLATION OF RACEWAYS AND BOXES

A. Comply with requirements in Section 26 05 33 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or modified in this Section.

1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

B. Comply with TIA-569-B for pull-box sizing and length of conduit and number of bends between pull points.

C. Install manufactured conduit sweeps and long-radius elbows if possible.

3.2 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1 and NFPA 70.

B. General Requirements for Cabling:

1. Terminate all conductors and optical fibers; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
2. Cables may not be spliced.
3. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
4. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems".
5. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
6. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps for heating.

7. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems". Monitor cable pull tensions.

C. Installation of Control-Circuit Conductors:

1. Install wiring in raceways except at cable trays and telecommunications racks. Comply with requirements specified in Section 26 05 33 "Raceways and Boxes for Electrical Systems."

D. Open-Cable Installation at cable trays and telecommunications racks:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.

E. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B recommendations for separating unshielded copper voice and data communications cable from potential EMI sources including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

   a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
   b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 12 inches (305 mm).
   c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 24 inches (600 mm).

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

   a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
   b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
   c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 12 inches (305 mm).

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

   a. Electrical Equipment or Circuit Rating Less Than 2 kVA: No requirement.
   b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 3 inches (75 mm).
   c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 6 inches (150 mm).

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or 5 HP and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.3 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits; No 14 AWG.
2. Class 2 low-energy, remote-control, and signal circuits; No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm, and signal circuits; No 12 AWG.

3.4 FIRESTOPPING

A. Comply with requirements in Division 07.

3.5 GROUNDING

A. For low-voltage control wiring and cabling, comply with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems."

3.6 IDENTIFICATION

A. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.7 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
2. Test cabling for direct-current loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not after cross-connection.

    a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

B. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.

C. End-to-end cabling will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

PART 4 - PAYMENT PROCEDURES

4.1 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments. Payment shall be based on percentage of work completed and cost of materials and equipment.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

B. Stored Materials: Include in Application for Payment amounts applied for acceptable, non-perishable materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

END OF SECTION 26 05 23

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. State of Maine Department of Transportation, “Standard Specifications,” Revision December 2002, and any corrections, additions and revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.
2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.2 SUMMARY

A. Section includes grounding and bonding systems and equipment.

B. Section includes grounding and bonding systems and equipment, plus the following special applications:

1. Underground distribution grounding.
2. Foundation steel electrodes.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

A. As-Built Data: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:

1. Test wells.
2. Ground rods.
3. Ground rings.
4. Grounding arrangements and connections for separately derived systems.

B. Qualification Data: For testing agency and testing agency's field supervisor.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Division 01, include the following:

    a. Instructions for periodic testing and inspection of grounding features at test wells, ground rings, and grounding connections for separately derived systems based on NETA MTS.

        1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
        2) Include recommended testing intervals.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Burndy; Part of Hubbell Electrical Systems.
2. ERICO International Corporation.
3. ILSCO.
4. O-Z/Gedney; A Brand of the EGS Electrical Group.

2.2 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.3 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.

3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.4 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless -type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.5 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet (19 mm by 3 m)

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 10 AWG and smaller, and stranded conductors for No. 8 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install barecopper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches (600 mm) below grade.
2. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation.

C. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches (150 mm) from the foundation.

3.4 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

D. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment

grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

E. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.5 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 26 05 43 "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches (300 mm) deep, with cover.

1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

G. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.

H. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.

1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
2. Bury ground ring not less than 24 inches (600 mm) from building's foundation.

I. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4 AWG.

1. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 5 ohms.

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

PART 4 - PAYMENT PROCEDURES

4.1 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments. Payment shall be based on percentage of work completed and cost of materials and equipment.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

B. Stored Materials: Include in Application for Payment amounts applied for acceptable, non-perishable materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

END OF SECTION 26 05 26

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SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. State of Maine Department of Transportation, “Standard Specifications,” Revision December 2002, and any corrections, additions and revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.
2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.2 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 ACTION SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.
2. Steel slotted channel systems. Include Product Data for components.
3. Equipment supports.

1.6 QUALITY ASSURANCE

A. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Cooper B-Line, Inc.; a division of Cooper Industries.
b. ERICO International Corporation.
c. Thomas & Betts Corporation.
d. Unistrut; Tyco International, Ltd.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) Cooper B-Line, Inc.; a division of Cooper Industries.
2) Empire Tool and Manufacturing Co., Inc.
3) Hilti Inc.
4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
5) MKT Fastening, LLC.

2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
5. Toggle Bolts: All-steel springhead type.
6. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slottedsupport system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps or single-bolt conduit clamps using spring friction action for retention in support channel.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
6. To Light Steel: Sheet metal screws.
7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete.

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

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

PART 4 - PAYMENT PROCEDURES

4.1 APPLICATIONS FOR PAYMENT

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END OF SECTION 26 05 29

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SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. State of Maine Department of Transportation, “Standard Specifications,” Revision December 2002, and any corrections, additions and revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.
2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.2 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Surface raceways.
5. Boxes, enclosures, and cabinets.
6. Handholes and boxes for exterior underground cabling.

B. Related Requirements:

1. Section 26 05 43 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

1.3 DEFINITIONS

A. GRC: Galvanized rigid steel conduit.

B. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

A. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Allied Tube & Conduit; a Tyco International Ltd. Co.
2. Anamet Electrical, Inc.
3. Electri-Flex Company.
4. O-Z/Gedney; a brand of EGS Electrical Group.
5. Robroy Industries.
6. Thomas & Betts Corporation.
7. Wheatland Tube Company; a division of John Maneely Company.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. IMC: Comply with ANSI C80.6 and UL 1242.

E. EMT: Comply with ANSI C80.3 and UL 797.

F. FMC: Comply with UL 1; zinc-coated steel or aluminum.

G. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Fittings for EMT:

a. Material: Steel.
b. Type: Setscrew or compression.

2. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

I. Joint Compound for IMC and GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.
3. CANTEX Inc.
4. CertainTeed Corp.
5. Kraloy.
6. Lamson & Sessions; Carlon Electrical Products.
7. RACO; a Hubbell company.
8. Thomas & Betts Corporation.

B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

D. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper B-Line, Inc.
2. Hoffman; a Pentair company.
3. Mono-Systems, Inc.
4. Square D; a brand of Schneider Electric.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Screw-cover type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.4 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Adalet.
2. Hoffman; a Pentair company.
3. Milbank Manufacturing Co.
4. RACO; a Hubbell Company.
5. Thomas & Betts Corporation.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy or aluminum, Type FD, with gasketed cover.

E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

F. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

G. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep) plus raised device cover or plaster ring sized to fit face of box flush with wall finish.

H. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

I. Cabinets:

1. NEMA 250, Type 1 galvanized-steel box unless otherwise indicated with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

2.5 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Armorcast Products Company.
b. Carson Industries LLC.
c. CDR Systems Corporation; Hubbell Power Systems.
d. NewBasis.
e. Oldcastle Precast, Inc.; Christy Concrete Products.
f. Synertech Moulded Products; a division of Oldcastle Precast, Inc.

2. Standard: Comply with SCTE 77.
3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "ELECTRIC.".
7. Handholes 12 Inches Wide by 24 Inches Long (300 mm Wide by 600 mm Long) and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.6 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC or IMC.
2. Concealed Conduit, Aboveground: EMT.
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried or concrete encased as indicated on the drawings.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:

    a. Areas subject to vehicle traffic up to 6’-0” above finished floor.

3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
5. Damp or Wet Locations: IMC.
6. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in damp or wet locations.

C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.
3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches (300 mm) of enclosures to which attached.

I. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

K. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

L. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

M. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

N. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

O. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

P. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

Q. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

R. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

S. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

T. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations.

U. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

V. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 for pipe less than 6 inches (150 mm) in nominal diameter.
2. Install backfill as specified in Division 31.
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31.
4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

5. Underground Warning Tape: Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.

D. Install handholes with bottom below frost line.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly using materials listed for that purpose and installed according to their listing.

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

PART 4 - PAYMENT PROCEDURES

4.1 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments. Payment shall be based on percentage of work completed and cost of materials and equipment.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

B. Stored Materials: Include in Application for Payment amounts applied for acceptable, non-perishable materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.

c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

END OF SECTION 26 05 33

SECTION 26 05 43-UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. State of Maine Department of Transportation, "Standard Specifications," Revision December 2002, and any corrections, additions and revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.
2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.2 SUMMARY

A. This Section includes the following:

1. Conduit, ducts, and duct accessories for direct-buried and concrete-encased duct banks, and in single duct runs.
2. Handholes and boxes.
3. Manholes.

1.3 DEFINITION

A. RNC: Rigid nonmetallic conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Duct-bank materials, including separators and miscellaneous components.
2. Ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
3. Accessories for manholes, handholes, boxes.
4. Warning tape.

B. Shop Drawings for Precast or Factory-Fabricated Underground Utility Structures: Include plans, elevations, sections, details, attachments to other work, and accessories, including the following:

1. Duct entry provisions, including locations and duct sizes.
2. Reinforcement details.
3. Frame and cover design and manhole frame support rings.
4. Ladder details.
5. Grounding details.
6. Dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.

7. Joint details.

C. Shop Drawings for Factory-Fabricated Handholes and Boxes Other Than Precast Concrete: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:

1. Duct entry provisions, including locations and duct sizes.
2. Cover design.
3. Grounding details.

1.5 INFORMATIONAL SUBMITTALS

A. Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures.

1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.
2. Drawings shall be signed and sealed by a qualified professional engineer.

B. Product Certificates: For concrete and steel used in precast concrete manholes and handholes, as required by ASTM C 858.

C. Qualification Data: For professional engineer and testing agency.

D. Source quality-control test reports.

E. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Comply with ANSI C2.

C. Comply with NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.

B. Store precast concrete and other factory-fabricated underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.

C. Lift and support precast concrete units only at designated lifting or supporting points.

1.8 PROJECT CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Owner no fewer than five days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Owner's written permission.

1.9 COORDINATION

A. Coordinate layout and installation of ducts, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field.

B. Coordinate elevations of ducts and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Architect.

PART 2 - PRODUCTS

2.1 CONDUIT

A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.

B. RNC: NEMA TC 2, Type EPC-40-PVC and Type EPC-80-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.2 PRECAST CONCRETE HANDHOLES AND BOXES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Carder Concrete Products.
2. Christy Concrete Products.
3. Elmhurst-Chicago Stone Co.
4. Oldcastle Precast Group.
5. Riverton Concrete Products; a division of Cretex Companies, Inc.
6. Utility Concrete Products, LLC.
7. Utility Vault Co.
8. Wausau Tile, Inc.

B. Comply with ASTM C 858 for design and manufacturing processes.

C. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.

1. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
2. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
3. Cover Legend: Molded lettering, As indicated for each service.
4. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
5. Extensions: Designed to mate with bottom of enclosure. Same material as enclosure.

    a. Extension shall provide increased depth of 12 inches (300 mm).

6. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.3 HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Description: Comply with SCTE 77.

1. Color: Gray.
2. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, As indicated for each service.
6. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have factory-installed inserts for cable racks and pulling-in irons.

B. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Armorcast Products Company.
    b. Carson Industries LLC.
    c. CDR Systems Corporation.
    d. NewBasis.

2.4 PRECAST MANHOLES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Carder Concrete Products.
2. Christy Concrete Products.
3. Elmhurst-Chicago Stone Co.
4. Oldcastle Precast Group.
5. Riverton Concrete Products; a division of Cretex Companies, Inc.
6. Utility Concrete Products, LLC.
7. Utility Vault Co.
8. Wausau Tile, Inc.

B. Comply with ASTM C 858, with structural design loading as specified in Part 3 "Underground Enclosure Application" Article and with interlocking mating sections, complete with accessories, hardware, and features.

1. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks plus an additional 12 inches (300 mm) vertically and horizontally to accommodate alignment variations.

a. Windows shall be located no less than 6 inches (150 mm) from interior surfaces of walls, floors, or roofs of manholes, but close enough to corners to facilitate racking of cables on walls.
b. Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
c. Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.

C. Concrete Knockout Panels: 1-1/2 to 2 inches (38 to 50 mm) thick, for future conduit entrance and sleeve for ground rod.

D. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

2.5 UTILITY STRUCTURE ACCESSORIES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Bilco Company (The).
2. Campbell Foundry Company.
3. McKinley Iron Works, Inc.
4. NewBasis.
5. Oldcastle Precast Group.
6. Riverton Concrete Products; a division of Cretex Companies, Inc..
7. Strongwell Corporation; Lenoir City Division.
8. Underground Devices, Inc.
9. Utility Concrete Products, LLC.

B. Manhole Frames, Covers, and Chimney Components: Comply with structural design loading specified for manhole.

1. Frame and Cover: Weatherproof, gray cast iron complying with ASTM A 48/A 48M, Class 30B with milled cover-to-frame bearing surfaces; diameter, 26 inches (660 mm).

a. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
b. Special Covers: Recess in face of cover designed to accept finish material in paved areas.

2. Cover Legend: Cast in. Selected to suit system.

a. Legend: "ELECTRIC-LV" for duct systems with power wires and cables for systems operating at 600 V and less.
b. Legend: "ELECTRIC-HV" for duct systems with medium-voltage cables.
c. Legend: "SIGNAL" for communications, data, and telephone duct systems.

3. Manhole Chimney Components: Precast concrete rings with dimensions matched to those of roof opening.

   a. Mortar for Chimney Ring and Frame and Cover Joints: Comply with ASTM C 270, Type M, except for quantities less than 2.0 cu. ft. (60 L) where packaged mix complying with ASTM C 387, Type M, may be used.

C. Manhole Sump Frame and Grate: ASTM A 48/A 48M, Class 30B, gray cast iron.

D. Pulling Eyes in Concrete Walls: Eyebolt with reinforcing-bar fastening insert, 2-inch- (50-mm-) diameter eye, and 1-by-4-inch (25-by-100-mm) bolt.

1. Working Load Embedded in 6-Inch (150-mm), 4000-psi (27.6-MPa) Concrete: 13,000-lbf (58-kN) minimum tension.

E. Pulling-In and Lifting Irons in Concrete Floors: 7/8-inch- (22-mm-) diameter, hot-dip galvanized, bent steel rod; stress relieved after forming; and fastened to reinforcing rod. Exposed triangular opening.

1. Ultimate Yield Strength: 40,000-lbf (180-kN) shear and 60,000-lbf (270-kN) tension.

F. Bolting Inserts for Concrete Utility Structure Cable Racks and Other Attachments: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; 1/2-inch (13-mm) ID by 2-3/4 inches (69 mm) deep, flared to 1-1/4 inches (32 mm) minimum at base.

1. Tested Ultimate Pullout Strength: 12,000 lbf (53 kN) minimum.

G. Expansion Anchors for Installation after Concrete Is Cast: Zinc-plated, carbon-steel-wedge type with stainless-steel expander clip with 1/2-inch (13-mm) bolt, 5300-lbf (24-kN) rated pullout strength, and minimum 6800-lbf (30-kN) rated shear strength.

H. Cable Rack Assembly: Steel, hot-dip galvanized, except insulators.

1. Stanchions: T-section or channel; 2-1/4-inch (57-mm) nominal size; punched with 14 holes on 1-1/2-inch (38-mm) centers for cable-arm attachment.
2. Arms: 1-1/2 inches (38 mm) wide, lengths ranging from 3 inches (75 mm) with 450-lb (204-kg) minimum capacity to 18 inches (460 mm) with 250-lb (114-kg) minimum capacity. Arms shall have slots along full length for cable ties and be arranged for secure mounting in horizontal position at any vertical location on stanchions.
3. Insulators: High-glaze, wet-process porcelain arranged for mounting on cable arms.

I. Cable Rack Assembly: Nonmetallic. Components fabricated from nonconductive, fiberglass-reinforced polymer.

1. Stanchions: Nominal 36 inches (900 mm) high by 4 inches (100 mm) wide, with minimum of 9 holes for arm attachment.
2. Arms: Arranged for secure, drop-in attachment in horizontal position at any location on cable stanchions, and capable of being locked in position. Arms shall be available in lengths ranging from 3 inches (75 mm) with 450-lb (204-kg) minimum capacity to 20 inches (508 mm) with 250-lb (114-kg) minimum capacity. Top of arm shall be nominally 4 inches (100 mm) wide, and arm shall have slots along full length for cable ties.

J. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F (2 deg C). Capable of withstanding temperature of 300 deg F (150 deg C) without slump and adhering to clean surfaces of plastic ducts,

metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.

K. Fixed Manhole Ladders: Arranged for attachment to wall of manhole. Ladder and mounting brackets and braces shall be fabricated from hot-dip galvanized steel.

L. Cover Hooks: Heavy duty, designed for lifts 60 lbf (270 N) and greater. Two required.

2.6 SOURCE QUALITY CONTROL

A. Test and inspect precast concrete utility structures according to ASTM C 1037.

B. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by a independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or the manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 GENERAL

A. Comply with utility company specifications and requirements for ducts, raceways, and enclosures for use by utility companies.

3.2 UNDERGROUND DUCT APPLICATION

A. Ducts for Electrical Cables Over 600 V: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank, unless otherwise indicated.

B. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-40-PVC for normal feeders and EPC-80-PVC for emergency feeders, in direct-buried duct bank where not under paved driveways or roadways, unless otherwise indicated. Duct banks shall be concrete encased where installed under paved driveways or roadways.

C. Ducts for Electrical Branch Circuits: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank, unless otherwise indicated.

D. Underground Ducts for Telephone, Communications, or Data Utility Service Cables: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank, unless otherwise indicated.

E. Underground Ducts Crossing Paved Paths, Walks, Driveways, and Roadways: RNC, NEMA Type EPC-40-PVC, encased in reinforced concrete.

3.3 UNDERGROUND ENCLOSURE APPLICATION

A. Handholes and Boxes for 600 V and Less, Including Telephone, Communications, and Data Wiring:

1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-20 structural load rating.
2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H-20 structural load rating.
3. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer concrete units, SCTE 77, Tier 8 structural load rating.

B. Manholes: Precast or cast-in-place concrete.

1. Units Located in Roadways and Other Deliberate Traffic Paths by Heavy or Medium Vehicles: H-20 structural load rating according to AASHTO HB 17.
2. Units Not Located in Deliberate Traffic Paths by Heavy or Medium Vehicles: H-10 load rating according to AASHTO HB 17.

3.4 EARTHWORK

A. Excavation and Backfill: Comply with Division 31, but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 32.

D. Cut and patch existing pavement in the path of underground ducts and utility structures according to Division 01.

3.5 DUCT INSTALLATION

A. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions.

B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches (1220 mm), both horizontally and vertically, at other locations, unless otherwise indicated.

C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

D. Duct Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches (250 mm) o.c. for 5-inch (125-mm) ducts, and vary proportionately for other duct sizes.

1. Begin change from regular spacing to end-bell spacing 10 feet (3 m) from the end bell without reducing duct line slope and without forming a trap in the line.
2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole.
3. Grout end bells into structure walls from both sides to provide watertight entrances.

E. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet (3 m) outside the building wall without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

F. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig (1.03-MPa) hydrostatic pressure.

G. Pulling Cord: Install 100-lbf- (445-N-) test nylon cord in ducts, including spares.

H. Concrete-Encased Ducts: Support ducts on duct separators.

1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than 5 spacers per 20 feet (6 m) of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches (150 mm) between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
2. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.

    a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
    b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch (19-mm) reinforcing rod dowels extending 18 inches (450 mm) into concrete on both sides of joint near corners of envelope.

3. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.
4. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
5. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
6. Depth: Install top of duct bank at least 24 inches (600 mm) below finished grade in areas not subject to deliberate traffic, and at least 30 inches (750 mm) below finished grade in deliberate traffic paths for vehicles, unless otherwise indicated.
7. Stub-Ups: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.

b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of base. Install insulated grounding bushings on terminations at equipment.

8. Warning Tape: Bury warning tape approximately 12 inches (300 mm) above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches (75 mm) of the centerline of duct bank. Provide an additional warning tape for each 12-inch (300-mm) increment of duct-bank width over a nominal 18 inches (450 mm). Space additional tapes 12 inches (300 mm) apart, horizontally.

I. Direct-Buried Duct Banks:

1. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
2. Space separators close enough to prevent sagging and deforming of ducts, with not less than 5 spacers per 20 feet (6 m) of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches (150 mm) between tiers.
3. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Division 31 for pipes less than 6 inches (150 mm) in nominal diameter.
4. Install backfill as specified in Division 31.
5. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand-place backfill to 4 inches (100 mm) over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction as specified in Division 31.
6. Depth: Install top of duct bank at least 36 inches (900 mm) below finished grade, unless otherwise indicated.
7. Set elevation of bottom of duct bank below the frost line.
8. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

3.6 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES

A. Cast-in-Place Manhole Installation:

1. Finish interior surfaces with a smooth-troweled finish.
2. Windows for Future Duct Connections: Form and pour concrete knockout panels 1-1/2 to 2 inches (38 to 50 mm) thick, arranged as indicated.
3. Cast-in-place concrete, formwork, and reinforcement are specified in Division 03.

B. Precast Concrete Handhole and Manhole Installation:

1. Comply with ASTM C 891, unless otherwise indicated.
2. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.

3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch (25-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevations:

1. Manhole Roof: Install with rooftop at least 15 inches (380 mm) below finished grade.
2. Manhole Frame: In paved areas and trafficways, set frames flush with finished grade. Set other manhole frames 1 inch (25 mm) above finished grade.
3. Install handholes with bottom below the frost line.
4. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade.
5. Where indicated, cast handhole cover frame integrally with handhole structure.

D. Drainage: Install drains in bottom of manholes where indicated. Coordinate with drainage provisions indicated.

E. Manhole Access: Circular opening in manhole roof; sized to match cover size.

1. Manholes with Fixed Ladders: Offset access opening from manhole centerlines to align with ladder.
2. Install chimney, constructed of precast concrete collars and rings to support frame and cover and to connect cover with manhole roof opening. Provide moisture-tight masonry joints and waterproof grouting for cast-iron frame to chimney.

F. Waterproofing: Apply waterproofing to exterior surfaces of manholes after concrete has cured at least three days. Waterproofing materials and installation are specified in Division 07. After ducts have been connected and grouted, and before backfilling, waterproof joints and connections and touch up abrasions and scars. Waterproof exterior of manhole chimneys after mortar has cured at least three days.

G. Hardware: Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.

H. Fixed Manhole Ladders: Arrange to provide for safe entry with maximum clearance from cables and other items in manholes.

I. Field-Installed Bolting Anchors in Manholes and Concrete Handholes: Do not drill deeper than 3-7/8 inches (98 mm) for manholes and 2 inches (50 mm) for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

J. Warning Sign: Install "Confined Space Hazard" warning sign on the inside surface of each manhole cover.

3.7 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.7-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas and trafficways, set so cover surface will be flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade.

D. Install handholes and boxes with bottom below the frost line, below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

F. Field-cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

G. For enclosures installed in asphalt paving and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.

1. Concrete: 3000 psi (20 kPa), 28-day strength, complying with Division 03, with a troweled finish.
2. Dimensions: 10 inches wide by 12 inches deep (250 mm wide by 300 mm deep).

3.8 GROUNDING

A. Ground underground ducts and utility structures according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

3.9 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
3. Test manhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 26 05 26 "Grounding and Bonding for Electrical Systems."

B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.10 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of manholes, including sump. Remove foreign material.

PART 4 - PAYMENT PROCEDURES

4.1 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments. Payment shall be based on percentage of work completed and cost of materials and equipment.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

B. Stored Materials: Include in Application for Payment amounts applied for acceptable, non-perishable materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

END OF SECTION 26 05 43

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SECTION 26 05 44 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. State of Maine Department of Transportation, “Standard Specifications,” Revision December 2002, and any corrections, additions and revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.
2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves for cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).

b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Advance Products & Systems, Inc.
b. CALPICO, Inc.
c. Metraflex Company (The).
d. Pipeline Seal and Insulator, Inc.
e. Proco Products, Inc.

2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel.
4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating or Stainless steel of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Presealed Systems.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Cables Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

   a. Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07.
   b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Cables Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel or cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

F. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

PART 4 - PAYMENT PROCEDURES

4.1 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments. Payment shall be based on percentage of work completed and cost of materials and equipment.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

B. Stored Materials: Include in Application for Payment amounts applied for acceptable, non-perishable materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.

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c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

END OF SECTION 26 05 44

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SECTION 26 05 48 - VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. State of Maine Department of Transportation, “Standard Specifications,” Revision December 2002, and any corrections, additions and revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.
2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.2 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Spring isolators.
3. Restrained spring isolators.
4. Channel support systems.
5. Restraint cables.
6. Hanger rod stiffeners.
7. Anchorage bushings and washers.

B. Related Sections include the following:

1. Section 26 05 29 "Hangers and Supports for Electrical Systems" for commonly used electrical supports and installation requirements.

1.3 DEFINITIONS

A. The IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 PERFORMANCE REQUIREMENTS

A. NOTE: This information is copied from Structural Drawing S000 dated 01/23/2014.

B. Building Code

1. Maine Uniform Building And Energy Code

2. International Building Code, 2009 Edition
3. ASCE 7-05 Minimum Design Loads For Buildings And Other Structures

C. Wind-Restraint Loading (outdoor equipment):

1. Basic Wind Speed: 95 Mph
2. Wind Load Importance Factor (Iw): 1.0
3. Wind Exposure: B

D. Seismic-Restraint Loading:

1. Building Category: II – Standard.
2. Mapped Spectral Response Accelerations:

   a. Ss: 0.292
   b. S1: 0.077

3. Seismic Site Class: E
4. Maximum Considered Earthquake ACC @ 5% Damped Design:

   a. Sds: 0.461
   b. Sdl: 0.180

5. Seismic Design Category: C
6. Importance Factor (Ip): A factor assigned to each structure according to its occupancy category as prescribed in Section 11 .5 .1 of ASCE/SEI 7-05. The following components are Ip= 1.5:

   a. Fire alarm system
   b. Generator and emergency power distribution system.

1.5 ACTION SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

   a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
   b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators and seismic restraints.

a. Coordinate design calculations with wind-load calculations required for equipment mounted outdoors. Comply with requirements in other electrical Sections for equipment mounted outdoors.

2. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.
3. Field-fabricated supports.
4. Seismic-Restraint Details:

a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
c. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.

B. Qualification Data: For professional engineer.

C. Welding certificates.

D. Field quality-control test reports.

1.7 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

D. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.
3. California Dynamics Corporation.
4. Isolation Technology, Inc.
5. Kinetics Noise Control.
6. Mason Industries.
7. Vibration Eliminator Co., Inc.
8. Vibration Isolation.
9. Vibration Mountings & Controls, Inc.

B. Pads: Arrange in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene, rubber, or hermetically sealed compressed fiberglass.

C. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- (6-mm-) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa).
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

D. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Seismic or limit-stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.2 SEISMIC-RESTRAINT DEVICES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. Cooper B-Line, Inc.; a division of Cooper Industries.
4. Hilti Inc.
5. Loos & Co.; Seismic Earthquake Division.
6. Mason Industries.
7. TOLCO Incorporated; a brand of NIBCO INC.
8. Unistrut; Tyco International, Ltd.

B. General Requirements for Restraint Components: Rated strengths, features, and application requirements shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

D. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or Reinforcing steel angle clamped to hanger rod. Do not weld stiffeners to rods.

F. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchors and studs.

G. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices.

H. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

I. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

J. Adhesive Anchor: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.3 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Strength of Support and Seismic-Restraint Assemblies: Sselect sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment and Hanger Restraints:

1. Install restrained isolators on electrical equipment where specified in other Division 26 sections.
2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

D. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust isolators after isolated equipment is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

PART 4 - PAYMENT PROCEDURES

4.1 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments. Payment shall be based on percentage of work completed and cost of materials and equipment.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

B. Stored Materials: Include in Application for Payment amounts applied for acceptable, non-perishable materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

END OF SECTION 26 05 48

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. State of Maine Department of Transportation, “Standard Specifications,” Revision December 2002, and any corrections, additions and revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.
2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.2 SUMMARY

A. Section Includes:

1. Identification for conductors.
2. Underground-line warning tape.
3. Warning labels and signs.
4. Equipment identification labels.
5. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams,

and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

B. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted, 3-mil- (0.08-mm-) thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-resistant, self-laminating, protective shield over the legend. Labels sized to fit the conductor diameter such that the clear shield overlaps the entire printed legend.

C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of conductor it identifies and to stay in place by gripping action.

D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve with diameter sized to suit diameter of conductor it identifies and to stay in place by gripping action.

E. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

F. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Labels for Tags: Self-adhesive label, machine-printed with permanent, waterproof, black ink recommended by printer manufacturer, sized for attachment to tag.

2.2 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
4. Pigmented polyolefin, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
5. Thickness: 4 mils (0.1 mm).
6. Weight: 18.5 lb/1000 sq. ft. (9.0 kg/100 sq. m).
7. 3-Inch (75-mm) Tensile According to ASTM D 882: 30 lbf (133.4 N), and 2500 psi (17.2 MPa).

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE,.
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE,.

2.3 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 7 by 10 inches (180 by 250 mm).

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 10 by 14 inches (250 by 360 mm).

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD."

2.4 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).

C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

2.5 EQUIPMENT IDENTIFICATION LABELS

A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

B. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

2.6 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black except where used for color-coding.

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

G. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.

3.2 IDENTIFICATION SCHEDULE

A. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.

a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.

b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

c. Colors for 480/277-V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

B. Power-Circuit Conductor Identification, More than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic plastic tag holder with adhesive-backed phase tags, and a separate tag with the circuit designation.

C. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

D. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, self-adhesive, self-laminating polyester labels with the conductor or cable designation, origin, and destination.

E. Control-Circuit Conductor Termination Identification: For identification at terminations provide self-adhesive, self-laminating polyester labels with the conductor designation.

F. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.

G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Install underground-line warning tape for both direct-buried cables and cables in raceway.

H. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

I. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to

disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

   a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
   b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
   c. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

   a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved, laminated acrylic or melamine label.
   b. Enclosures and electrical cabinets.
   c. Access doors and panels for concealed electrical items.
   d. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
   e. Enclosed switches.
   f. Enclosed circuit breakers.
   g. Enclosed controllers.

PART 4 - PAYMENT PROCEDURES

4.1 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments. Payment shall be based on percentage of work completed and cost of materials and equipment.

   1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
   2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
   3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

B. Stored Materials: Include in Application for Payment amounts applied for acceptable, non-perishable materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

   1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
   2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.

3. Provide summary documentation for stored materials indicating the following:

   a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
   b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
   c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

END OF SECTION 26 05 53

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SECTION 26 05 72 - OVERCURRENT PROTECTIVE DEVICE SHORT-CIRCUIT STUDY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. State of Maine Department of Transportation, "Standard Specifications," Revision December 2002, and any corrections, additions and revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.
2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.2 SUMMARY

A. Section includes a computer-based, fault-current study to determine the minimum interrupting capacity of circuit protective devices.

1.3 DEFINITIONS

A. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

B. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

C. SCCR: Short-circuit current rating.

D. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.4 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: Submit the following after the approval of system protective devices submittals. Submittals may be in digital form.

1. Short-circuit study input data, including completed computer program input data sheets.
2. Short-circuit study and equipment evaluation report; signed, dated, and sealed by a qualified professional engineer.

    a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment

manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

b. Revised single-line diagram, reflecting field investigation results and results of short-circuit study.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Short-Circuit Study Specialist

B. Product Certificates: For short-circuit study software, certifying compliance with IEEE 399.

1.6 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

B. Short-Circuit Study Specialist Qualifications: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE

A. Software Developers: Subject to compliance with requirements, provide software by one of the following:

1. ESA Inc
2. Operation Technology, Inc.
3. Power Analytics, Corporation.
4. SKM Systems Analysis, Inc.

B. Comply with IEEE 399 and IEEE 551.

C. Analytical features of fault-current-study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

D. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output.

2.2 SHORT-CIRCUIT STUDY REPORT CONTENTS

A. Executive summary.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of the computer printout.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Cable size and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations.

D. Comments and recommendations for system improvements, where needed.

E. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short-circuit ratings.
2. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
3. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
4. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
5. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

F. Short-Circuit Study Input Data: As described in "Power System Data" Article in the Evaluations.

G. Short-Circuit Study Output:

1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

    a. Voltage.
    b. Calculated fault-current magnitude and angle.
    c. Fault-point X/R ratio.
    d. Equivalent impedance.

2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

    a. Voltage.
    b. Calculated symmetrical fault-current magnitude and angle.
    c. Fault-point X/R ratio.
    d. Calculated asymmetrical fault currents:

        1) Based on fault-point X/R ratio.
        2) Based on calculated symmetrical value multiplied by 1.6.
        3) Based on calculated symmetrical value multiplied by 2.7.

3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

    a. Voltage.
    b. Calculated symmetrical fault-current magnitude and angle.
    c. Fault-point X/R ratio.

d. No AC Decrement (NACD) ratio.
e. Equivalent impedance.
f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Obtain all data necessary for the conduct of the study.

1. Verify completeness of data supplied on the one-line diagram. Call any discrepancies to the attention of Architect.
2. For equipment provided that is Work of this Project, use characteristics submitted under the provisions of action submittals and information submittals for this Project.

B. Gather and tabulate the following input data to support the short-circuit study. Comply with recommendations in IEEE 551 as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Product Data for Project's overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Obtain electrical power utility impedance at the service.
3. Power sources and ties.
4. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
5. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
6. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip, SCCR, current rating, and breaker settings.
7. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
8. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
9. Motor horsepower and NEMA MG 1 code letter designation.
10. Cable sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).

3.2 SHORT-CIRCUIT STUDY

A. Perform study following the general study procedures contained in IEEE 399.

B. Calculate short-circuit currents according to IEEE 551.

C. Base study on the device characteristics supplied by device manufacturer.

D. The extent of the electrical power system to be studied is indicated on Drawings.

E. Begin short-circuit current analysis at the service, extending down to the system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 10 kA or less.
2. Exclude equipment rated 240-V ac or less when supplied by a single transformer rated less than 125 kVA.

F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

G. The calculations shall include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and shall apply to low- and medium-voltage, three-phase ac systems. The calculations shall also account for the fault-current dc decrement, to address the asymmetrical requirements of the interrupting equipment.

1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

H. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each of the following:

1. Electric utility's supply termination point.
2. Incoming switchgear.
3. Unit substation primary and secondary terminals.
4. Low-voltage switchgear.
5. Motor-control centers.
6. Control panels.
7. Standby generators and automatic transfer switches.
8. Branch circuit panelboards.
9. Disconnect switches.

3.3 ADJUSTING

A. Make minor modifications to equipment as required to accomplish compliance with short-circuit study.

3.4 DEMONSTRATION

A. Train Owner's operating and maintenance personnel in the use of study results.

PART 4 - PAYMENT PROCEDURES

4.1 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments. Payment shall be based on percentage of work completed and cost of materials and equipment.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.

2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

B. Stored Materials: Include in Application for Payment amounts applied for acceptable, non-perishable materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

END OF SECTION 26 05 72

SECTION 26 08 01-COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. State of Maine Department of Transportation, “Standard Specifications,” Revision December 2002, and any corrections, additions and revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.
2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.2 SUMMARY

A. This Section describes the requirements for start-up and commissioning for Division 26 installed work.

B. Electrical systems to be commissioned:

1. Lighting system
2. Lighting control system.
3. Emegency Generator System.

C. Related Sections:

1. Section 01 91 13 "General Commissioning Requirements" for general commissioning process requirements.

1.3 DEFINITIONS

A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

B. Commissioning: A systematic process confirming that building systems have been installed, properly started, and consistently operated in strict accordance with the Contract Documents, that all systems are complete and functioning in accordance with the Contract Documents at Substantial Completion, and that Contractor has provided Owner adequate system documentation and training. Commissioning includes deferred and/or seasonal tests as approved by Owner.

C. CxA: Commissioning Authority.

D. Deferred Tests: Functional Performance or Integrated System Tests performed after Substantial Completion due to partial occupancy, partial equipment acceptance, seasonal requirements, design, or other Site conditions that prohibit the test from being performed prior to Substantial Completion.

E. Deficiency: Condition of a component, piece of equipment or system that is not in compliance with Contract Documents.

F. Factory Testing: Testing of equipment at the factory, by factory personnel with an Owner's representative present if deemed necessary by Owner.

G. Functional Performance Test Procedures: Commissioning protocols and detailed test procedures and instructions in tabular and script-type format that fully describe system configuration and steps required to determine if the system is performing and functioning properly. Contractor prepares these procedures to document Functional Performance Tests.

H. Functional Performance Test (FPT): Test of dynamic function and operation of equipment and systems executed by Contractor. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, life safety conditions, power failure, etc. Systems are run through all specified sequences of operation. Components are verified to be responding in accordance with Contract Documents. Functional Performance Tests are executed after start-ups and Prefunctional Checklists are complete.

I. Integrated System Test: Test of dynamic function and operation of multiple systems. Integrated System Tests are tested under various modes, such as fire alarm and emergency situations, life safety conditions, power failure, etc. Systems are integrally operated through all specified sequences of operation. Components are verified to be responding in accordance with Contract Documents. Integrated System Tests are executed after Functional Performance Tests are complete and prior to Substantial Completion. Integrated System Tests provide verification that the integrated systems will properly function according to the Contract Documents.

J. Integrated System Test Procedures: Commissioning protocols and detailed test procedures and instructions in tabular and script-type format that fully describe system configurations and steps required to determine if the interacting systems are performing and functioning properly. Contractor prepares these procedures to document Integrated System Tests.

K. Lighting Systems: Interior and exterior lighting control systems including occupancy sensors, time clocks, photocells and BAS interface.

L. Emergency Generator System: Generator, automatic transfer switches, and associated controls and wiring.

M. Prefunctional Checklist: A list of static inspections and material or component tests that verify proper installation of equipment (e.g., belt tension, oil levels, labels affixed, gages in place, sensors calibrated, etc.). The word Prefunctional refers to before Functional tests. Prefunctional Checklists must include the manufacturer's Start-up checklist(s). Contractor shall sign Prefunctional Checklists as complete and submit with the Request for Start-up/Functional Performance Test Form.

N. Start-up: The activities where equipment is initially energized, tested, and operated. Start-up is completed prior to Functional Performance Tests.

O. Test Requirements: Requirements specifying what systems, modes and functions, etc. must be tested. Test requirements are not detailed test procedures. Test requirements and acceptance criteria are specified in the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Submittals shall comply with the requirements of the Construction Contract Clauses, Division 01, and the individual sections specifying the work.

B. Prefunctional Checklists of readiness.

C. Prefunctional Checklists of completion of installation, prestart, and startup activities.

1.5 CONTRACTOR'S RESPONSIBILITIES

A. Perform commissioning tests at the direction of the CxA.

B. Attend construction phase coordination meeting.

C. Attend testing, adjusting, and balancing review and coordination meeting.

D. Participate in systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.

E. Provide information requested by the CxA for final commissioning documentation.

F. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

1.6 CxA'S RESPONSIBILITIES

A. Provide Project-specific construction checklists and commissioning process test procedures for systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.

B. Direct commissioning testing.

C. Verify testing, adjusting, and balancing of Work are complete.

D. Provide test data, inspection reports, and certificates in Systems Manual.

1.7 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CxA for inclusion in the commissioning plan:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for systems, assemblies, equipment, and components to be verified and tested.
4. Prefunctional Checklists certifying that installation, prestart checks, and startup procedures have been completed.
5. Prefunctional Checklists certifying that systems, subsystems, equipment, and associated controls are ready for testing.
6. Test and inspection reports and certificates.
7. Corrective action documents.

8. Verification of testing and adjusting reports.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TESTING PREPARATION

A. Certify that systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify that instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

C. Certify that testing and adjusting procedures have been completed and that testing and adjusting reports have been submitted, discrepancies corrected, and corrective work approved.

D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, emergency power, and alarm conditions).

E. Inspect and verify the position of each device and interlock identified on checklists.

F. Check safety cutouts and interlocks during each mode of operation.

G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.2 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.

B. Scope of lighting control system testing shall include lighting system installation for all interior spaces and exterior.

C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response.

D. The CxA in cooperation with the Contractor shall prepare detailed testing plans, procedures, and checklists for systems, subsystems, and equipment.

E. Tests will be performed using design conditions whenever possible.

F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

G. The CxA may direct that set points be altered when simulating conditions is not practical.

H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

I. If tests cannot be completed because of a deficiency outside the scope of the system to be commissioned, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

3.3 ELECTRICAL SYSTEM COMMISSIONING

A. Perform commissioning work after equipment is installed and system is ready for operation.

B. Perform commissioning work in accordance with equipment manufacturer's standard procedures and check lists.

3.4 CHECKLIST

1. Prior to Functional Performance Test:

    a. System in place, including all components indicated, and tested.
    b. Connected to facility power system on a permanent basis.

2. Personnel to be present or assist as required to Perform Functional Performance Test:

    a. Electrical Contractor, sub-contractors and specialty contractors as required.
    b. Owner’s Representative's Project Manager/Representative and/or Inspector of Record (I.O.R.).
    c. Owner’s maintenance staff, as desired.
    d. Design Engineer.

3. Functional Performance Test: Demonstrate operation of normal power distribution system per specifications including the following:

    a. Verify performance meets the specified design intent.

4. Results:

    a. If specified equipment performance is not verified, the contractor shall have corrections made and reschedule Functional performance Test as soon as possible after corrective work is completed.

3.5 DOCUMENTATION

1. All prefunctional and functional testing documentation as well as a final commissioning report shall be prepared and delivered to the owner per the commissioning contract.

PART 4 - PAYMENT PROCEDURES

4.1 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments. Payment shall be based on percentage of work completed and cost of materials and equipment.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

B. Stored Materials: Include in Application for Payment amounts applied for acceptable, non-perishable materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

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    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

END OF SECTION 26 08 01

SECTION 26 09 23 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. State of Maine Department of Transportation, "Standard Specifications," Revision December 2002, and any corrections, additions and revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.
2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.2 SUMMARY

A. Section Includes:

1. Photoelectric switches.
2. Indoor occupancy sensors.
3. Lighting contactors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show installation details for occupancy and light-level sensors.

1. Interconnection diagrams showing field-installed wiring.
2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 OUTDOOR PHOTOELECTRIC SWITCHES

A. Manufacturers: Subject to compliance with requirements available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper Industries, Inc.
2. Intermatic, Inc.
3. NSi Industries LLC; TORK Products.
4. Tyco Electronics; ALR Brand.

B. Description: Solid state, with SPST dry contacts rated for 1800 VA, to operate connected load, complying with UL 773.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lux), with an adjustment for turn-on and turn-off levels within that range.
3. Time Delay: Thirty-second minimum, to prevent false operation.
4. Lightning Arrester: Air-gap type.

2.2 INDOOR OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Bryant Electric; a Hubbell company.
2. Cooper Industries, Inc.
3. Hubbell Building Automation, Inc.
4. Leviton Mfg. Company Inc.
5. Lithonia Lighting; Acuity Lighting Group, Inc.
6. Lutron Electronics Co., Inc.
7. Sensor Switch, Inc.
8. Square D; a brand of Schneider Electric.

B. General Requirements for Sensors: Ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
5. Mounting:

    a. Sensor: Suitable for mounting in any position on a standard outlet box.

b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
7. Bypass Switch: Override the "on" function in case of sensor failure.
8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux); turn lights off when selected lighting level is present.

C. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.

2.3 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Hubbell H-MOSS or comparable product by one of the following:

1. Cooper Industries, Inc.
2. Leviton Mfg. Company Inc.
3. Lightolier Controls.
4. Sensor Switch, Inc.
5. Watt Stopper.

B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application[,
2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F (0 to 49 deg C).
3. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent.

C. Wall-Switch Sensor Tag OS:

1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 1000 sq. ft. (84 sq. m).
2. Sensing Technology: Dual technology - PIR and ultrasonic.
3. Switch Type: SP, field selectable automatic "on," or manual "on" automatic "off."
4. Voltage: Match the circuit voltage type.
5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc (108 to 1600 lux). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.

7. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.

D. Wall-Switch Sensor Tag OS2:

1. Standard Range: 180-degree field of view, with a minimum coverage area of 1000 sq. ft. (84 sq. m).
2. Sensing Technology: Dual technology - PIR and ultrasonic.
3. Switch Type: SP, dual circuit, field selectable automatic "on," or manual "on" automatic "off."
4. Voltage: Match the circuit voltage; type.
5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc (108 to 1600 lux). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
7. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.

2.4 LIGHTING CONTACTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Allen-Bradley/Rockwell Automation.
2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
3. Eaton Corporation.
4. General Electric Company; GE Consumer & Industrial - Electrical Distribution; Total Lighting Control.
5. Square D; a brand of Schneider Electric.

B. Description: Electrically operated and mechanically held, combination-type lighting contactors complying with NEMA ICS 2 and UL 508.

1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
3. Enclosure: Comply with NEMA 250.
4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.
5. Where two-wire maintained switch control is indicated, provide solid-state control modules as required for indicated switching arrangement.

2.5 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 16 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller thanNo. 14 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 WIRING INSTALLATION

A. Wiring Method: Comply with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch (13 mm).

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION

A. Identify components and power and control wiring according to Section 26 05 53 "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Lighting control devices will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.

3.6 DEMONSTRATION

A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control systems specified in Section 26 09 43 "Network Lighting Controls."

B. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

PART 4 - PAYMENT PROCEDURES

4.1 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments. Payment shall be based on percentage of work completed and cost of materials and equipment.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

B. Stored Materials: Include in Application for Payment amounts applied for acceptable, non-perishable materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.

c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

END OF SECTION 26 09 23

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SECTION 26 09 43-NETWORK LIGHTING CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. State of Maine Department of Transportation, “Standard Specifications,” Revision December 2002, and any corrections, additions and revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.
2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.2 SUMMARY

A. Section includes manually operated lighting controls with relays, time clock, photocell control, external source relays and control module.

B. Related Sections:

1. Section 26 09 23 "Lighting Control Devices" for photoelectric sensors, occupancy sensors, and multipole contactors.

1.3 DEFINITIONS

A. BACnet: A networking communication protocol that complies with ASHRAE 135.

B. BAS: Building automation system.

C. LonWorks: A control network technology platform for designing and implementing interoperable control devices and networks.

D. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling and power-limited circuits.

E. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.

F. PC: Personal computer; sometimes plural as "PCs."

G. Power Line Carrier: Use of radio-frequency energy to transmit information over transmission lines whose primary purpose is the transmission of power.

H. RS-485: A serial network protocol, similar to RS-232, complying with TIA-485-A.

I. UTP: Unshielded twisted pair.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for control modules, power distribution components, manual switches and plates, and conductors and cables.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Outline Drawings: Indicate dimensions, weights, arrangement of components, and clearance and access requirements.
3. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.
4. Wiring Diagrams: For power, signal, and control wiring. Coordinate nomenclature and presentation with a block diagram.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems specified in other Sections.

1. Show interconnecting signal and control wiring and interfacing devices that prove compatibility of inputs and outputs.
2. For networked controls, list network protocols and provide statements from manufacturers that input and output devices meet interoperability requirements of the network protocol.

B. Field quality-control reports.

C. Software licenses and upgrades required by and installed for operation and programming of digital and analog devices.

D. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lighting controls to include in emergency, operation, and maintenance manuals.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain lighting control module and power distribution components through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with 47 CFR, Subparts A and B, for Class A digital devices.

D. Comply with NFPA 70.

1.8 COORDINATION

A. Coordinate lighting control components to form an integrated interconnection of compatible components.

1. Match components and interconnections for optimum performance of lighting control functions.

B. Coordinate lighting control components specified in this Section with components specified in Section 26 24 16 "Panelboards."

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of lighting controls that fail in materials or workmanship or from transient voltage surges within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of software input/output to execute switching or dimming commands.
b. Failure of modular relays to operate under manual or software commands.
c. Damage of electronic components due to transient voltage surges.

2. Warranty Period: Two years from date of Substantial Completion.
3. Extended Warranty Period Failure Due to Transient Voltage Surges: five years.
4. Extended Warranty Period for Electrically Held Relays: 10 years from date of Substantial Completion.

1.10 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning with Substantial Completion, provide software support for two years.

B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of the software.

1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Hubbell LX series or comparable product by one of the following:

1. Acuity Brands Lighting, Inc.; Lithonia Lighting brand.
2. Cooper Controls
3. Leviton Mfg. Company Inc.
4. Lighting Control & Design, Inc.
5. Lightolier Controls; a division of Genlyte Group, LLC.
6. Lutron Electronics Co., Inc.

2.2 SYSTEM REQUIREMENTS

A. Expandability: System shall be capable of increasing the number of control functions in the future by 25 percent of current capacity; to include equipment ratings, housing capacities, spare relays, terminals, number of conductors in control cables, and control software.

B. Performance Requirements: Manual switches, an internal timing and control unit, and external sensors or other control signal sources send a signal to a PC-based network-system control module that processes the signal according to its programming and routes an open or close command to one or more relays in the power-supply circuits, or routes variable commands to one or more dimmers, for groups of lighting fixtures or other loads.

2.3 CONTROL MODULE

A. Control Module Description: Comply with UL 508 (CAN/CSA C22.2, No. 14); microprocessor-based, networked, control unit; mounted in preassembled, modular relay panel. Low-voltage-controlled, latching-type, single-pole lighting circuit relays shall be prime output circuit devices. Where indicated, a limited number of digital or analog, low-voltage control-circuit outputs shall be supported by control unit and circuit boards associated with relays. Control units shall be capable of receiving inputs from sensors and other sources. Line-voltage components and wiring shall be separated from low-voltage components and wiring by barriers. Control module shall be locally programmable.

2.4 POWER DISTRIBUTION COMPONENTS

A. Modular Relay Panel: Comply with UL 508 (CAN/CSA C22.2, No. 14) and UL 916 (CSA C22.2, No. 205); factory assembled with modular single-pole relays, power supplies, and accessory components required for specified performance.

1. Cabinet: Steel with hinged, locking door.

a. Barriers separate low-voltage and line-voltage components.
b. Directory: Mounted on back of door. Identifies each relay as to load groups controlled and each programmed pilot device if any.
c. Control Power Supply: Transformer and full-wave rectifier with filtered dc output.

2. Single-Pole Relays: Mechanically held unless otherwise indicated; split-coil, momentary-pulsed type.

    a. Low-Voltage Leads: Plug connector to the connector strip in cabinet and pilot light power where indicated.
    b. Rated Capacity (Mounted in Relay Panel): 20 A, 125-V ac for tungsten filaments; 20 A, 277-V ac for ballasts.
    c. Endurance: 50,000 cycles at rated capacity.
    d. Mounting: Provision for easy removal and installation in relay cabinet.

B. Line-Voltage Surge Suppression: Factory installed as an integral part of 120- and 277-V ac, solid-state control panels or field-mounting surge suppressors that comply with Section 26 43 13 "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits" for Category A locations.

2.5 MANUAL ANALOG SWITCHES AND PLATES

A. Push-Button Switches: Modular, momentary-contact, low-voltage type.

1. Match color specified in Section 26 27 26 "Wiring Devices."
2. Integral green LED pilot light to indicate when circuit is on.

B. Manual, Maintained Contact, Full- or Low-Voltage Switch: Comply with Section 26 27 26 "Wiring Devices."

C. Wall Plates: Single and multigang plates as specified in Section 26 27 26 "Wiring Devices."

D. Legend: Engraved or permanently silk-screened on wall plate where indicated. Use designations indicated on Drawings.

2.6 FIELD-MOUNTED DIGITAL CONTROLS AND PLATES

A. Connection Type: RS-485 protocol, category 5e UTP cable, using RJ45 connectors. Power shall be from the control unit.

B. Pushbutton Switches: Modular, solid-state, programmable, digital, momentary contact, designed to connect to a microprocessor based control unit as a manual control source.

1. Mounting: Standard single-gang recessed switchbox, using device plates specified in Section 26 27 26 "Wiring Devices."
2. Multi-Gang Mounting: One to six pushbuttons per gang.

2.7 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Class 2 Power Source: Not smaller than No. 12 AWG, complying with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cables: Stranded copper, complying with UL 83, multiconductor cable with copper conductors not smaller than No. 18 AWG, complying with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cables: Stranded copper, complying with UL 83, multiconductor cable with copper conductors not smaller than No. 14 AWG, complying with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

D. Structured Network Digital and Multiplexed Signal Cables: UTP cable with copper conductors, complying with TIA/EIA-568-B.2, Category 5e for horizontal copper cable and with Section 26 74 00 "Telecommunications."

E. RS-485 Cables:

1. Standard Cable: NFPA 70, Type CMR.

a. Paired, 2 pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors.
b. PVC insulation.
c. Unshielded.
d. PVC jacket.
e. Flame Resistance: Comply with UL 1581.

PART 3 - EXECUTION

3.1 WIRING INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Install wiring in raceways except where installed in accessible ceilings. Minimum conduit size shall be 1/2 inch (13 mm).

1. For power wiring comply with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
2. For digital data transmission and low-voltage (operating at less than 50 V) remote control and signaling cables, comply with Section 26 05 23 "Control-Voltage Electrical Power Cables."

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.

D. Install field-mounting transient voltage suppressors for lighting control devices in Category A locations that do not have integral line-voltage surge protection.

E. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

F. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in terminal cabinets, equipment enclosures, and in junction, pull, and outlet boxes.

G. Identify components and power and control wiring according to Section 26 05 53 "Identification for Electrical Systems."

3.2 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Test for circuit continuity.
2. Verify that the control module features are operational.
3. Check operation of local override controls.
4. Test system diagnostics by simulating improper operation of several components selected by Architect.

C. Lighting controls will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.3 SOFTWARE INSTALLATION

A. Install and program software with initial settings of adjustable values. Make backup copies of software and user-supplied values. Provide current licenses for software.

3.4 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting controls and software training for PC-based control systems. See Division 01 for further information.

PART 4 - PAYMENT PROCEDURES

4.1 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments. Payment shall be based on percentage of work completed and cost of materials and equipment.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.

2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

B. Stored Materials: Include in Application for Payment amounts applied for acceptable, non-perishable materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

END OF SECTION 26 09 43

SECTION 26 24 16-PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. State of Maine Department of Transportation, “Standard Specifications,” Revision December 2002, and any corrections, additions and revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.
2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. TVSS: Transient voltage surge suppressor.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
6. Include wiring diagrams for power, signal, and control wiring.
7. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.5 INFORMATIONAL SUBMITTALS

A. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

B. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01, include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.

1.8 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NEMA PB 1.

E. Comply with NFPA 70.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards.

B. Handle and prepare panelboards for installation according to NECA 407.

1.10 PROJECT CONDITIONS

A. Environmental Limitations:

1. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding minus 22 deg F (minus 30 deg C) to plus 104 deg F (plus 40 deg C).
b. Altitude: Not exceeding 6600 feet (2000 m).

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet (2000 m).

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Owner no fewer than five days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Owner's written permission.
3. Comply with NFPA 70E.

1.11 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.12 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems."

B. Enclosures: Flush- and surface-mounted cabinets as indicated on the drawings.

1. Rated for environmental conditions at installed location.

    a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
    b. Outdoor Locations: NEMA 250, Type 3R.

2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
3. Finishes:

    a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    b. Back Boxes: Galvanized steel or Same finish as panels and trim.

4. Directory Card: Inside panelboard door, mounted in transparent card holder

C. Incoming Mains Location: Top or bottom to match feeder locations.

D. Phase, Neutral, and Ground Buses:

1. Material: Tin-plated aluminum or Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

E. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Tin-plated aluminum or Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Mechanical type.
3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

H. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

B. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 2.

2.3 DISTRIBUTION PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.

D. Mains: Circuit breaker or Lugs only as scheduled.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only as scheduled.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

F. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
4. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
5. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
6. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

a. Standard frame sizes, trip ratings, and number of poles.
b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
d. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at percent of rated voltage.
e. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
f. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
g. Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.
h. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
i. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
j. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.6 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NECA 407.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panelboards and accessories according to NECA 407.

B. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.

C. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

D. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

E. Install filler plates in unused spaces.

F. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.

G. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

H. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 26 05 53 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Panelboards will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

PART 4 - PAYMENT PROCEDURES

4.1 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments. Payment shall be based on percentage of work completed and cost of materials and equipment.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.

2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

B. Stored Materials: Include in Application for Payment amounts applied for acceptable, non-perishable materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

END OF SECTION 26 24 16

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SECTION 26 27 13 - ELECTRICITY METERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. State of Maine Department of Transportation, “Standard Specifications,” Revision December 2002, and any corrections, additions and revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.
2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.2 SUMMARY

A. Section includes equipment for electricity metering by utility company.

1.3 ACTION SUBMITTALS

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

B. Shop Drawings: For electricity-metering equipment.

1. Dimensioned plans and sections or elevation layouts.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Owner no fewer than five days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Owner's written permission.

1.6 COORDINATION

A. Electrical Service Connections: Coordinate with utility companies and components they furnish as follows:

1. Comply with requirements of utilities providing electrical power services.
2. Coordinate installation and connection of utilities and services, including provision for electricity-metering components.

PART 2 - PRODUCTS

2.1 EQUIPMENT FOR ELECTRICITY METERING BY UTILITY COMPANY

A. Meters will be furnished by utility company.

B. Meter Sockets: Comply with requirements of electrical-power utility company.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with equipment installation requirements in NECA 1.

3.2 IDENTIFICATION

A. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

1. Equipment Identification Labels: Adhesive film labels with clear protective overlay.

PART 4 - PAYMENT PROCEDURES

4.1 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments. Payment shall be based on percentage of work completed and cost of materials and equipment.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

B. Stored Materials: Include in Application for Payment amounts applied for acceptable, non-perishable materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.

2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

END OF SECTION 26 27 13

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SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. State of Maine Department of Transportation, “Standard Specifications,” Revision December 2002, and any corrections, additions and revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.
2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.2 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Twist-locking receptacles.
3. Weather-resistant receptacles.
4. Snap switches and wall-box dimmers.
5. Wall-switch occupancy sensors.
6. Cord and plug sets.
7. Floor service outlets, poke-through assemblies, and multioutlet assemblies.

B. Related Sections:

1. Section 260943 “Network Lighting Controls” for manual switches for use with lighting control panels.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.

2. Cord and Plug Sets: Match equipment requirements.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

1.6 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Service-Outlet Assemblies: One for every 10, but no fewer than one.
2. Poke-Through, Fire-Rated Closure Plugs: One for every five floor service outlets installed, but no fewer than two.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Pass & Seymour/Legrand (Pass & Seymour).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Cooper; 5351 (single), CR5362 (duplex).
b. Hubbell; HBL5351 (single), HBL5352 (duplex).
c. Pass & Seymour; 5361 (single), 5362 (duplex).

2.4 GFCI RECEPTACLES

A. General Description:

1. Straight blade, feed -through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Cooper; VGF20.
b. Hubbell; GFR5352L.
c. Pass & Seymour; 2095.

2.5 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A unless otherwise indicated: Comply with NEMA WD 1, NEMA WD 6 Configuration, and UL 498.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Cooper; CWL520R.
b. Hubbell; HBL2310.
c. Pass & Seymour; L520-R.

2.6 PENDANT CORD-CONNECTOR DEVICES

A. Description:

1. Matching, locking-type plug and receptacle body connector.
2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.
3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.7 CORD AND PLUG SETS

A. Description:

1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.8 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Catalog numbers in lists below are for 20-A devices; revise catalog numbers to require other configurations and ratings.

1) Single Pole:
   a) Cooper; AH1221.
   b) Hubbell; HBL1221.
   c) Pass & Seymour; CSB20AC1.
2) Two Pole:
   a) Cooper; AH1222.
   b) Hubbell; HBL1222.
   c) Pass & Seymour; CSB20AC2.
3) Three Way:
   a) Cooper; AH1223.
   b) Hubbell; HBL1223.
   c) Pass & Seymour; CSB20AC3.
4) Four Way:
   a) Cooper; AH1224.
   b) Hubbell; HBL1224.
   c) Pass & Seymour; CSB20AC4.

C. Pilot-Light Switches, 20 A:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Cooper; AH1221PL for 120 and 277 V.
    b. Hubbell; HBL1201PL for 120 and 277 V.
    c. Pass & Seymour; PS20AC1RPL for 120 V, PS20AC1RPL7 for 277 V.

2. Description: Single pole, with neon-lighted handle, illuminated when switch is "off."

2.9 DECORATOR-STYLE DEVICES

A. Toggle Switches, Square Face, 120/277 V, 15 A: Comply with NEMA WD 1, UL 20, and FS W-S-896.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Cooper; 7621 (single pole), 7623 (three way).
    b. Hubbell; DS115 (single pole), DS315 (three way).
    c. Pass & Seymour; 2621 (single pole), 2623 (three way).

B. Lighted Toggle Switches, Square Face, 120/277V, 15 A: Comply with NEMA WD 1 and UL 20.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Cooper; 7631 (single pole), 7633 (three way).
    b. Hubbell; DS120IL (single pole), DS320 (three way).
    c. Pass & Seymour; 2625 (single pole), 2626 (three way).

2. Description: With neon-lighted handle, illuminated when switch is "off."

C. Pilot-Light Switches, Square Face, 20 A:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Hubbell; SNAP212PL for 120 and 277 V.

2. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON".

2.10 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: , satin-finished, Type 302 stainless steel 0.04-inch- (1-mm) thick.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.11 FLOOR SERVICE FITTINGS

A. Type: Modular, flap-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Rectangular or Round, with finish as selected by Architect.

D. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.

E. Voice and Data Communication Outlet: Modular, keyed, color-coded, RJ-45 jacks for UTP cable complying with requirements in Section 26 74 00 "Telecommunications."

2.12 POKE-THROUGH ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Hubbell Incorporated; Wiring Device-Kellems.
2. Pass & Seymour/Legrand.
3. Square D/Schneider Electric.
4. Thomas & Betts Corporation.
5. Wiremold/Legrand.

B. Description:

1. Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.
2. Comply with UL 514 scrub water exclusion requirements.
3. Service-Outlet Assembly Flush type with four simplex receptacles and space for four RJ-45 jacks complying with requirements in Section 26 74 00 "Telecommunications."
4. Size: Selected to fit nominal 4-inch (100-mm) cored holes in floor and matched to floor thickness.
5. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
6. Closure Plug: Arranged to close unused 4-inch (100-mm) cored openings and reestablish fire rating of floor.
7. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of four, four-pair cables that comply with requirements in Section 26 74 00 "Telecommunications."

2.13 FINISHES

A. Device Color:

1. As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Section 26 05 53 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with white-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

PART 4 - PAYMENT PROCEDURES

4.1 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments. Payment shall be based on percentage of work completed and cost of materials and equipment.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

B. Stored Materials: Include in Application for Payment amounts applied for acceptable, non-perishable materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

END OF SECTION 26 27 26

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SECTION 26 28 13 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. State of Maine Department of Transportation, “Standard Specifications,” Revision December 2002, and any corrections, additions and revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.
2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.2 SUMMARY

A. Section Includes:

1. Cartridge fuses rated 600-V ac and less for use in control circuits, enclosed switches, and enclosed controllers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

    a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
    b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
3. Current-limitation curves for fuses with current-limiting characteristics.
4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
5. Coordination charts and tables and related data.
6. Fuse sizes for elevator feeders and elevator disconnect switches.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified Division 01, include the following:

1. Ambient temperature adjustment information.
2. Current-limitation curves for fuses with current-limiting characteristics.
3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
4. Coordination charts and tables and related data.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

1.7 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.8 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper Bussmann, Inc.
2. Edison Fuse, Inc.
3. Ferraz Shawmut, Inc.
4. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Cartridge Fuses:

1. Feeders: Class RK1, time delay or Class RK5, time delay.
2. Motor Branch Circuits: Class RK5, time delay.
3. Other Branch Circuits: Class RK1, time delay or Class RK5, time delay.
4. Control Circuits: Class CC, time delay.

B. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.3 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

PART 4 - PAYMENT PROCEDURES

4.1 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments. Payment shall be based on percentage of work completed and cost of materials and equipment.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

B. Stored Materials: Include in Application for Payment amounts applied for acceptable, non-perishable materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
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    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

END OF SECTION 26 28 13

SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. State of Maine Department of Transportation, “Standard Specifications,” Revision December 2002, and any corrections, additions and revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.
2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Shunt trip switches.
4. Molded-case circuit breakers (MCCBs).
5. Molded-case switches.
6. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.5 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
5. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.8 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 6600 feet (2010 m).

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Owner no fewer than five days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Owner's written permission.
4. Comply with NFPA 70E.

1.10 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 240 or 600-V ac as appropriate for circuit voltage, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
4. Lugs: Mechanical type, suitable for number, size, and conductor material.
5. Service-Rated Switches: Labeled for use as service equipment.

2.2 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single Throw,-240 or 600-V ac as appropriate for circuit voltage, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
4. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.3 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

C. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:

1. Instantaneous trip.
2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I^2t response.

D. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

E. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

F. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

G. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
7. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
8. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.

2.4 MOLDED-CASE SWITCHES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. General Requirements: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.

C. Features and Accessories:

1. Standard frame sizes and number of poles.
2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.

3. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic switch contacts, "b" contacts operate in reverse of switch contacts.

2.5 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4X.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems."

C. Install fuses in fusible devices.

D. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

C. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges.

PART 4 - PAYMENT PROCEDURES

4.1 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments. Payment shall be based on percentage of work completed and cost of materials and equipment.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

B. Stored Materials: Include in Application for Payment amounts applied for acceptable, non-perishable materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

END OF SECTION 26 28 16

SECTION 26 29 13 - ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. State of Maine Department of Transportation, “Standard Specifications,” Revision December 2002, and any corrections, additions and revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.
2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.2 SUMMARY

A. Section includes the following enclosed controllers rated 600 V and less:

1. Full-voltage manual.
2. Full-voltage magnetic.

1.3 DEFINITIONS

A. CPT: Control power transformer.

B. MCCB: Molded-case circuit breaker.

C. MCP: Motor circuit protector.

D. N.C.: Normally closed.

E. N.O.: Normally open.

F. OCPD: Overcurrent protective device.

G. SCR: Silicon-controlled rectifier.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed controllers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.5 ACTION SUBMITTALS

A. Product Data: For each type of enclosed controller. Include manufacturer's technical data on features, performance, electrical characteristics, ratings, and enclosure types and finishes.

B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.

1. Show tabulations of the following:

a. Each installed unit's type and details.
b. Factory-installed devices.
c. Nameplate legends.
d. Short-circuit current rating of integrated unit.
e. Features, characteristics, ratings, and factory settings of individual OCPDs in combination controllers.

2. Wiring Diagrams: For power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For enclosed controllers, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

C. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

D. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor running overload protection suit actual motors to be protected.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01, include the following:

1. Routine maintenance requirements for enclosed controllers and installed components.
2. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
3. Manufacturer's written instructions for setting field-adjustable overload relays.

1.8 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. IEEE Compliance: Fabricate and test enclosed controllers according to IEEE 344 to withstand seismic forces defined in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems."

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 6600 feet (2010 m).

B. Interruption of Existing Electrical Systems: Do not interrupt electrical systems in facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Owner no fewer than five days in advance of proposed interruption of electrical systems.
2. Indicate method of providing temporary utilities.
3. Do not proceed with interruption of electrical systems without Owner's written permission.
4. Comply with NFPA 70E.

1.11 COORDINATION

A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FULL-VOLTAGE CONTROLLERS

A. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.

B. Motor-Starting Switches: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off or on.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
    b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
    c. Rockwell Automation, Inc.; Allen-Bradley brand.
    d. Siemens Energy & Automation, Inc.
    e. Square D; a brand of Schneider Electric.

2. Configuration: Nonreversing.
3. Surface mounting.
4. Red pilot light.

C. Magnetic Controllers: Full voltage, across the line, electrically held.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
    b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
    c. Rockwell Automation, Inc.; Allen-Bradley brand.
    d. Siemens Energy & Automation, Inc.
    e. Square D; a brand of Schneider Electric.

2. Configuration: Nonreversing
3. Contactor Coils: Pressure-encapsulated type.

    a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.

4. Power Contacts: Totally enclosed, double-break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
5. Control Circuits: 120-V ac maximum; obtained from integral CPT, with primary and secondary fuses, of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.

    a. CPT Spare Capacity: 100 VA.

6. Melting Alloy Overload Relays:

    a. Inverse-time-current characteristic.
    b. Class 20 tripping characteristic.
    c. Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.

7. Bimetallic Overload Relays:

    a. Inverse-time-current characteristic.
    b. Class 20 tripping characteristic.
    c. Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
    d. Ambient compensated.
    e. Automatic resetting.

8. Solid-State Overload Relay:

   a. Switch or dial selectable for motor running overload protection.
   b. Sensors in each phase.
   c. Class 20 tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.

9. N.O., isolated overload alarm contact.
10. External overload reset push button.

D. Combination Magnetic Controller: Factory-assembled combination of magnetic controller, OCPD, and disconnecting means.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
   c. Rockwell Automation, Inc.; Allen-Bradley brand.
   d. Siemens Energy & Automation, Inc.
   e. Square D; a brand of Schneider Electric.

2. Fusible Disconnecting Means:

   a. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate Class R fuses.
   b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.

3. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.
4. MCP Disconnecting Means:

   a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
   b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
   c. Auxiliary contacts "a" and "b" arranged to activate with MCP handle.
   d. N.O. alarm contact that operates only when MCP has tripped.
   e. Current-limiting module to increase controller short-circuit current (withstand) rating to 100 kA.

5. MCCB Disconnecting Means:

   a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents; thermal-magnetic MCCB, with inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
   b. Front-mounted, adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
   c. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
   d. Auxiliary contacts "a" and "b" arranged to activate with MCCB handle.
   e. N.O. alarm contact that operates only when MCCB has tripped.

2.2 ENCLOSURES

A. Enclosed Controllers: NEMA ICS 6, to comply with environmental conditions at installed location.

1. Dry and Clean Indoor Locations: Type 1.
2. Outdoor Locations: Type 3R
3. Other Wet or Damp Indoor Locations: Type 4X.

2.3 ACCESSORIES

A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.

1. Push Buttons, Pilot Lights, and Selector Switches: Heavy-duty, type.

a. Push Buttons: Recessed types; momentary.
b. Pilot Lights: LED types; colors as indicated; push to test.
c. Selector Switches: Rotary type Hand-off-automatic for units with remote automatic control; on-off for units with only local control.

B. Reversible N.C./N.O. auxiliary contact(s).

C. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.

D. Breather and drain assemblies, to maintain interior pressure and release condensation in Type 4X enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and surfaces to receive enclosed controllers, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 26 05 29 "Hangers and Supports for Electrical Systems."

B. Seismic Bracing: Comply with requirements specified in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems."

C. Install fuses in each fusible-switch enclosed controller.

D. Install fuses in control circuits if not factory installed. Comply with requirements in Section 26 28 13 "Fuses."

E. Install heaters in thermal overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.

F. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

G. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved nameplate.
3. Label each enclosure-mounted control and pilot device.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
2. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.
4. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Architect before starting the motor(s).
5. Test each motor for proper phase rotation.
6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Enclosed controllers will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

B. Adjust overload-relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.

C. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust to six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notifyArchitect before increasing settings.

D. Set field-adjustable circuit-breaker trip ranges.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until enclosed controllers are ready to be energized and placed into service.

B. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers

PART 4 - PAYMENT PROCEDURES

4.1 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments. Payment shall be based on percentage of work completed and cost of materials and equipment.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

B. Stored Materials: Include in Application for Payment amounts applied for acceptable, non-perishable materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

END OF SECTION 26 29 13

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SECTION 26 32 13 - ENGINE GENERATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. State of Maine Department of Transportation, “Standard Specifications,” Revision December 2002, and any corrections, additions and revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.
2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.2 SUMMARY

A. This Section includes packaged engine-generator sets for emergency power supply with the following features:

1. Diesel engine.
2. Unit-mounted cooling system.
3. Unit-mounted control and monitoring.
4. Performance requirements for sensitive loads.
5. Outdoor enclosure.

B. Related Sections include the following:

1. Section 26 36 00 "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.
2. Section 26 08 01 “Commissioning of Electrical Systems” for commissioning requirements for generators.

1.3 DEFINITIONS

A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:

1. Thermal damage curve for generator.
2. Time-current characteristic curves for generator protective device.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.
2. Design Calculations: Signed and sealed by a qualified professional engineer. Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
3. Vibration Isolation Base Details: Signed and sealed by a qualified professional engineer. Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.
4. Wiring Diagrams: Power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer Seismic Qualification Certification: Submit certification that engine-generator set, batteries, battery racks, accessories, and components will withstand seismic forces defined in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Qualification Data: For installer and manufacturer.

C. Source quality-control test reports.

1. Certified summary of prototype-unit test report.
2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
3. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.
4. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
5. Report of sound generation.
6. Report of exhaust emissions showing compliance with applicable regulations.
7. Certified Torsional Vibration Compatibility: Comply with NFPA 110.

D. Field quality-control test reports.

E. Warranty: Special warranty specified in this Section.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01, include the following:

1. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: One for every 10 of each type and rating, but no fewer than one of each.
2. Filters: One set each of lubricating oil, fuel, and combustion-air filters.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1. Maintenance Proximity: Not more than four hours' normal travel time from Installer's place of business to Project site.
2. Engineering Responsibility: Preparation of data for vibration isolators and seismic restraints of engine skid mounts, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

C. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with ASME B15.1.

F. Comply with NFPA 37.

G. Comply with NFPA 70.

H. Comply with NFPA 110 requirements for Level 1 emergency power supply system.

I. Comply with UL 2200.

J. Engine Exhaust Emissions: Comply with applicable state and local government requirements.

K. Noise Emission: Comply with 71 dB(A) @ 23’ under full load for maximum noise level due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

1.9 PROJECT CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Owner no fewer than five days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Owner's written permission.

B. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: Minus 15 to plus 40 deg C.
2. Relative Humidity: 0 to 95 percent.
3. Altitude: Sea level to 1000 feet (300 m).

1.10 COORDINATION

A. Coordinate size and location of concrete bases for package engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

1.12 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide equipment and services as manufactured by Caterpillar, Inc. or a comparable product by one of the following:

1. Kohler Co.; Generator Division.
2. Onan/Cummins Power Generation; Industrial Business Group.

2.2 ENGINE-GENERATOR SET

A. Factory-assembled and -tested, engine-generator set.

B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.

1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.

C. Capacities and Characteristics:

1. Power Output Ratings:
   a. Genset A: 600 kW, 750 kVA
   b. Genset B: 800 kW, 1000 kVA
2. Output Connections: 480/277 volts, three-phase, four-wire.
3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

D. Generator-Set Performance:

1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
7. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
8. Start Time: Comply with NFPA 110, Type 10, system requirements.

E. Generator-Set Performance for Sensitive Loads:

1. Oversizing generator compared with the rated power output of the engine is permissible to meet specified performance.

   a. Nameplate Data for Oversized Generator: Show ratings required by the Contract Documents rather than ratings that would normally be applied to generator size installed.

2. Steady-State Voltage Operational Bandwidth: 1 percent of rated output voltage from no load to full load.
3. Transient Voltage Performance: Not more than 10 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within 0.5 second.

4. Steady-State Frequency Operational Bandwidth: Plus or minus 0.25 percent of rated frequency from no load to full load.
5. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
6. Transient Frequency Performance: Less than 2-Hz variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within three seconds.
7. Output Waveform: At no load, harmonic content measured line to neutral shall not exceed 2 percent total with no slot ripple. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
8. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to winding insulation or other generator system components.
9. Excitation System: Performance shall be unaffected by voltage distortion caused by nonlinear load.

    a. Provide permanent magnet excitation for power source to voltage regulator.

10. Start Time: Comply with NFPA 110, Type 10, system requirements.

2.3 ENGINE

A. Fuel: Fuel oil, Grade DF-2

1. Ultra Low Sulphur content as required by the State of Maine

2. The work of this section includes providing fuel as required for startup, testing, commissioning, and training activities plus topping off the fuel tank so that it is full upon acceptance by the Owner.

B. Rated Engine Speed: 1800 rpm.

C. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm (11.4 m/s).

D. Lubrication System: The following items are mounted on engine or skid:

1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

E. Engine Fuel System:

1. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
2. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.

F. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.

G. Governor Adjustable isochronous, with speed sensing.

H. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.

1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
3. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.

    a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and noncollapsible under vacuum.
    b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

I. Muffler/Silencer: Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.

1. Minimum sound attenuation of 25 dB at 500 Hz.
2. Sound level measured at a distance of 10 feet (3 m) from exhaust discharge after installation is complete shall be 85 dBA or less.

J. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

K. Starting System: 24-V electric, with negative ground.

1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
3. Cranking Cycle: As required by NFPA 110 for system level specified
4. Battery: Adequate capacity within ambient temperature range specified in Part 1 "Project Conditions" Article to provide specified cranking cycle at least three times without recharging.
5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
6. Battery Rack: Factory fabricated of metal with acid-resistant finish. Thermostatically controlled heater shall be arranged to maintain battery above 10 deg C regardless of external ambient temperature within range specified in Part 1 "Project Conditions" Article. Include accessories required to support and fasten batteries in place.
7. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
8. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236 and include the following features:

a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.4 FUEL OIL STORAGE

A. Comply with NFPA 30.

B. Base-Mounted Fuel Oil Tank: Factory installed and piped, complying with UL 142 fuel oil tank. Features include the following:

1. Tank level indicator.
2. Capacity: Greater of 1400 gallons or Fuel for twenty four (24) hours' continuous operation at 100 percent rated power output.
3. Vandal-resistant fill cap, or within lockable generator enclosure.
4. Containment Provisions: Comply with requirements of authorities having jurisdiction.

2.5 CONTROL AND MONITORING

A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.

B. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts generator set. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.

C. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration.

D. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 1 system, and the following:

1. AC voltmeter.
2. AC ammeter.
3. AC frequency meter.
4. DC voltmeter (alternator battery charging).
5. Engine-coolant temperature gage.
6. Engine lubricating-oil pressure gage.
7. Running-time meter.
8. Ammeter-voltmeter, phase-selector switch(es).
9. Generator-voltage adjusting rheostat.
10. Fuel tank derangement alarm.
11. Fuel tank high-level shutdown of fuel supply alarm.
12. Generator overload.

E. Indicating and Protective Devices and Controls:

1. AC voltmeter.
2. AC ammeter.
3. AC frequency meter.
4. AC Wattmeter
5. AC Power Factor meter
6. DC voltmeter (alternator battery charging).
7. Engine-coolant temperature gage.
8. Engine lubricating-oil pressure gage.
9. Running-time meter.
10. Ammeter-voltmeter, phase-selector switch(es).
11. Generator-voltage adjusting rheostat.
12. Start-stop switch.
13. Overspeed shutdown device.
14. Coolant high-temperature shutdown device.
15. Coolant low-level shutdown device.
16. Oil low-pressure shutdown device.
17. Fuel tank derangement alarm.

F. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

G. Connection to Data Link: A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication is reserved for connections for data-link transmission of indications to remote data terminals. Data system connections to terminals are covered in Section 26 09 13 "Electrical Power Monitoring and Control."

H. Remote Alarm Annunciator: Comply with NFPA 110 for Level 1 systems. An LED labeled with proper alarm conditions shall identify each alarm event and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.

I. Remote Emergency-Stop Switch: Surface; wall mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation.

2.6 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Generator Circuit Breakers: Molded-case, electronic-trip type; 80 percent rated; complying with UL 489.

1. Tripping Characteristics: Adjustable long-time and short-time delay and instantaneous.
2. Trip Settings: Selected to coordinate with generator thermal damage curve.
3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
4. Mounting: Adjacent to or integrated with control and monitoring panel.

B. Ground-Fault Indication: Comply with NFPA 70, "Emergency System" signals for ground-fault. Integrate ground-fault alarm indication with other generator-set alarm indications.

C. Genset A: Provide one 100-amp, 3-pole and one 1000-amp, 3-pole with Ground Fault protection output circuit breakers. Each circuit breaker shall be mounted in an individual enclosure.

Genset B: Provide one 1200-amp, 3-pole with Ground Fault protection output circuit breaker.

2.7 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class H or Class F.

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.

E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

F. Enclosure: Dripproof.

G. Instrument Transformers: Mounted within generator enclosure.

H. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.

1. Adjusting rheostat on control and monitoring panel shall provide plus or minus 5 percent adjustment of output-voltage operating band.

I. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

K. Subtransient Reactance: 12percent, maximum.

2.8 OUTDOOR GENERATOR-SET ENCLOSURE

A. Description: Vandal-resistant, weatherproof steel housing, wind resistant up to 100 mph (160 km/h). Multiple panels shall be lockable and provide adequate access to components requiring maintenance.

Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.

B. The complete diesel engine generator set, including generator control panel, engine starting batteries and fuel oil tank, shall be enclosed in a factory assembled, sound attenuated enclosure mounted on the fuel tank base.

1. A weather resistant, sound attenuated enclosure of steel with electrostatically applied powder coated baked polyester paint. The enclosure shall have a resulting sound level of 71.0 dB(A) @ 23 ft with the genset running under full load. It shall consist of a roof, side walls, and end walls. Fasteners shall be either zinc plated or stainless steel.
2. Enclosure Sound Attenuation: Acoustical foam shall be provided between all supports and inside doors and sound baffles on air intake and air discharge.

C. Convenience Outlet: Factory wired, GFCI. Arrange for external electrical connection.

2.9 VIBRATION ISOLATION DEVICES

A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.

2.10 FINISHES

A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

2.11 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.

B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:

1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
2. Full load run.
3. Maximum power.
4. Voltage regulation.
5. Transient and steady-state governing.
6. Single-step load pickup.
7. Safety shutdown.
8. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.
9. Report factory test results within 10 days of completion of test.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.

B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.

B. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

C. Install packaged engine generator on concrete base. Secure sets to anchor bolts installed in concrete bases. Concrete base construction is specified in Section 26 05 29, “Hangers and Supports for Electrical Systems.”

D. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping and specialties.

B. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow service and maintenance.

C. Connect engine exhaust pipe to engine with flexible connector.

D. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.4 IDENTIFICATION

A. Identify system components according to Section 26 05 53 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Tests and Inspections:

1. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection for "AC Generators and for Emergency Systems" specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
3. The manufacturer’s local dealer shall provide a temporary resistive 1.0 PF load bank and temporary cable to test the generator set at 100% nameplate rating.
4. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.

    a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
    b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
    c. Verify acceptance of charge for each element of the battery after discharge.
    d. Verify that measurements are within manufacturer's specifications.

5. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
6. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
7. Exhaust Emissions Test: Comply with applicable government test criteria.
8. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.

C. Coordinate tests with tests for transfer switches and run them concurrently.

D. Test instruments shall have been calibrated within the last 12 months, traceable to standards of NIST, and adequate for making positive observation of test results. Make calibration records available for examination on request.

E. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

F. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

H. Remove and replace malfunctioning units and retest as specified above.

I. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

J. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

K. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each power wiring termination and each bus connection. Remove all access panels so terminations and connections are accessible to portable scanner.

1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
2. Record of Infrared Scanning: Prepare a certified report that identifies terminations and connections checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators. Refer to Division 01.

PART 4 - PAYMENT PROCEDURES

4.1 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments. Payment shall be based on percentage of work completed and cost of materials and equipment.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

B. Stored Materials: Include in Application for Payment amounts applied for acceptable, non-perishable materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.

c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

END OF SECTION 26 32 13

SECTION 26 36 00 - TRANSFER SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. State of Maine Department of Transportation, “Standard Specifications,” Revision December 2002, and any corrections, additions and revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.
2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.2 SUMMARY

A. Section includes transfer switches rated 600 V and less, including the following:

1. Automatic transfer switches.

B. Related Requirements:

1. Division 21 for automatic transfer switches for fire pumps.
2. Section 26 08 01 “Commissioning of Electrical Systems” for commissioning requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

1. Single-Line Diagram: Show connections between transfer switch, bypass/isolation switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Manufacturer Seismic Qualification Certification: Submit certification that transfer switches accessories, and components will withstand seismic forces defined in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

    a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01, include the following:

1. Features and operating sequences, both automatic and manual.
2. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.

B. Source Limitations: Obtain automatic transfer switches through one source from a single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NEMA ICS 1.

E. Comply with NFPA 70.

F. Comply with NFPA 110.

G. Comply with UL 1008 unless requirements of these Specifications are stricter.

1.7 COORDINATION

A. For floor mounted equipment, coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Contactor Transfer Switches:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Emerson; ASCO Power Technologies, LP Series 300SE or comparable product by one of the following:

a. Kohler Power Systems; Generator Division.
b. Onan/Cummins Power Generation; Industrial Business Group.
c. Russelectric, Inc.

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

B. Transfer switches shall be listed and labeled suitable for use as service equipment.

C. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.

D. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

E. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

F. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.

G. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
2. Switch Action: Double throw; mechanically held in both directions.
3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.

H. Neutral Terminal: Solid and fully rated, unless otherwise indicated.

I. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in Section 26 05 53 "Identification for Electrical Systems."

1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.

J. Enclosures: General-purpose NEMA 250, Type 1 complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.3 AUTOMATIC TRANSFER SWITCHES

A. Comply with Level 1 equipment according to NFPA 110.

B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.

C. Manual Switch Operation: Unloaded. Control circuit automatically disconnects from electrical operator during manual operation.

D. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.

E. In-Phase Monitor: Factory-wired, internal relay controls transfer so it occurs only when the two sources are synchronized in phase. Relay compares phase relationship and frequency difference between normal and emergency sources and initiates transfer when both sources are within 15 electrical degrees, and only if transfer can be completed within 60 electrical degrees. Transfer is initiated only if both sources are within 2 Hz of nominal frequency and 70 percent or more of nominal voltage.

F. Motor Disconnect and Timing Relay: Controls designate starters so they disconnect motors before transfer and reconnect them selectively at an adjustable time interval after transfer. Control connection to motor starters is through wiring external to automatic transfer switch. Time delay for reconnecting individual motor loads is adjustable between 1 and 60 seconds, and settings are as indicated. Relay contacts handling motor-control circuit inrush and seal currents are rated for actual currents to be encountered.

G. Automatic Transfer-Switch Features:

1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
5. Test Switch: Simulate normal-source failure.
6. Switch-Position Pilot Lights: Indicate source to which load is connected.
7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.

a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."

8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
11. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
12. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:

a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
b. Push-button programming control with digital display of settings.
c. Integral battery operation of time switch when normal control power is not available.

2.4 SOURCE QUALITY CONTROL

A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details. See Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems."

B. Floor-Mounting Switch: Anchor to floor by bolting.

1. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 4 inches (100 mm) in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support. Construct concrete bases according to Section 26 05 29 "Hangers and Supports for Electrical Systems."

C. Identify components according to Section 26 05 53 "Identification for Electrical Systems."

D. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.2 CONNECTIONS

A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

B. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.

    a. Check for electrical continuity of circuits and for short circuits.
    b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
    c. Verify that manual transfer warnings are properly placed.
    d. Perform manual transfer operation.

4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.

    a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
    b. Simulate loss of phase-to-ground voltage for each phase of normal source.
    c. Verify time-delay settings.
    d. Verify pickup and dropout voltages by data readout or inspection of control settings.
    e. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
    f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.

    a. Verify grounding connections and locations and ratings of sensors.

B. Coordinate tests with tests of generator and run them concurrently.

C. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

F. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.

1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
2. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as in Division 01.

B. Coordinate this training with that for generator equipment.

PART 4 - PAYMENT PROCEDURES

4.1 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments. Payment shall be based on percentage of work completed and cost of materials and equipment.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

B. Stored Materials: Include in Application for Payment amounts applied for acceptable, non-perishable materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.

b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

END OF SECTION 26 36 00

SECTION 26 51 16 - FLUORESCENT INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. State of Maine Department of Transportation, “Standard Specifications,” Revision December 2002, and any corrections, additions and revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.
2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.2 SUMMARY

A. Section Includes:

1. Interior fluorescent luminaires, lamps, and ballasts.
2. Luminaire supports.

B. Related Requirements:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Section 260943 "Network Lighting Controls for lighting control panels.
3. Section 260801 “Commissioning of Electrical Systems” for commissioning requirements for lighting systems.

1.3 DEFINITIONS

A. BIM: Building information model.

B. CAD: Computer-aided design.

C. CCT: Correlated color temperature.

D. CRI: Color Rendering Index.

E. Fixture: See "Luminaire."

F. IP: International Protection or Ingress Protection Rating

G. Lumen: Measured output of lamp and luminaire, or both.

H. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Ballast, including BF.
5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
6. Include photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the luminaire as applied in this Project.

    a. Photometric data shall be certified by a qualified independent testing agency or by manufacturer.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Samples for Verification: As requested by Architect.

1. Include Samples of luminaires and accessories to verify finish selection.
2. Lamps and ballasts, installed.
3. Cords and plugs.
4. Pendant support system.

D. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Luminaires.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches (300 mm) of the plane of the luminaires.
4. Structural members to which equipment and/or luminaires will be attached.
5. Initial access modules for acoustical tile.
6. Items penetrating finished ceiling, including the following:

    a. Other luminaires.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Ceiling mounted projectors.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

C. Product Certificates: For each type of ballast for bi-level and dimmer-controlled luminaires, from manufacturer.

D. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

E. Sample warranty.

F. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

C. Mockups: For interior luminaires in room or module mockups, complete with power and control connections.

1. Obtain Architect's approval of luminaires in mockups before starting installations.

2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified."

2.2 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. UL Compliance: Comply with UL 1598.

D. Lamp base complying with ANSI C81.61.

E. Nominal Operating Voltage: As scheduled on drawings.

F. Recessed Luminaires: Comply with NEMA LE 4.

G. EMI Filters: Factory installed to suppress conducted EMI according to MIL-STD-461E. Fabricate luminaires with one filter on each ballast indicated to require a filter.

H. Refer to Luminaire Schedule on Drawings for further information.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. General Requirements for Electronic Ballasts:

1. Comply with UL 935 and with ANSI C82.11.
2. Designed for type and quantity of lamps served.
3. Ballasts shall be designed for full light output unless another BF, dimmer, or bi-level control is indicated.
4. Sound Rating: Class A.
5. THD Rating: Less than 10 percent.
6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
7. Operating Frequency: 42 kHz or higher.
8. Lamp Current Crest Factor: 1.7 or less.
9. BF: 0.88 or higher.
10. Power Factor: 0.98 or higher.
11. Parallel Lamp Circuits: For luminaires connected to emergency system, multiple lamp ballasts shall comply with ANSI C82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.

B. Luminaires controlled by occupancy sensors shall have programmed-start ballasts.

C. Electronic Programmed-Start Ballasts for T5 and T5HO Lamps: Comply with ANSI C82.11 and the following:

1. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
2. Automatic lamp starting after lamp replacement.

D. Ballasts for Low-Temperature Environments:

1. Temperatures 0 Deg F (Minus 17 Deg C) and Higher: Electronic type rated for 0 deg F (minus 17 deg C) starting and operating temperature with indicated lamp types.
2. Temperatures Minus 20 Deg F (Minus 29 Deg C) and Higher: Electromagnetic type designed for use with indicated lamp types.

E. Ballasts for Low-EMI Environments: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on EMI and RFI for consumer equipment.

F. Ballasts for Bi-Level Controlled Luminaires: Electronic type. Provide where step dimming control is indicated on the drawings.

1. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level operation and off.

   a. High-Level Operation: 100 percent of rated lamp lumens.
   b. Low-Level Operation: 30 percent of rated lamp lumens.

2. Ballast shall provide equal current to each lamp in each operating mode.
3. Compatibility: Certified by manufacturer for use with specific bi-level control system and lamp type indicated.

2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

A. Description: Electronic-programmed rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:

1. Lamp end-of-life detection and shutdown circuit.
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: Class A.
4. THD Rating: Less than 20 percent.
5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. BF: 0.95 or higher unless otherwise indicated.
9. Power Factor: 0.98 or higher.
10. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on EMI and RFI for nonconsumer equipment.

2.5 FLUORESCENT LAMPS

A. T5 rapid-start lamps, rated 28-W maximum, nominal length of 45.2 inches (1150 mm), 2900 initial lumens (minimum), CRI of 85 (minimum), color temperature as scheduled on the drawings, and average rated life of 20,000 hours unless otherwise indicated.

B. T5HO rapid-start, high-output lamps, rated 54-W maximum, nominal length of 45.2 inches (1150 mm), 5000 initial lumens (minimum), CRI of 85 (minimum), color temperature as scheduled on the drawings, and average rated life of 20,000 hours unless otherwise indicated.

C. Compact Fluorescent Lamps: Four-pin, CRI of 80 (minimum), color temperature as scheduled on the drawings, and average rated life of 10,000 hours at three hours of operation per start unless otherwise indicated.

1. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).
2. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).
3. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).

2.6 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:

1. Glass: Annealed crystal glass unless otherwise indicated.

2. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
3. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

D. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage, and coating.
c. CCT and CRI for all luminaires.

2.7 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.8 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish shall match luminaire.

C. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm) minimum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

A. Comply with NECA 1.

B. Remote Mounting of Ballasts: Distance between the ballast and luminaire shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.

C. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

D. Install lamps in each luminaire.

E. Coordinate layout and installation of luminaires and suspension system with other construction that penetrates ceilings or is supported by them.

F. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.

G. Ceiling-Grid-Mounted Luminaire Supports: Use grid as a support element.

1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each luminaire. Locate not more than 6 inches (150 mm) from luminaire corners.
2. Support Clips: Fasten to luminaires and to ceiling grid members at or near each luminaire corner with clips that are UL listed for the application.
3. Luminaires of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support luminaires independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
4. Install at least one independent support rod or wire from structure to a tab on luminaire. Wire or rod shall have breaking strength of the luminaire weight at a safety factor of 3.

H. Flush-Mounted Luminaire Support:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

I. Wall-Mounted Luminaire Support methods:

1. Attached to structural members in walls
2. Attached to a minimum 20 gauge backing plate attached to wall structural members
3. Attached using through bolts and backing plates on either side of wall.
4. Do not attach luminaires directly to gypsum board.

J. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.

2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Continuous Rows of Luminaires: Use tubing or cord for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

K. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

B. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

1. Test for Emergency Lighting: Interrupt normal power supply to demonstrate proper operation. Verify transfer from normal power to emergency power and retransfer to normal.

C. Luminaire will be considered defective if it does not pass operation tests and inspections.

D. Prepare test and inspection reports.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

PART 4 - PAYMENT PROCEDURES

4.1 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments. Payment shall be based on percentage of work completed and cost of materials and equipment.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

B. Stored Materials: Include in Application for Payment amounts applied for acceptable, non-perishable materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

END OF SECTION 26 51 16

SECTION 26 51 19 - LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. State of Maine Department of Transportation, “Standard Specifications,” Revision December 2002, and any corrections, additions and revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.
2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.2 SUMMARY

A. Section Includes:

1. Interior solid-state luminaires that use LED technology.
2. Lighting fixture supports.

B. Related Requirements:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Section 260943 "Network Lighting Controls for lighting control panels.
3. Section 260801 “Commissioning of Electrical Systems” for commissioning requirements for lighting systems.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
5. Photometric data and adjustment factors based on laboratory tests IES LM-79 and IES LM-80.

a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Samples for Verification: As requested by Architect.

1. Include Samples of luminaires and accessories to verify finish selection.

D. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Lighting luminaires.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches (300 mm) of the plane of the luminaires.
4. Structural members to which equipment and/or luminaires will be attached.
5. Initial access modules for acoustical tile, including size and locations.
6. Items penetrating finished ceiling, including the following:

a. Other luminaires.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Access panels.
f. Ceiling-mounted projectors.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

C. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

D. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Product Certificates: For each type of luminaire.

F. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

G. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1. Provide a list of all lamp module types used on Project; use ANSI and manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamp modules: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

C. Provide luminaires from a single manufacturer for each luminaire type.

D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

E. Mockups: For interior lighting luminaires in room or module mockups, complete with power and control connections.

1. Obtain Architect's approval of luminaires in mockups before starting installations.
2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7

1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified."

2.2 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. Recessed Fixtures: Comply with NEMA LE 4.

D. CRI of minimum 70. CCT as scheduled on the drawings.

E. Rated lamp life of 50,000 hours.

F. Lamps dimmable from 100 percent to 0 percent of maximum light output where dimming control is indicated on the drawings.

G. Internal driver or remote driver as applicable for each scheduled luminaire.

H. Nominal Operating Voltage: As scheduled on the drawings. .

1. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

2.3 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:

1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

D. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage, and coating.
c. CCT and CRI for all luminaires.

2.4 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.5 LUMINAIRE FIXTURE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish shall match luminaire.

C. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm) minimum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.

E. Ceiling-Grid-Mounted Luminaire Supports: Use grid as a support element.

1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each luminaire. Locate not more than 6 inches (150 mm) from luminaire corners.
2. Support Clips: Fasten to luminaires and to ceiling grid members at or near each luminaire corner with clips that are UL listed for the application.
3. Luminaires of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support luminaires independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
4. Install at least one independent support rod or wire from structure to a tab on luminaire. Wire or rod shall have breaking strength of the luminaire weight at a safety factor of 3.

F. Flush-Mounted Luminaire Support:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

G. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls
2. Attached to a minimum 20 gauge backing plate attached to wall structural members
3. Attached using through bolts and backing plates on either side of wall.
4. Do not attach luminaires directly to gypsum board.

H. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Continuous Rows of Luminaires: Use tubing or cord for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

I. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt normal power supply to demonstrate proper operation. Verify transfer from normal power to emergency power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.6 STARTUP SERVICE

A. Comply with requirements for startup specified in Section 260943 "Network Lighting Controls."

3.7 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

PART 4 - PAYMENT PROCEDURES

4.1 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments. Payment shall be based on percentage of work completed and cost of materials and equipment.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

B. Stored Materials: Include in Application for Payment amounts applied for acceptable, non-perishable materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

END OF SECTION 26 51 19

SECTION 26 56 00 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. State of Maine Department of Transportation, “Standard Specifications,” Revision December 2002, and any corrections, additions and revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.
2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.2 SUMMARY

A. Section Includes:

1. Exterior luminaires with LED arrays and drivers.
2. Luminaire-mounted photoelectric relays.
3. Poles and accessories.

B. Related Sections:

1. Section 26 51 00 "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color-rendering index.

C. HID: High-intensity discharge.

D. LED: Light emitting diode

E. LER: Luminaire efficacy rating.

F. Luminaire: Complete lighting fixture, including ballast housing if provided.

G. Pole: Luminaire support structure, including tower used for large area illumination.

H. Standard: Same definition as "Pole" above.

1.4 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4-M.

B. Live Load: Single load of 500 lbf (2224 N), distributed as stated in AASHTO LTS-4-M.

C. Ice Load: Load of 3 lbf/sq. ft. (145 Pa), applied as stated in AASHTO LTS-4-M Ice Load Map.

D. Wind Load: Pressure of wind on pole and luminaire and banners and banner arms, calculated and applied as stated in AASHTO LTS-4-M.

1. Basic wind speed for calculating wind load for poles 50 feet (15 m) high or less is 90 mph (40 m/s).

a. Wind Importance Factor: 1.0.
b. Minimum Design Life: 25 years.
c. Velocity Conversion Factors: 1.0.

1.5 ACTION SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:

1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
2. Details of attaching luminaires and accessories.
3. Details of installation and construction.
4. Luminaire materials.
5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.

a. Manufacturer Certified Data: Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

6. Photoelectric relays.
7. Ballasts, including energy-efficiency data.
8. Lamps, including life, output, CCT, CRI, lumens, and energy-efficiency data.
9. Materials, dimensions, and finishes of poles.
10. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
11. Anchor bolts for poles.
12. Manufactured pole foundations.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
3. Wiring Diagrams: For power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS

A. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations by a professional engineer.

B. Field quality-control reports.

C. Warranty: Sample of special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and poles to include in emergency, operation, and maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: One for every 100 of each type and rating installed. Furnish at least one of each type.
2. Glass and Plastic Lenses, Covers, and Other Optical Parts: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Ballasts: One for every 100 of each type and rating installed. Furnish at least one of each type.
4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.9 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with IEEE C2, "National Electrical Safety Code."

D. Comply with NFPA 70.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Store poles on decay-resistant-treated skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

B. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.

1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
3. Warranty Period for Color Retention: Five years from date of Substantial Completion.
4. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LUMINAIRES

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

1. LER Tests Incandescent Fixtures: Where LER is specified, test according to NEMA LE 5A.
2. LER Tests HID Fixtures: Where LER is specified, test according to NEMA LE 5B.

B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

M. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

a. Color: As selected from manufacturer's standard catalog of colors.

N. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

a. Color: As selected by Architect from manufacturer's standard catalog of colors.

O. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps/LED engines and ballasts/drivers. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

2.3 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

A. Comply with UL 773 or UL 773A.

B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc (16 to 32 lx) and off at 4.5 to 10 fc (48 to 108 lx) with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.

1. Relay with locking-type receptacle shall comply with ANSI C136.10.
2. Adjustable window slide for adjusting on-off set points.

2.4 DRIVERS FOR LED ENGINES

A. UL 1598, suitable for Wet Locations.

B. RoHS compliant.

C. Design Lights Consortium (DLC) Certified.

D. Housing: IP 66 rating.

E. Voltage: Unit accepts 120V through 277V, 50hz to 60hz input.

F. Output based on wattage of LED array.

G. Include plug type disconnect.

H. Power factor shall not be less than 90 percent.

2.5 LED LIGHT ENGINES

A. Array wattage shall be as scheduled on the drawings plus or minus 8 percent for ambient temperature and forward voltage.

B. Minimum Lumen Output: As scheduled on the drawings based on IESNA LM-79 or LM-80 testing.

C. Color Temperature: As scheduled on the drawings with minimum 70 CRI.

D. Lumen depreciation: 70 percent of initial output after 215,000 hours at a temperature of 40°C using IESNA LM-80 methodology.

2.6 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

A. Structural Characteristics: Comply with AASHTO LTS-4-M.

1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.
2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.

B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.

1. Materials: Shall not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
3. Anchor-Bolt Template: Plywood or steel.

D. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches (65 by 130 mm), with cover secured by stainless-steel captive screws.

E. Concrete Pole Foundations: Pre-cast or cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 03.

2.7 STEEL POLES

A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig (317 MPa); one-piece construction up to 40 feet (12 m) in height with access handhole in pole wall.

1. Shape: Square, straight.
2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

B. Brackets for Luminaires: Detachable, cantilever, without underbrace.

1. Adapter fitting welded to pole, allowing the bracket to be bolted to the pole mounted adapter, then bolted together with stainless-steel bolts.
2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire.
3. Match pole material and finish.

C. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

D. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

E. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.

F. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or with SSPC-SP 8, "Pickling."
2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

    a. Color: As selected by Architect from manufacturer's standard colors.

2.8 POLE ACCESSORIES

A. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.

1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

3.2 POLE INSTALLATION

A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:

1. Fire Hydrants and Storm Drainage Piping: 60 inches (1520 mm).
2. Water, Gas, Electric, Communication, and Sewer Lines: five feet.
3. Trees: 15 feet (5 m) from tree trunk.

C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 03.

D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.

1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
3. Install base covers unless otherwise indicated.
4. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

E. Poles and Pole Foundations Set in Concrete Paved Areas: Install poles with minimum of 6-inch- (150-mm-) wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch (25 mm) below top of concrete slab.

F. Raise and set poles using web fabric slings (not chain or cable).

3.3 BOLLARD LUMINAIRE INSTALLATION

A. Align units for optimum directional alignment of light distribution.

B. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at bollard location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 03.

3.4 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 26 05 33 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.5 GROUNDING

A. Ground metal poles and support structures according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole unless otherwise indicated.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

3.6 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.

1. Verify operation of photoelectric controls.

C. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

PART 4 - PAYMENT PROCEDURES

4.1 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments. Payment shall be based on percentage of work completed and cost of materials and equipment.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.

2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

B. Stored Materials: Include in Application for Payment amounts applied for acceptable, non-perishable materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

END OF SECTION 26 56 00

SECTION 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. State of Maine Department of Transportation, "Standard Specifications," Revision December 2002, and any corrections, additions and revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.
2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.2 SUMMARY

A. Section Includes:

1. Fire alarm wire and cable.
2. Identification products.

1.3 DEFINITIONS

A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

B. Open Cabling: Passing cabling through open space (e.g., between the studs of a wall cavity).

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.

1.6 FIELD CONDITIONS

A. Do not install conductors and cables that are wet, moisture damaged, or mold damaged.

1. Indications that wire and cables are wet or moisture damaged include, but are not limited to, discoloration and sagging of factory packing materials.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 FIRE ALARM WIRE AND CABLE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Comtran Corporation.
2. Draka Cableteq USA.
3. Genesis Cable Products; Honeywell International, Inc.
4. Rockbestos-Suprenant Cable Corp.
5. West Penn Wire.

B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

C. Signaling Line Circuits: Twisted, shielded pair, size as recommended by system manufacturer, but not smaller than 18 AWG.

1. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with red identifier stripe, NTRL listed for fire alarm and cable tray installation, plenum rated.

D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.

1. Low-Voltage Circuits: No. 16 AWG, minimum.
2. Line-Voltage Circuits: No. 12 AWG, minimum.
3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with red identifier stripe, NTRL listed for fire alarm and cable tray installation, plenum rated.

2.3 IDENTIFICATION PRODUCTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Brady Worldwide, Inc.
2. Kroy LLC.
3. Panduit Corp.

B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

C. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."

PART 3 - EXECUTION

3.1 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for installation of supports for cables.

3.2 WIRING METHOD

A. Install wiring in metal raceways where exposed. Listed fire alarm MC cable shall be permitted where concealed in walls and ceilings and above accessible ceilings if allowed by the Authority Having Jurisdiction.

1. Minimum conduit size shall be 3/4 inch (21 mm). Control and data transmission wiring shall not share conduit with other building wiring systems.
2. Comply with requirements in Division 26.

B. Install cable, concealed in accessible ceilings, walls, and floors when possible.

3.3 FIRE ALARM WIRING INSTALLATION

A. Comply with NECA 1 and NFPA 72.

B. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

C. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

D. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

E. For Class A circuits, provide separate conduits or cable for outgoing and return conductors.

F. Wiring to Remote Alarm Transmitting Device: 1-inch (25-mm) conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.4 POWER AND CONTROL-CIRCUIT CONDUCTORS

A. 120-V Power Wiring: Install according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" unless otherwise indicated.

B. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits, No. 14 AWG.
2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

3.5 CONNECTIONS

A. Comply with requirements in Section 28 31 11 "Digital, Addressable Fire-Alarm System for connecting, terminating, and identifying wires and cables.

3.6 FIRESTOPPING

A. Comply with requirements in Division 07.

3.7 GROUNDING

A. For low-voltage wiring and cabling, comply with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems."

3.8 IDENTIFICATION

A. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.9 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Visually inspect cable placement, cable termination, grounding and bonding, equipment, and labeling of all components.

PART 4 - PAYMENT PROCEDURES

4.1 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments. Payment shall be based on percentage of work completed and cost of materials and equipment.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.

2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

B. Stored Materials: Include in Application for Payment amounts applied for acceptable, non-perishable materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

END OF SECTION 28 05 13

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SECTION 28 08 01 - COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. State of Maine Department of Transportation, “Standard Specifications,” Revision December 2002, and any corrections, additions and revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.
2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.2 SUMMARY

A. This Section describes the requirements for start-up and commissioning for Division 28 installed work.

B. Electronic Safety and Security Systems to be commissioned:

1. Fire alarm system.

C. Related Sections:

1. Section 01 91 13 "General Commissioning Requirements" for general commissioning process requirements.

1.3 DEFINITIONS

A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

B. Commissioning: A systematic process confirming that building systems have been installed, properly started, and consistently operated in strict accordance with the Contract Documents, that all systems are complete and functioning in accordance with the Contract Documents at Substantial Completion, and that Contractor has provided Owner adequate system documentation and training. Commissioning includes deferred and/or seasonal tests as approved by Owner.

C. CxA: Commissioning Authority.

D. Deferred Tests: Functional Performance or Integrated System Tests performed after Substantial Completion due to partial occupancy, partial equipment acceptance, seasonal requirements, design, or other Site conditions that prohibit the test from being performed prior to Substantial Completion.

E. Deficiency: Condition of a component, piece of equipment or system that is not in compliance with Contract Documents.

F. Factory Testing: Testing of equipment at the factory, by factory personnel with an Owner's representative present if deemed necessary by Owner.

G. Functional Performance Test Procedures: Commissioning protocols and detailed test procedures and instructions in tabular and script-type format that fully describe system configuration and steps required to determine if the system is performing and functioning properly. Contractor prepares these procedures to document Functional Performance Tests.

H. Functional Performance Test (FPT): Test of dynamic function and operation of equipment and systems executed by Contractor. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, life safety conditions, power failure, etc. Systems are run through all specified sequences of operation. Components are verified to be responding in accordance with Contract Documents. Functional Performance Tests are executed after start-ups and Prefunctional Checklists are complete.

I. Integrated System Test: Test of dynamic function and operation of multiple systems. Integrated System Tests are tested under various modes, such as fire alarm and emergency situations, life safety conditions, power failure, etc. Systems are integrally operated through all specified sequences of operation. Components are verified to be responding in accordance with Contract Documents. Integrated System Tests are executed after Functional Performance Tests are complete and prior to Substantial Completion. Integrated System Tests provide verification that the integrated systems will properly function according to the Contract Documents.

J. Integrated System Test Procedures: Commissioning protocols and detailed test procedures and instructions in tabular and script-type format that fully describe system configurations and steps required to determine if the interacting systems are performing and functioning properly. Contractor prepares these procedures to document Integrated System Tests.

K. Prefunctional Checklist: A list of static inspections and material or component tests that verify proper installation of equipment (e.g., belt tension, oil levels, labels affixed, gages in place, sensors calibrated, etc.). The word Prefunctional refers to before Functional tests. Prefunctional Checklists must include the manufacturer's Start-up checklist(s). Contractor shall sign Prefunctional Checklists as complete and submit with the Request for Start-up/Functional Performance Test Form.

L. Start-up: The activities where equipment is initially energized, tested, and operated. Start-up is completed prior to Functional Performance Tests.

M. Test Requirements: Requirements specifying what systems, modes and functions, etc. must be tested. Test requirements are not detailed test procedures. Test requirements and acceptance criteria are specified in the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Submittals shall comply with the requirements of the Construction Contract Clauses, Division 01, and the individual sections specifying the work.

B. Prefunctional Checklists of readiness.

C. Prefunctional Checklists of completion of installation, prestart, and startup activities.

1.5 CONTRACTOR'S RESPONSIBILITIES

A. Perform commissioning tests at the direction of the CxA.

B. Attend construction phase coordination meeting.

C. Attend testing, adjusting, and balancing review and coordination meeting.

D. Participate in systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.

E. Provide information requested by the CxA for final commissioning documentation.

F. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

1.6 CxA'S RESPONSIBILITIES

A. Provide Project-specific construction checklists and commissioning process test procedures for systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.

B. Direct commissioning testing.

C. Verify testing, adjusting, and balancing of Work are complete.

D. Provide test data, inspection reports, and certificates in Systems Manual.

1.7 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CxA for inclusion in the commissioning plan:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for systems, assemblies, equipment, and components to be verified and tested.
4. Prefunctional Checklists certifying that installation, prestart checks, and startup procedures have been completed.
5. Prefunctional Checklists certifying that systems, subsystems, equipment, and associated controls are ready for testing.
6. Test and inspection reports and certificates.
7. Corrective action documents.
8. Verification of testing and adjusting reports.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TESTING PREPARATION

A. Certify that systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify that instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

C. Certify that testing and adjusting procedures have been completed and that testing and adjusting reports have been submitted, discrepancies corrected, and corrective work approved.

D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, emergency power, and alarm conditions).

E. Inspect and verify the position of each device and interlock identified on checklists.

F. Check safety cutouts and interlocks during each mode of operation.

G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.2 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.

B. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response.

C. The CxA in cooperation with the Contractor shall prepare detailed testing plans, procedures, and checklists for systems, subsystems, and equipment.

D. Tests will be performed using design conditions whenever possible.

E. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

F. The CxA may direct that set points be altered when simulating conditions is not practical.

G. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

H. If tests cannot be completed because of a deficiency outside the scope of the system to be commissioned, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

3.3 ELECTRONIC SAFETY AND SECURITY SYSTEM COMMISSIONING

A. Perform commissioning work after equipment is installed and system is ready for operation.

B. Perform commissioning work in accordance with equipment manufacturer's standard procedures and check lists.

3.4 CHECKLIST

1. Prior to Functional Performance Test:

   a. System in place, including all components indicated, and tested.
   b. Connected to facility power system on a permanent basis.
   c. Connected to monitoring facility on a permanent basis.

2. Personnel to be present or assist as required to Perform Functional Performance Test:

   a. Contractor, sub-contractors and specialty contractors as required.
   b. Owner’s Representative's Project Manager/Representative and/or Inspector of Record (I.O.R.).
   c. Owner’s maintenance staff, as desired.
   d. Design Engineer.

3. Functional Performance Test: Demonstrate operation of normal power distribution system per specifications including the following:

   a. Verify performance meets the specified design intent.

4. Results:

   a. If specified equipment performance is not verified, the contractor shall have corrections made and reschedule Functional performance Test as soon as possible after corrective work is completed.

3.5 DOCUMENTATION

1. All prefunctional and functional testing documentation as well as a final commissioning report shall be prepared and delivered to the owner per the commissioning contract.

PART 4 - PAYMENT PROCEDURES

4.1 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments. Payment shall be based on percentage of work completed and cost of materials and equipment.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.

3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

B. Stored Materials: Include in Application for Payment amounts applied for acceptable, non-perishable materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

END OF SECTION 28 08 01

SECTION 28 31 11 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. State of Maine Department of Transportation, “Standard Specifications,” Revision December 2002, and any corrections, additions and revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.
2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.2 SUMMARY

A. Section Includes:

1. Fire-alarm control unit with voice evacuation.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Heat detectors.
5. Notification appliances.
6. Device guards.
7. Magnetic door holders.
8. Remote annunciator.
9. Addressable interface device.
10. Digital alarm communicator transmitter.

B. Related Requirements:

1. Section 28 05 13 "Conductors and Cables for Electronic Safety and Security" for cables and conductors for fire-alarm systems.

1.3 DEFINITIONS

A. EMT: Electrical Metallic Tubing.

B. FACP: Fire Alarm Control Panel.

C. HLI: High Level Interface.

D. NICET: National Institute for Certification in Engineering Technologies.

E. PC: Personal computer.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including furnished options and accessories.

1. Include construction details, material descriptions, dimensions, profiles, and finishes.
2. Include rated capacities, operating characteristics, and electrical characteristics.

B. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, details, and attachments to other work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Detail assembly and support requirements.
5. Include voltage drop calculations for notification-appliance circuits.
6. Include battery-size calculations.
7. Include input/output matrix.
8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
9. Include performance parameters and installation details for each detector.
10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
11. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.

    a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
    b. Show field wiring required for HVAC unit shutdown on alarm.
    c. Locate detectors according to manufacturer's written recommendations.
    d. Show air-sampling detector pipe routing.

12. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
13. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

C. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:

    a. Trained and certified by manufacturer in fire-alarm system design.
    b. NICET-certified, fire-alarm technician; Level III minimum.
    c. Licensed or certified by authorities having jurisdiction.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1.6 Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following and deliver copies to authorities having jurisdiction:

a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
d. Riser diagram.
e. Device addresses.
f. Record copy of site-specific software.
g. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:

1) Equipment tested.
2) Frequency of testing of installed components.
3) Frequency of inspection of installed components.
4) Requirements and recommendations related to results of maintenance.
5) Manufacturer's user training manuals.

h. Manufacturer's required maintenance related to system warranty requirements.
i. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
3. Smoke Detectors, Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type.
4. Detector Bases: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.
5. Keys and Tools: One extra set for access to locked or tamperproofed components.
6. Audible and Visual Notification Appliances: One of each type installed.
7. Fuses: Two of each type installed in the system. Provide in a box or cabinet with compartments marked with fuse types and sizes.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level III technician.

C. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

1.10 PROJECT CONDITIONS

A. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.

1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Noncoded, UL-certified addressable system, with multiplexed signal transmission and horn/strobe evacuation.

B. Automatic sensitivity control of certain smoke detectors.

C. All components provided shall be listed for use with the selected system.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.
5. Automatic sprinkler system water flow.
6. Fire-extinguishing system operation.
7. Dry system pressure flow switch.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm and specific initiating device at fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Release fire and smoke doors held open by magnetic door holders.
5. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
6. Close smoke dampers in air ducts of designated air-conditioning duct systems.
7. Recall elevators to primary or alternate recall floors.
8. Activate elevator power shunt trip.
9. Activate emergency shutoffs for gas and fuel supplies.
10. Record events in the system memory.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. High- or low-air-pressure switch of a dry-pipe or preaction sprinkler system.
3. Elevator shunt-trip supervision.
4. Fire pump running.
5. Fire-pump loss of power.
6. Fire-pump power phase reversal.
7. Independent fire-detection and -suppression systems.
8. User disabling of zones or individual devices.
9. A drop in the water level of the fire tank to 90% or below of the tank’s capacity.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
4. Loss of primary power at fire-alarm control unit.
5. Ground or a single break in internal circuits of fire-alarm control unit.
6. Abnormal ac voltage at fire-alarm control unit.

7. Break in standby battery circuitry.
8. Failure of battery charging.
9. Abnormal position of any switch at fire-alarm control unit or annunciator.

E. System Supervisory Signal Actions:

1. Identify specific device initiating the event at fire-alarm control unit and remote annunciators.
2. After a time delay of 200 seconds, transmit a upervisory signal to the remote alarm receiving station.

2.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified

2.4 FIRE-ALARM CONTROL UNIT

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Faraday.
2. GAMEWELL.
3. Notifier.
4. Siemens Industry, Inc.; Fire Safety Division.

B. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.

a. System software and programs shall be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.
b. Include a real-time clock for time annotation of events on the event recorder and printer.
c. Provide communication between the FACP and remote circuit interface panels, annunciators, and displays.
d. The FACP shall be listed for connection to a central-station signaling system service.
e. Provide nonvolatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FACP shall provide a minimum 500-event history log.

2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
3. Addressable Control Circuits for Operation of Mechanical Equipment: The FACP shall be listed for releasing service.

C. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, two line(s) of 40 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.

D. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:

1. Pathway Class Designations: NFPA 72, Class A.
2. Pathway Survivability: Level 0.
3. Install no more than 99 addressable devices on each signaling-line circuit.
4. Serial Interfaces:

    a. One dedicated RS 485 port for central-station operation using point ID DACT.
    b. One RS 485 port for remote annunciators, Ethernet module, or multi-interface module (printer port).
    c. One USB port for PC configuration.

E. Smoke-Alarm Verification:

1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
2. Activate an approved "alarm-verification" sequence at fire-alarm control unit and detector.
3. Record events by the system printer.
4. Sound general alarm if the alarm is verified.
5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.

F. Notification-Appliance Circuit:

1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
2. Where notification appliances provide signals to sleeping areas, the alarm signal shall be a 520-Hz square wave with an intensity 15 dB above the average ambient sound level or 5 dB above the maximum sound level, or at least 75 dBA, whichever is greater, measured at the pillow.
3. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.

G. Elevator Recall:

1. Elevator recall shall be initiated only by one of the following alarm-initiating devices:

    a. Elevator lobby detectors except the lobby detector on the designated floor.
    b. Smoke detector in elevator machine room.
    c. Smoke detectors in elevator hoistway.

2. Elevator controller shall be programmed to move the cars to the alternate recall floor if lobby detectors located on the designated recall floors are activated.
3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.

    a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.

H. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke-barrier walls shall be connected to fire-alarm system.

I. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory.

J. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

K. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

L. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed lead calcium.

M. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.5 MANUAL FIRE-ALARM BOXES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper Wheelock.
2. Faraday.
3. GAMEWELL.
4. Notifier.
5. Siemens Industry, Inc.; Fire Safety Division.
6. System Sensor.

B. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Station Reset: Key- or wrench-operated switch.
3. Indoor Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.

4. Weatherproof Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

2.6 SYSTEM SMOKE DETECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Faraday.
2. GAMEWELL.
3. Gentex Corporation.
4. Notifier.
5. Siemens Industry, Inc.; Fire Safety Division.
6. SimplexGrinnell LP.
7. System Sensor.

B. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be two-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
7. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.

    a. Rate-of-rise temperature characteristic of combination smoke- and heat-detection units shall be selectable at fire-alarm control unit for 15 or 20 deg F (8 or 11 deg C) per minute.
    b. Fixed-temperature sensing characteristic of combination smoke- and heat-detection units shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F (57 or 68 deg C).
    c. Multiple levels of detection sensitivity for each sensor.
    d. Sensitivity levels based on time of day.

C. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

D. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

2.7 HEAT DETECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Faraday.
2. GAMEWELL.
3. Notifier.
4. Siemens Industry, Inc.; Fire Safety Division.
5. System Sensor.

B. General Requirements for Heat Detectors: Comply with UL 521.

1. Temperature sensors shall test for and communicate the sensitivity range of the device.

C. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

D. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F (88 deg C).

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.8 NOTIFICATION APPLIANCES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper Wheelock.
2. Gentex Corporation.
3. Siemens Industry, Inc.; Fire Safety Division.
4. System Sensor.

B. General Requirements for Notification Appliances: Individually addressed, connected to a signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.

C. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

D. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.

1. Rated Light Output:

a. 15/30/75/110 cd, selectable in the field.

2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, red.

E. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol..

2.9 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.

1. Electromagnets: Require no more than 3 W to develop 25-lbf (111-N) holding force.
2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
3. Rating: 24-V ac or dc.
4. Rating: 120-V ac.

B. Material and Finish: Match door hardware.

2.10 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.11 ADDRESSABLE INTERFACE DEVICE

A. General:

1. Include address-setting means on the module.
2. Store an internal identifying code for control panel use to identify the module type.
3. Listed for controlling HVAC fan motor controllers.

B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.

C. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall or to circuit-breaker shunt trip for power shutdown.

1. Allow the control panel to switch the relay contacts on command.
2. Have a minimum of two normally open and two normally closed contacts available for field wiring.

D. Control Module:

1. Operate notification devices.
2. Operate solenoids for use in sprinkler service.

2.12 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Address of the supervisory signal.

3. Address of the trouble-initiating device.
4. Loss of ac supply.
5. Loss of power.
6. Low battery.
7. Abnormal test signal.
8. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.

B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION

A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

1. Devices placed in service before all other trades have completed cleanup shall be replaced.
2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.

B. Install wall-mounted equipment, with tops of cabinets not more than 78 inches (1980 mm) above the finished floor.

1. Comply with requirements for seismic-restraint devices specified in Section 26 05 48.16 "Seismic Controls for Electrical Systems."

C. Manual Fire-Alarm Boxes:

1. Install manual fire-alarm box in the normal path of egress within 60 inches (1520 mm) of the exit doorway.
2. Mount manual fire-alarm box on a background of a contrasting color.
3. The operable part of manual fire-alarm box shall be between 42 inches (1060 mm) and 48 inches (1220 mm) above floor level. All devices shall be mounted at the same height unless otherwise indicated.

D. Smoke- or Heat-Detector Spacing:

1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet (9 m).
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A or Annex B in NFPA 72.
5. HVAC: Locate detectors not closer than 36 inches (910 mm) from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.

E. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.

F. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches (9100 mm) long shall be supported at both ends.

1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.

G. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Do not install smoke detectors in sprinklered elevator shafts.

H. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

I. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.

J. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling. Install all devices at the same height unless otherwise indicated.

K. Device Location-Indicating Lights: Locate in public space near the device they monitor.

3.3 PATHWAYS

A. Pathways above recessed ceilings and in nonaccessible locations may be routed exposed.

1. Exposed pathways located less than 96 inches (2440 mm) above the floor shall be installed in EMT.

B. Pathways shall be installed in EMT.

C. Exposed EMT shall be painted red enamel.

3.4 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 08. Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches (910 mm) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Smoke dampers in air ducts of designated HVAC duct systems.
2. Magnetically held-open doors.
3. Alarm-initiating connection to elevator recall system and components.
4. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
5. Supervisory connections at valve supervisory switches.
6. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
7. Supervisory connections at elevator shunt-trip breaker.
8. Data communication circuits for connection to building management system.
9. Supervisory connections at fire-pump engine control panel.

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.6 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.7 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by authorities having jurisdiction.

B. Perform tests and inspections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Visual Inspection: Conduct visual inspection prior to testing.

a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.

b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test visible appliances for the public operating mode according to manufacturer's written instructions.
5. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

D. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

E. Fire-alarm system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods for the first year of occupancy by the Owner. Use forms developed for initial tests and inspections.

H. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.8 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
2. Perform tests in the "Test Methods" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Perform tests per the "Testing Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

3.9 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

PART 4 - PAYMENT PROCEDURES

4.1 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments. Payment shall be based on percentage of work completed and cost of materials and equipment.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

B. Stored Materials: Include in Application for Payment amounts applied for acceptable, non-perishable materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

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SECTION 31 22 00

GRADING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. State of Maine Department of Transportation, "Standard Specifications," Revision December 2002, and any revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.

2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.02 SECTION INCLUDES

A. Removal of topsoil.

B. Rough grading the site.

C. Finish grading.

1.03 RELATED REQUIREMENTS

A. Section 31 10 00 - Site Clearing.

B. Section 31 23 16 - Excavation.

C. Section 31 23 23 - Fill: Filling and compaction.

D. Section 31 23 16.13 - Trenching: Trenching and backfilling for utilities.

E. Section 31 23 16.26 - Rock Removal.

1.04 SUBMITTALS

A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with State of Maine, Department of Transportation standards.

1.06 PROJECT CONDITIONS

A. Protect above- and below-grade utilities that remain.

B. Protect plants, lawns, rock outcroppings, and other features to remain as a portion of final landscaping.

C. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from grading equipment and vehicular traffic.

PART 2 PRODUCTS

2.01 MATERIALS

A. Topsoil: See Section 31 23 23 2.01.H.

B. Other Fill Materials: See Section 31 23 23.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey benchmark and intended elevations for the Work are as indicated.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Stake and flag locations of known utilities.

C. Locate, identify, and protect from damage above- and below-grade utilities to remain.

3.03 ROUGH GRADING

A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.

B. Do not remove topsoil when wet.

C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.

D. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.

E. When excavating through roots, perform work by hand and cut roots with sharp axe.

F. See Section 31 23 23 for filling procedures.

G. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.04 SOIL REMOVAL

A. Stockpile excavated topsoil on site.

B. Stockpile excavated subsoil on site.

C. Stockpiles: Use areas designated on site; pile depth not to exceed 8 feet; protect from erosion.

3.05 FINISH GRADING

A. Before Finish Grading:
   1. Verify building and trench backfilling have been inspected.
   2. Verify subgrade has been contoured and compacted.

B. Remove debris, roots, branches, stones, in excess of 1/2 inch in size. Remove soil contaminated with petroleum products.

C. Where topsoil is to be placed, scarify surface to depth of 4 inches.

D. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 4 inches.

E. Place topsoil in areas indicated.

F. Place topsoil during dry weather.

G. Remove roots, weeds, rocks, and foreign material while spreading.

H. Near plants spread topsoil manually to prevent damage.

I. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.

J. Lightly compact placed topsoil.

3.06 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 1/10 foot from required elevation.

B. Top Surface of Finish Grade: Plus or minus 1/2 inch.

3.07 REPAIR AND RESTORATION

A. Existing Facilities, Utilities, and Site Features to Remain: If damaged due to this work, repair or replace to original condition at no cost to Owner.

B. Trees to Remain: If damaged due to this work, trim broken branches and repair bark wounds; if root damage has occurred, obtain instructions from Engineer as to remedy. Perform work at no cost to Owner.

C. Other Existing Vegetation to Remain: If damaged due to this work, replace with vegetation of equivalent species and size at no cost to Owner.

3.08 FIELD QUALITY CONTROL

A. See Section 31 23 23 for compaction density testing.

3.09 CLEANING

A. Remove unused stockpiled topsoil and subsoil. Grade stockpile area to prevent standing water.

B. Leave site clean and raked, ready to receive landscaping.

C. Protect newly graded areas from traffic and erosion and keep free of trash and debris.

D. Repair and re-establish grades in settled, eroded and rutted areas within specified tolerances.

E. Slope fill surfaces to shed water.

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END OF SECTION 31 22 00

SECTION 31 23 16

EXCAVATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. State of Maine Department of Transportation, "Standard Specifications," Revision December 2002, and any revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.

2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.02 SECTION INCLUDES

A. Excavating for building volume below grade, footings, slabs-on-grade, paving, site structures, and utilities within the building.

1.03 RELATED REQUIREMENTS

A. Geotechnical Engineering Study (Soils Report) by S.W. Cole Engineering, Inc. dated November 7, 2013: Geotechnical Engineering Services, MaineDOT BGS Fleet Services, 66 Industrial Drive, Augusta, Maine.

B. Section 31 22 00 - Grading: Soil removal from surface of site.

C. Section 31 23 23 - Fill: Fill materials, filling, and compacting.

D. Section 31 23 16.13 - Trenching: Excavating for utility trenches outside the building to utility main connections.

E. Section 31 23 16.26 - Rock Removal: Removal of rock during excavating.

1.04 PROJECT CONDITIONS

A. Verify that survey benchmark and intended elevations for the Work are as indicated.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey benchmark and intended elevations for the work are as indicated.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. Perform all work in accordance with the recommendations and requirements of the Geotechnical Engineering Study (soils report) by S.W. Cole Engineering, Inc. dated November 7, 2012.

C. Comply with the requirements contained within this specification section, the contract drawings, and the recommendations contained within the Geotechnical Engineering Study (soils report). In the event of conflicting requirements, the more stringent standard shall apply.

D. See Section 31 22 00 for additional requirements.

3.03 EXCAVATING

A. Underpin adjacent structures that could be damaged by excavating work.

B. Excavate to accommodate new structures and construction operations.

C. Notify Site Engineer and Geotechnical Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

D. Excavate materials encountered when establishing required subgrade elevations in accordance with (MaineDOT) Specification Section (203.04 and 203.05)

E. Conform to elevations, contours, dimensions, line and grade shown on the Drawings.

F. When excavation through roots is necessary, perform work by hand and cut roots with a sharp axe.

G. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored. All excavations shall be consistent with OSHA regulations.

H. Do not interfere with 45 degree bearing splay of foundations.

I. Do not excavate wet subsoil.

J. Remove all existing fill soils from beneath foundations.

K. Cut utility trenches wide enough to allow inspection of installed utilities.

L. Hand trim excavations. Remove loose matter.

M. Remove lumped subsoil, boulders, solid mortared stone masonry, concrete masonry and rock up to 2 cu yd measured by volume. See Section 31 23 16.26 for removal of larger material.

N. Relic foundations shall be removed to a depth of at least 2 feet below proposed finished grades in paved areas. Removal of relic foundations is incidental to the contract and will not be paid for under rock excavation.

O. Correct areas that are over-excavated and load-bearing surfaces that are disturbed at no cost to Owner; see Section 31 23 23.

P. Grade top perimeter of excavation to prevent surface water from draining into excavation.

Q. Remove excavated material that is unsuitable for re-use from site.

R. Surplus Material:

1. Make arrangements to provide suitable disposal areas off-site.

2. Deposit and grade material to the satisfaction of the owner of the property on which the material is deposited.

3. Obtain any necessary permits for disposal.

4. Provide suitable watertight vehicles to haul soft or wet materials over streets or pavements to prevent deposits on same.

5. Keep crosswalks, streets, and pavements clean and free of debris.

6. Clean up materials dropped from vehicles as often as directed by Owner.

3.04 FIELD QUALITY CONTROL

A. Provide for visual inspection of load-bearing excavated surfaces before placement of foundations.

3.05 PROTECTION

A. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.

B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

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END OF SECTION 31 23 16

SECTION 31 23 16.13

TRENCHING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. State of Maine Department of Transportation, "Standard Specifications," Revision December 2002, and any revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.

2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.02 SECTION INCLUDES

A. Excavating trenches and backfill for utilities, including underslab utilities.

B. Excavating for manholes, catch basins and other structures.

C. Compacted bedding and compacted backfilling over utilities to subgrade elevations.

D. Compacted base and compacted backfilling for manholes, catch basins and other structures to subgrade elevations.

E. Compaction requirements.

F. Dust control.

1.03 RELATED REQUIREMENTS

A. Geotechnical Engineering Study by S.W. Cole Engineering, Inc. dated November 7, 2013: Geotechnical Engineering Services, MaineDOT BGS Fleet Services, 66 Industrial Drive, Augusta, Maine.

B. Section 31 22 00 - Grading: Site grading.

C. Section 31 23 16 - Excavation: Building and foundation excavating.

D. Section 31 23 23 - Fill: Backfilling at building and foundations.

E. Section 31 23 16.26 - Rock Removal: Removal of rock during excavating.

1.04 DEFINITIONS

A. Finish Grade Elevations: Indicated on drawings.

B. Subgrade Elevations: Indicated on drawings or the bottom of aggregate subbase gravel in paved areas, the bottom of aggregate base gravel in sidewalk areas, the bottom of loam in seeded areas, or to bottom of structural fill in slab areas.

1.05 REFERENCES

A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54

kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials; 2010.

B. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2006.

C. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012.

D. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2007.

E. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN m/m3)); 2012.

F. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2008.

G. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.

H. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2005.

I. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.

J. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2010.

1.06 SUBMITTALS

A. Samples: 75 lb sample of each type of fill; submit in air-tight containers to testing laboratory.

B. Materials Sources: Submit name and location of imported materials source.

C. Fill Composition Test Reports: Results of laboratory tests (gradation and proctor) on proposed and actual materials used.

D. Compaction Density Test Reports.

1.07 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

B. When fill materials need to be stored on site, locate stockpiles where designated.
   1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
   2. Prevent contamination.
   3. Protect stockpiles from erosion and deterioration of materials.

C. Protect excavations by shoring, bracing, sheet piling, underpinning or other methods required to prevent cave-in or loose soil from falling into excavation.

D. Protect above or below grade utilities which are to remain. Repair any damage caused by construction of this project at no cost to Owner.

E. Underpin adjacent structures which may be damaged by excavation work, including service utilities and pipe chases.

F. Protect excavations and soil adjacent to and beneath foundations from frost.

G. Grade excavation top perimeter to prevent surface water runoff into excavations.

H. Maintenance of existing flows:
   1. Keep existing sewers and drains in operation.
   2. If existing sewers and drains are disturbed, provide for maintenance of such flows until work is completed.
   3. Do not allow raw sewage to flow on ground surface or stand in excavation.

I. The Contractor will be responsible for obtaining the necessary street opening permits from the MaineDOT and/or City of Augusta, and complying with the terms and conditions of said permit. The MaineDOT and/or City of Augusta will not waive the permit fees for this project and the Contractor is required to pay for applicable fees. Applicable fees are to be included in bid.

PART 2 PRODUCTS

2.01 FILL MATERIALS

A. Type 'B' Underdrain Sand: MDOT 703.22 Granular material meeting the requirements of MDOT 703.22 Type 'B' underdrain backfill, with the following limits:
   1. 1 inch sieve: 95 to 100 percent passing by weight
   2. 1/2 inch sieve: 75 to 100 percent passing by weight
   3. No. 4 sieve: 50 to 100 percent passing by weight
   4. No. 20 sieve: 15 to 80 percent passing by weight
   5. No. 50 sieve: 0 to 15 percent passing by weight
   6. No. 200 sieve: 0 to 5 percent passing by weight
   7. Type B backfill shall not contain organic matter and shall not contain particles of rock which will not pass the 1-1/2 inch square mesh sieve.

B. Type 'C' Underdrain stone: MDOT 703.22; Crushed Stone meeting the requirements of MDOT 703.22 Underdrain Backfill Type 'C' meeting the following requirements:
   1. 1 inch sieve: 100 percent passing by weight
   2. 3/4 inch sieve: 90 to 100 percent passing by weight
   3. 3/8 inch sieve: 0 to 75 percent passing by weight
   4. No. 4 sieve: 0 to 25 percent passing by weight
   5. No. 10 sieve: 0 to 5 percent passing by weight

C. Sand Bedding and Backfill; free of silt, clay, loam, friable or soluble materials, and organic matter. Graded in accordance with the following limits:
   1. 3/8 inch sieve: 100 percent passing by weight
   2. No. 4 sieve: 95 to 100 percent passing by weight
   3. No. 200 sieve: 0 to 5 percent passing by weight.

2.02 ACCESSORIES

A. Non-Woven Geotextile Fabric: Non-biodegradable, Mirafi 160N or equivalent.

B. Woven Geotextile Fabric: Non-biodegradable, Mirafi 500X or equivalent.

B. Water for sprinkling: Fresh and free from oil, acid and injurious alkali or vegetable matter.

C. Calcium chloride: ASTM D98 commercial grade except as waived by the Owner.

2.03 SOURCE QUALITY CONTROL

A. If tests indicate materials do not meet specified requirements, change material and retest. Materials not meeting specified requirements, if used prior to acceptance, shall be removed and replaced at no cost to Owner.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench marks and intended elevations for the work are as indicated.

B. Identify required lines, levels, contours, and datum locations.

C. See Section 31 22 00 for additional requirements.

D. Examine the areas and conditions under which excavating and filling is to be performed and notify Owner in writing of conditions detrimental to proper and timely completion of work.

E. Correct unsatisfactory conditions in a manner acceptable to Owner prior to proceeding with work.

F. Maintain in operating condition existing utilities, active utilities and drainage systems encountered in utility installation.

G. Locate, identify, and protect utilities that remain and protect from damage.

H. Notify utility company to remove and relocate utilities.

I. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

J. Protect plants, lawns, rock outcroppings, and other features to remain.

3.02 INSPECTION

A. Verify stockpiled fill to be used is approved.

B. Verify areas to be backfilled are free of organics, debris, snow, ice or water, and surfaces are not frozen.

3.03 GENERAL REQUIREMENTS

A. See Section 31 23 16 for additional requirements.

B. Provide trenching and backfilling for storm drain, water service, sewerage pipes, conduits and structures. Water and sewerage lines separation shall be minimum 10 feet horizontally and 18 inches vertically. Lay all piping in open trench. Maintain access to fire hydrants by fire-fighting equipment.

C. Sheet and brace trenches and remove water as necessary to fully protect workmen and adjacent facilities, in keeping with local regulations or, in the absence thereof, with the provisions of the "Manual of Accident Prevention in Construction," of the Associated General Contractors of America, Inc. Under no circumstances lay pipe or install appurtenances in water. Keep the trench free from water until pipe joint material has hardened. Sheeting left in place shall be cut off not less than 2 feet below finished grade. Sheeting shall not be removed until the trench is substantially backfilled.

D. Excavation under this contract shall be unclassified.

E. Grade the bottom of the trenches evenly to ensure uniform bearing for full length of all pipes. Excavate all rock, cemented gravel, old masonry, or other hard material to at least 6 inches below the pipe at all points. Refill such space and all other cuts below grade with sand bedding or fine gravel firmly compacted.

F. Should soil conditions necessitate special supports for piping and/or appurtenances, including

the removal of unsuitable material and refilling with sand bedding or fine gravel, such work shall be performed as necessary.

G. Backfill trenches only after piping has been inspected, tested and the locations of pipe and appurtenances have been recorded. Backfill by hand around pipe and for a depth of 1 foot above the pipe. Use earth without rock fragments or large stones and tamp as specified in layers not exceeding 6 inches in thickness, taking care not to disturb the pipe or damage the pipe coating. Compact the remainder of the backfill as specified with a rammer of suitable weight, or with an approved mechanical tamper, provided that under pavements, walks and other surfacing, the backfill shall be tamped as specified. Exclude all cinders, rubbish and scrap metal from trenches in which metal pipes are laid. Special care shall be used to properly tamp backfill under lower half of sewer pipe.

3.04 PREPARATION

A. Identify known underground utilities. Stake and flag locations.

B. Identify and flag surface and aerial utilities.

C. Notify utility companies of work to be done.

D. When necessary, compact subgrade surfaces to density requirements for embankment, aggregate base, and aggregate subbase materials.

E. Cut out soft areas of subgrade not capable of compaction in place. Backfill with Type 'B' underdrain sand backfill and compact to density equal to requirements for subsequent backfill material.

F. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.05 TRENCHING

A. Notify Site Engineer and Geotechnical Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

B. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored. All excavations shall be consistent with OSHA requirements.

C. Do not interfere with 45 degree bearing splay of foundations.

D. Excavate subsoil required for piping and appurtenances.

E. Cut trenches wide enough to allow inspection of installed utilities.

F. Relic topsoil, if encountered in utility trenches shall be removed from beneath pipes and pipe bedding.

G. Hand trim excavations. Remove loose matter.

H. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.

I. Remove lumped subsoil, boulders, and rock up to 2 cu yd measured by volume. See Section 31 23 16.26 for removal of larger material.

J. Remove excavated material that is unsuitable for re-use from site.

K. Stockpile excavated material to be re-used in area designated on site in accordance with Section 31 22 00.

L. Correct unauthorized excavation with Sand Bedding, (Type B Underdrain Sand or Type C Underdrain Stone) or as directed by Owner.

M. Fill over-excavated areas under pipe bearing surfaces with Sand Bedding, (Type B Underdrain Sand or Type C Underdrain Stone) or as directed by Owner.

N. Do not store excavated material adjacent to excavations where they could surcharge sideslopes.

O. Remove excess excavated material from site.

P. Surplus Material:
1. Make arrangements to provide suitable disposal areas off-site.
2. Deposit and grade material to the satisfaction of the owner of the property on which the material is deposited.
3. Obtain any necessary permits for disposal.
4. Provide suitable watertight vehicles to haul soft or wet materials over streets or pavements to prevent deposits on same.
5. Keep crosswalks, streets, and pavements clean and free of debris.
6. Clean up materials dropped from vehicles as often as directed by Owner.

3.06 PREPARATION FOR UTILITY PLACEMENT

A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with Type B Underdrain Sand or Type C Underdrain Stone or as directed by Owner.

B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.07 ELECTRICAL/TELEPHONE

A. Refer to the Handbook of Standard Requirements for Electric Service and Meter Installation for installation requirements for primary electric service, secondary electric service, telephone service and cable services. Pull ropes shall be installed in all conduits.

3.08 REPAIRS TO EXISTING PIPES, CONDUIT AND WATER LINES

A. Remove damaged or broken portions of pipe or conduit and replace with a pipe or conduit of the same size and material, unless otherwise directed by Owner, designed to serve same function as existing pipe or conduit.

B. Make connections for repair with flexible couplings to satisfaction of Owner.

C. Maintain inventory of suitable repair materials on site.

D. Make repairs immediately following discovery of damage.

E. Do not backfill until repairs have been completed to satisfaction of Owner.

F. Repairs to water mains and services will be by the water utility. Coordination and payment for repairs shall be the responsibility of the Contractor.

3.09 BACKFILLING

A. Backfill to contours and elevations indicated using unfrozen materials.

B. Place and compact bedding material to grade of underside of pipe in trench bottom as soon as excavation reaches grade.

C. Compact bedding material to provide firm laying base.

D. Underslab utilities shall be installed on sand bedding material and backfilled with sand backfill.

E. After pipe is laid to grade, place bedding material uniformly on each side of pipe up to spring line while carefully compacting bedding material under haunches of pipe.

F. Support pipe and conduit during placement and compaction of bedding fill.

G. Place and compact base material to grade of underside of appurtenant structures in bottom of excavation as soon as excavation reaches grade.

H. Compact base material for appurtenant structures to provide a firm laying base.

I. Place and compact backfill materials in continuous layers not exceeding 12 inches in area of paving, slabs-on-grade, and similar construction. Lift thickness not to exceed 16 inches in lawn or field areas.

J. Install geotextile fabric in accordance with manufacturer's recommendations and where shown on Drawings.

K. Employ a placement method that does not disturb or damage other work.

L. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

M. Maintain optimum moisture content of fill materials to attain required compaction density.

N. Slope grade away from building minimum 2 inches in 10 ft, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

O. Correct areas that are over-excavated.
   1. Thrust bearing surfaces: Fill with concrete.
   2. Other areas: Use common borrow in lawn areas or granular borrow in paved/building areas, flush to required elevation, compacted to minimum 95 percent of maximum dry density.

P. Leave stockpile areas completely free of excess fill materials.

Q. Upon completion of backfilling in paved areas, sweep undisturbed pavement.

R. Upon request of Owner implement the following dust control measures during the interim period between backfilling and capping of the trench:
   1. Apply water and calcium chloride as directed by Owner.
   2. Spread calcium chloride uniformly over designated areas.
   3. Apply water with equipment having a tank with pressure pump and nozzle equipped spray bar acceptable to Owner.

S. Compaction Density Unless Otherwise Specified or Indicated:
   1. Under paving, slabs-on-grade, and similar construction: 95 percent of maximum dry density.
   2. At other locations: 90 percent of maximum dry density.

T. Reshape and re-compact fills subjected to vehicular traffic.

3.10 TOLERANCES

A. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.11 FIELD QUALITY CONTROL

A. Compaction density testing will be performed on compacted fill in accordance with ASTM

D1556, ASTM D2167, ASTM D2922, or ASTM D3017.

B. Results will be evaluated in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D698 ("standard Proctor"), ASTM D1557 ("modified Proctor"), or AASHTO T 180.

C. If tests indicate work does not meet specified requirements, remove work, replace and retest at no cost to Owner.

D. Frequency of Tests: 1 test for each 200 feet of trench for the first and every other lift of compacted trench backfill not including pipe bedding.

3.12 CLEANING

A. Leave unused materials in a neat, compact stockpile.

B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

C. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION 31 23 16.13

SECTION 31 23 19

DEWATERING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. State of Maine Department of Transportation, "Standard Specifications," Revision December 2002, and any revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.

2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.02 SECTION INCLUDES

A. Furnish, operate and maintain dewatering equipment for control, collection, and disposal of ground and surface water entering trenches and excavations.

1.03 RELATED SECTIONS

A. Section 31 23 16 - Excavation

B. Section 31 23 23 - Fill

C. Section 31 23 16.13 - Trenching.

D. Section 31 10 00 - Site Clearing

E. Section 31 25 00 - Slope Protection and Erosion Control.

F. Geotechnical Engineering Study (Soils Report) by Fessenden Geo-Environmental Services Dated November 2013: Geotechnical report; bore hole locations and findings of subsurface materials.

1.04 DESIGN REQUIREMENTS

A. Design dewatering facilities including drains, piping and pumping.

B. Control groundwater in foundation excavations to two feet below the foundation grade as required in the Geotechnical report for the project.

1.05 PRICE AND PAYMENT PROCEDURES

A. Measurement and payment will be as follows:

B. Basis of Payment – Dewatering shall be considered incidental to the work being performed and no separate payment will be made.

1.06 SUBMITTALS

A. Prior to start of excavation and trenching, submit dewatering design and methods to Owner for review.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Provide pumps, drains, piping and other facilities necessary to keep excavations and trenches free of water including spare units available for immediate use in the event of equipment failure.

PART 3 EXECUTION

3.01 PROTECTION

A. Protect watercourses, sewer systems and adjacent properties from siltation by use of sediment ponds or other measures acceptable to Owner.

B. Keep excavations clear of groundwater, surface water, seepage, sewage and stormwater.

3.02 INSTALLATION

A. Install, construct and maintain equipment and facilities required for work of this section.

B. Dispose of water removed from Work in a suitable manner which will not interfere with other work, cause erosion, damage pavements, other surfaces or property and is acceptable to Owner:

C. Remove dewatering equipment and facilities when no longer required.

D. Backfill excavations in accordance with 31 23 16 and 31 23 16.13.

E. Repair damage resulting from dewatering operations.

F. Dewatering costs shall be included in bid and no separate payment shall be made.

END OF SECTION 31 23 19

SECTION 31 23 23

FILL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. State of Maine Department of Transportation, "Standard Specifications," Revision December 2002, and any revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.
2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.02 SECTION INCLUDES

A. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

B. Construct embankments with excavated subsoil and borrow.

C. Prepare subsoil and borrow to receive subbase and base gravels and topsoil materials.

D. Place, grade, and compact subbase and base gravels to receive pavement.

E. Compaction requirements.

F. Dust control.

1.03 RELATED REQUIREMENTS

A. Geotechnical Engineering Study (Soils Report) by S.W. Cole Engineering, Inc. dated November 7, 2013.

B. Section 31 22 00 - Grading: Removal and handling of soil to be re-used.

C. Section 31 22 00 - Grading: Site grading.

D. Section 31 23 16 - Excavation: Removal and handling of soil to be re-used.

E. Section 31 23 16.13 - Trenching: Excavating for utility trenches outside the building to utility main connections.

F. Section 31 23 16.26 - Rock Removal: Removal of rock during excavating.

1.04 REFERENCE STANDARDS

A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials; 2010.

B. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2006.

C. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012.

D. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2007.

E. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN m/m3)); 2012.

F. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2008.

G. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.

H. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2005.

I. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.

J. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2010.

1.05 SUBMITTALS

A. Submittals shall be provided by the contractor at least 2 weeks in advance of imported fill use.

B. Samples: 75 lb sample of each type of fill; submit in air-tight containers to testing laboratory.

C. Materials Sources: Submit name of imported materials source.

Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used. The results from the following tests shall be submitted:

1. Moisture and density relationship: ASTM D 1557 or D 698 as required by the Geotechnical Engineering Study (soils report).
2. Mechanical Analysis AASHTO T-88.
3. Mechanical Analysis AASHTO T-88.

1.06 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

B. When fill materials need to be stored on site, locate stockpiles where indicated.

1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
2. Prevent contamination.
3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.01 FILL MATERIALS

A. Subsoil: Reused meeting the requirements of Common Borrow.

B. Common Borrow: MDOT 703.18; Earth suitable for embankment construction, free from frozen material, perishable rubbish, peat, organics and other unsuitable material, with sufficient moisture content to provide the required compaction and stable embankment, moisture content shall not exceed 4 percent above optimum. Determine optimum moisture content in accordance with ASTM D698 (cohesive soils) or D1557 (granular soils).

C. Granular Borrow: MDOT 703.19; Mixture of sand, gravel, and silt or reclaimed asphalt, concrete, brick, crushed rock that is crushed and blended with sand, free from vegetable matter,

lumps or balls of clay and other deleterious substances. The gradation of that portion passing a 3 inch sieve shall meet the following requirements:

1. No. 40 sieve: 0 to 70 percent passing by weight.
2. No. 200 sieve: 0 to 10 percent passing by weight.
3. Granular borrow shall contain no particles or fragments with a maximum dimension in excess of one-half of the compacted thickness of the layer being placed. Granular Borrow shall not contain particles of rock which will not pass the 6 inch square mesh sieve.

D. Aggregate Subbase: MDOT 703.06 Type 'D' gravel, of hard durable particles free from vegetable matter, lumps or balls of clay and other deleterious substances. The gradation of that part that passes a 3 inch sieve shall meet the following requirements:

1. 1/4 inch sieve: 25 to 70 percent passing by weight
2. No. 40 sieve: 0 to 30 percent passing by weight
3. No. 200 sieve: 0 to 7 percent passing by weight
4. Type D aggregate shall not contain particles of rock which will not pass the 6" square mesh sieve.

E. Structural Fill: Clean granular material free from organic matter, contaminants, frozen material, and other deleterious substances. Maximum particle sizes should not exceed two thirds of the proposed loose lift thickness. The material shall meet the following gradation.

1. 3 inch sieve: 100 percent passing by weight
2. 1/4 inch sieve: 25-75 percent passing by weight
3. #40 sieve: 0-30 percent passing by weight
4. #200 sieve: 0-5 percent passing by weight

F. Type B Underdrain Backfill (MaineDOT Section 703.22): Granular material shall be free of organic matter and shall meet the following gradation.

1. 1 inch sieve: 95-100 percent passing by weight
2. ½ inch sieve: 75-100 percent passing by weight
3. No. 4 inch sieve: 50-100 percent passing by weight
4. No. 20 sieve: 15-80 percent passing by weight
5. No. 50 sieve: 0-15 percent passing by weight
6. No. 200 sieve: 0-5.0 percent passing by weight

G. Type C Underdrain Backfill (MaineDOT Section 703.22): The material shall meet the following gradation.

1. 1 inch sieve: 100 percent passing by weight
2. ¾ inch sieve: 90-100 percent passing by weight
3. 3/8 inch sieve: 0-75 percent passing by weight
4. No. 4 sieve: 0-25 percent passing by weight
5. No. 10 sieve: 0-5 percent passing by weight

H. Topsoil: Either stripped from site or imported, friable loam: free of subsoil, large clods, lumps, roots, grass, excessive amounts of weeds, stone and foreign matter 2" or greater and smaller stones in excessive quantities as determined by the Owner. Material shall conform to the requirements of MaineDOT Standard Specifications Section 615.02.

2.02 ACCESSORIES

A. Woven Geotextile Fabric: Non-biodegradable, Mirafi 500x or 600x or approved equivalent, as noted on the plans.

B. Non-Woven Geotextile Fabric: Non-biodegradable, Mirafi 160n or approved equivalent.

C. Water for sprinkling: Fresh and free from oil, acid, and injurious alkali or vegetable matter.

D. Calcium chloride: ASTM D98 commercial grade except as waived by Owner.

2.03 SOURCE QUALITY CONTROL

A. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.

B. If tests indicate materials do not meet specified requirements, change material and retest at no cost to owner.

C. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench marks and intended elevations for the Work are as indicated.

B. Identify required lines, levels, contours, and datum locations.

C. See Section 31 22 00 for additional requirements.

D. Examine the areas and conditions under which excavating and filling is to be performed and notify owner in writing of conditions detrimental to proper and timely completion of work.

E. Correct unsatisfactory conditions in a manner acceptable to owner prior to proceeding with work.

F. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.

G. Verify structural ability of unsupported walls to support imposed loads by the fill.

H. Verify underground tanks are anchored to their own foundations to avoid flotation after backfilling.

I. Comply with the requirements contained within this specification section, the contract drawings, and the recommendations contained within the Geotechnical Engineering Study (soils report). In the event of conflicting requirements, the more stringent standard shall apply

3.02 PREPARATION

A. Proofroll subgrade surface to identify soft spots.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with structural fill or equivalent above the groundwater table, or crushed stone or equivalent below the groundwater table.

C. Identify known underground utilities. Stake and flag locations. Locate and protect utilities to remain.

D. Identify and flag surface and aerial utilities.

E. Notify utility companies of work to be done.

F. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

G. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 FILLING

A. Fill to contours and elevations indicated using unfrozen materials.

B. Topsoil and pavement shall be removed from proposed fill and pavement areas.

C. Proofroll subgrade using a 10 ton vibratory roller-compactor unless otherwise noted, any areas that continue to yield after 3 to 5 passes of the compaction equipment shall be over excavated and replaced with clean granular fill in dry non-freezing conditions and structural fill in other conditions.

D. Pavement subgrade shall consist of structural fill compacted to at least 95 percent of its maximum dry density as determined by ASTM D-1557.

E. Landscape subgrade shall consist of common fill compacted to at least 90 percent of its maximum dry density as determined by ASTM D-1557.

F. Place and compact fill materials in continuous layers not exceeding 12 inches loose depth upon compacted material.

G. Fill up to subgrade elevations unless otherwise indicated.

H. Employ a placement method that does not disturb or damage other work.

I. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

J. Maintain optimum moisture content of fill materials to attain required compaction density.

K. Slope grade away from building minimum 2 inches in 10 ft, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

L. Correct areas that are over-excavated.
   1. Pavement areas: Use structural fill above the groundwater table, and crushed stone below the groundwater table. Fill flush to required elevation, compacted to 95 percent of maximum dry density.
   2. Other areas: Use granular fill, flush to required elevation, compacted to minimum 95 percent of maximum dry density. Use crushed stone as necessary to backfill wet areas of over excavation.

M. Compaction Density Unless Otherwise Specified or Indicated:
   1. Under paving, slabs-on-grade, and similar construction: 95 percent of maximum dry density.
   2. At other locations: 90 percent of maximum dry density.

N. Reshape and re-compact fills subjected to vehicular traffic.

O. Leave stockpile areas completely free of excess fill materials.

P. Frost:
   1. Do not excavate to full indicated depth when freezing temperatures may be expected unless fill material or structures can be constructed immediately after the excavation has been completed. Protect the excavation from frost if placing of fill or structure is delayed.
   2. Fill shall not be placed over frozen soil. Soil that is frozen shall be removed prior to placement of compacted fill. Remove all frozen uncompacted soil prior to placing additional fill for compaction.

Q. Native soils can undergo substantial strength loss when subjected to construction traffic and excavation activities, particularly during periods of precipitation and shallow groundwater levels. Care must be exercised to minimize disturbance of the bearing soils. Should the subgrade become yielding or difficult to work, disturbed areas shall be excavated and backfilled in accordance with Section 3.04 L.

R. Clean granular soil meeting the structural fill gradation shall be provided to a depth of 5.0 feet below the top of entrance slabs and sidewalks in contact with the structure. The thickness of structural fill shall extend horizontally from the structure outward to a point at least one foot beyond the width of the slab or sidewalk, or for a distance of 12 feet, whichever is less. The structural fill shall have a gradual transition up to the bottom of the adjacent subbase at a 1V to 3H slope or flatter.

3.04 CONSTRUCTION OF AGGREGATE BASE AND SUBBASE COURSE

A. Place and compact aggregate base and subbase course materials in continuous layers not exceeding 12 inches loose depth upon compacted material, unless noted otherwise.

B. Employ a placement method so not to disturb or damage structures and utilities.

C. Spread well mixed materials having no pockets of either fine or coarse material.

D. Do not segregate large or fine particles.

E. Compact by mechanical means to obtain 95 percent of maximum dry density as determined in accordance with ASTM D-1557. Base course material shall be compacted with a minimum of two passes with self propelled vibratory compaction equipment.

F. Maintain surface, compaction and stability until pavement course has been placed.

G. Conform to elevations, contours, dimensions, line and grade shown on the Drawings.

3.05 DUST CONTROL

A. Upon request of Owner, implement the following dust control measures:
1. Apply water and calcium chloride as directed by Owner.
2. Spread calcium chloride uniformly over designated area.
3. Apply water with equipment having a tank with pressure pump and nozzle equipped spray bar acceptable to Owner.

3.06 TOLERANCES

A. Top surface of base and subbase course: Plus or minus 3/8 inch.

3.07 FIELD QUALITY CONTROL

A. Provide for visual inspection of load-bearing excavated surfaces before placement of foundations.

B. Compaction density testing will be performed by the Owner on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D2922, or ASTM D3017.

C. Results will be evaluated in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D698 ("standard Proctor"), ASTM D1557 ("modified Proctor"), or AASHTO T 180.

D. If tests indicate work does not meet specified requirements, remove work, replace and retest at no cost to Owner.

E. Frequency of Tests:
1. Building subgrade areas, including 10 feet outside exterior building lines: In fill areas, not less than one compaction test on each lift for every 2,500 square feet. Proofroll cut areas.
2. Areas of construction exclusive of building subgrade: In fill areas, not less than one compaction test on each lift for every 10,000 square feet. Proofroll cut areas.

3.08 CLEANING

A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

B. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

3.09 ATTACHMENT

A. Geotechnical Engineering Study (Soils Report)

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END OF SECTION 31 23 23

SECTION 33 05 13

MANHOLES AND STRUCTURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. State of Maine Department of Transportation, "Standard Specifications," Revision December 2002, and any revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.
2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.02 SECTION INCLUDES

A. Modular precast concrete manhole sections with tongue-and-groove joints with masonry transition to lid frame, covers, anchorage, and accessories.

B. Modular precast catch basins with frames and grates.

C. Pump Station wet well.

D. Light Pole Bases.

E. Bollards.

F. Accessories: tongue and groove joint sealant, manhole steps, sewer brick, pipe to manhole joints, water quality inlets.

1.03 RELATED REQUIREMENTS

A. Section 03 30 00 – Cast in Place Concrete.

B. Section 31 23 16 - Excavation.

C. Section 31 23 16.13 - Trenching.

D. Section 33 31 11 - Site Sanitary Utility Sewerage Piping.

E. Section 33 41 11 - Site Storm Utility Drainage Piping

F. Section 33 36 00 – Utility Septic Tanks – Additional Pump Station Requirements

1.04 REFERENCE STANDARDS

A. Greater Augusta Utility District (GAUD) Water and Sewer Construction Specifications and Procedures, Latest Revision.

B. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections; 2012.

C. ASTM C478M - Standard Specification for Precast Reinforced Concrete Manhole Sections [Metric]; 2012.

D. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals; 2008.

E. ASTM C923M - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals [Metric]; 2008b.

1.05 SUBMITTALS

A. Shop Drawings: Indicate manhole/catch basin locations, elevations, piping sizes and elevations of penetrations.

B. Product Data: Provide manhole covers, component construction, catch basin frames and grates, pipe to manhole connectors, manhole steps, manhole joint sealant, features, configuration, and dimensions.

1.06 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.01 MATERIALS

A. Manhole, Pump Station Wet Well, and Catch Basin Sections: Reinforced precast concrete in accordance with ASTM C 478 (ASTM C 478M), with resilient connectors complying with ASTM C 923 (ASTM C 923M).
   1. Use concrete that will attain a 28-day compressive strength of not less than 4,000 psi.
   2. Reinforcing: H-20 loading.
   3. Horizontal Joints:
      a. Tongue and Groove formed of concrete to receive a flexible plastic gasket.
      b. Joints to be watertight.
      c. Cast to allow installation to be vertical and in true alignment.
   4. Provide two tapered lifting holes 180 degrees apart in each section for handling and placing.
   5. Base section: Cast holes for pipes to provide invert elevations as required by drawings.
   6. Pipe to structure joints:
      a. Flexible sleeves, rubber quality, ASTM C-443 and C-361 cast into base.
      b. If pre-manufactured adaptor cannot be installed, use rubber concrete adaptor designed to provide a watertight seal between pipe and structure.

B. Mortar and Grout:
   1. Masonry below grade and in contact with earth: Type S

C. Concrete Masonry Units: ANSI/ASTM C-139

D. Manhole Brick: ANSI/ASTM C 32, Grade MS.

E. Sewer Brick: ANSI/ASTM C 32, Grade SS

F. Masonry Mortar: ANSI/ASTM C 270, Type M.

G. Manhole Frames and Covers: Grey cast iron ANSI/ASTM A 48, Class 30 B.
   1. Furnish covers with cast in legend on roadway face as indicated.

H. Manhole Steps: Polypropylene steps meeting the requirements of ASTM C-478 and AASHTO M-199. Polypropylene conforms to ASTM-D4101. Grade 60, 1/2 inch diameter reinforcing bar meeting the requirements of ASTM A-615.

I. Catch Basin Frames and Gratings: Grey cast iron, ANSI/ASTM A 48, Class 30 B.

J. Other Precast Structures:
   1. Use concrete that will attain a 28-day compressive strength of not less than 4,000 psi.
   2. Manufactured in accordance with ASTM C-478.
   3. Reinforcing: H-20 loading.
   4. Horizontal Joints:
      a. Tongue and Groove formed of concrete to receive a flexible plastic gasket.
      b. Joints to be watertight.
      c. Cast to allow installation to be vertical and in true alignment.
   5. Pipe to Structure Joints:
      a. Flexible sleeves, rubber quality, ASTM C-433 and C-361 cast into base.
      b. If pre-manufactured adaptor cannot be installed, use rubber-concrete adaptor designed to provide a watertight seal between pipe and structure.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify items provided by other sections of Work are properly sized and located.

B. Verify that built-in items are in proper location, and ready for roughing into Work.

C. Verify excavation for manholes, catch basins and other structures is correct.

3.02 PREPARATION

A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

3.03 PRECAST CONCRETE STRUCTURES

A. Precast Concrete Structures: Place precast concrete sections as shown on drawings. Where structures occur in pavement, set tops of frames and covers flush with finish surface. Elsewhere set tops 3" above finish surface, unless otherwise indicated.
   1. Use epoxy bonding compound where manhole steps are mortared into structure walls.
   2. Provide rubber joint gasket complying with ASTM C-443.
   3. Place base section level on layer of crushed stone as shown on plan set details.
   4. Fix inlet and outlet stubs into sleeves with stainless steel pipe clamp.
   5. Place barrel sections, cones or tops of the appropriate combination of heights to meet grades required by Drawings or existing conditions.
   6. Seal horizontal joints as recommended by manufacturer.
   7. Apply lubricant to inside tongue and rubber gaskets immediately prior to joining sections.
   8. Fill lifting holes with non-shrink mortar.
   9. Place frame and grate on top or otherwise prevent accidental entry by unauthorized persons until ready for adjustment to grade.
   10. Repair damaged coating of frames and covers with coal-tar-pitch varnish.
   11. The top 6 feet of the exterior surface of the sewer manhole and pump station shall be wrapped with a minimum of 4 layers of 6 mil high grade polyethylene.

3.04 MASONRY WORK

A. Laying Brick:
   1. Use clean bricks.
   2. Lay Brick by methods consistent with the trade acceptable to Owner.
   3. Lay in a full bed of mortar and joint without subsequent grouting, flushing, or filling, and thoroughly bond.
   4. Bring casting rim to grade with brick and coat outside with mortar; minimum thickness 3/8 inch with troweled waterproof surface.

3.05 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with the requirements of the servicing utility.

B. Provide copies of test report to owner and servicing utility, documenting results and compliance with requirements in advance of requesting a certificate of occupancy.

C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

END OF SECTION 33 05 13

SECTION 33 11 16

SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. State of Maine Department of Transportation, "Standard Specifications," Revision December 2002, and any revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.

2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.02 SECTION INCLUDES

A. Pipe and fittings for site water lines.

B. Valves.

1.03 RELATED REQUIREMENTS

A. Section 31 23 16 - Excavation: Excavating of trenches.

B. Section 31 23 23 - Fill: Bedding and backfilling.

C. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.

1.04 REFERENCES

A. Greater Augusta Utility District (GAUD) Water and Sewer Construction Specifications and Procedures, Latest Revision

A. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter; 2012.

B. AWWA C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water; American Water Works Association; 2008 (ANSI/AWWA C104/A21.4).

C. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; American Water Works Association; 2007 (ANSI/AWWA C111/A21.11).

D. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water; American Water Works Association; 2009 (ANSI/AWWA C151/A21.51).

E. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service; American Water Works Association; 2009 (ANSI/AWWA C509).

F. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances; American Water Works Association; 2010 (ANSI/AWWA C600).

G. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm), for Water Service; American Water Works Association; 2008.

H. UL 246 - Hydrants for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.05 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.

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

C. Project Record Documents: Record actual locations of piping mains, valves, connections, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Unload materials so as to avoid shock or damage. Handle and store all pipe in such a manner as to avoid deterioration or other injury thereto. Place no pipe within pipe of larger size. Store pipe and fittings on sills above storm drainage level and ready for delivery for laying after trenches are excavated.

PART 2 PRODUCTS

2.01 MATERIALS

2.02 WATER PIPE

A. Polyethylene Pipe: ASTM D3035, for 100 psig pressure rating:
   1. Fittings: AWWA C901, molded or fabricated.
   2. Joints: Compression.

B. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Water Service” in large letters. Minimum 8 Gauge wire or approved equivalent.

2.03 BEDDING AND COVER MATERIALS

A. Bedding: As specified in Section 31 23 16.13.

B. Cover: As specified in Section 31 23 16.13.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building service connection, water main size, location, and invert are as indicated.

3.02 PREPARATION

A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare pipe connections to equipment with flanges or unions.

3.03 TRENCHING

A. See Section 31 23 16.13 for additional requirements.

B. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.04 INSTALLATION - PIPE

A. Service line from existing well shall be furnished and installed to serve the project. The project

contract work shall connect to existing water service and shall include all water lines and appurtenances as shown on the drawings, except as indicated otherwise.

B. Pipe Laying - General:
   1. The interior of all pipe shall be clean and joint surfaces wiped clean and dry before the pipe is lowered into trench. Lower each pipe, fitting and valve into the trench carefully and lay true to line and without objectionable breaks in grade. The depth of cover below finished grade shall be not less than 5'-6" and the standard cover shall be 6'-0"
   2. Provide uniform bearing for all pipes in trenches. Do not allow trench water or dirt to enter the pipe after laying. Insert a watertight plug in the open end of the piping while laying of pipe is not in progress.
   3. Do not lay pipe closer than 10 feet to a sewer. At cross-overs with sewers, no joint in the water line shall be closer than 6 feet from the cross-over point. A minimum vertical distance of 18 inches between the outside of the water main and the outside of the sewer shall be maintained when the water main is either above or below the sewer. Provide valves, plugs or caps, as required, where pipe ends are left for future connections.

C. All pipes shall be laid with standard provisions for expansion and contraction and in accordance with manufacturers recommendations. All pipe with slip type joints shall be restrained at elbows and tees by thrust blocks or rods and clamps.

D. Install suitable fittings at all changes in direction, dead ends and branch connections, provided that double strap saddles, in lieu of tees, may be used for service taps

E. Route pipe in straight line.

F. Install pipe to allow for expansion and contraction without stressing pipe or joints.

G. Connect to building water outlets.

3.06 FIELD QUALITY CONTROL

A. Disinfect water mains in accordance with the requirements of the Maine Department of Health and Human Services Drinking Water Program.

B. Pressure test water piping to 100 psi.

C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

3.07 ATTACHMENTS

A. Greater Augusta Utility District Water and Sewer Construction Specifications and Procedures, Latest Revision

END OF SECTION 33 11 16

Greater Augusta Utility District

Water and Sewer Construction Specifications and Procedures

Latest Revision: May 13, 2008

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Table of Contents

Section I: General Information

1. ENGINEERING REQUIREMENTS

   a. GENERAL

      The applicant, upon submission of a project to construct a water and/or sewerage system for the public use and/or dedication to the Greater Augusta Utility District shall provide one (1) set of plans and specifications to the District. The plans shall show plan and profile of the proposed water or sewer main, pump station plans and details (if applicable), right-of-way boundaries, other utilities, ledge profile or test borings and any other physical or topological features relevant to the project. Other requirements are as follows:

      1. All drawings shall be drawn with the title designating the name of the project, location, and the names of the person(s) preparing the drawings and the date prepared, including the latest revision date. Drawings, specifications and engineer's reports shall be stamped and signed by a duly qualified Registered Professional Engineer.

      2. An 8 l/2 x 11 photocopy of the U.S.G.S. quad sheet showing the location of the proposed activity and the outline of the area in which the activity is located.

      3. An 8 l/2 x 11 section of the City of Augusta property map on which the site of the proposed activity is outlined.

      4. Final design plans approved by the District for construction must be submitted to the District in AutoCAD compatible format a minimum of one week prior to the start of construction.

      5. The District may under special circumstances consider alternative designs to those specified here.

   b. WATER MAINS AND APPURTENANCES

      1. Plan sheet shall be 24" x 36".
      2. Scale: 1" = 40' or 20' horizontal and 1" = 4' vertical. Other scales may be considered upon request.
      3. Profile – Elevations for existing ground elevation and finish grade shall be at centerline of pipe. Plan and profile shall be on same drawing.
      4. Location of all existing or proposed underground utilities shall be shown in plan and in profile where utility crosses water main.
      5. Stationing of water main and appurtenances shall correspond with the roadway centerline stationing and shall be stated as station and offset from centerline left or right.
      6. Minimum of five and one-half feet of cover to finish grade elevation is required over the top of all water mains, hydrant branches, services etc.

   c. SANITARY SEWERS

      1. For design purposes it shall be assumed that each single family home shall contribute 250 GPD and each apartment unit shall contribute 175 GPD to the sanitary sewer. Design flows for all other types of development shall be determined on an individual basis.

      2. Plan sheet shall be 24" x 36".

3. Scale: 1"= 40' or 20' horizontal and 1" = 4' vertical. Other scales may be considered upon request.

4. Number and Station each manhole.

5. Profile – Elevations for existing ground elevation and finish grade shall be at centerline of pipe. Plan and profile shall be on same drawing.

6. Station 0+00 shall be at the low point in each system (for example Pump Station, Lowest MH or Outfall,) and stationing shall be along centerline of pipe.

7. Location of all existing or proposed underground utilities shall be shown in plan and in profile where utility crosses sewer.

8. Sanitary manholes shall be installed at all changes in grade and /or alignment of the pipe. Maximum distance between manholes shall be 350 feet.

9. Minimum of five feet of cover is required over the tops of all gravity sewers.

10. Paved aprons around all manhole frames and covers is required when sewer is installed in the shoulder of the road.

11. Service connections shall be at a manhole when possible.

12. Bench mark shall be shown on all drawings

13. All sanitary sewer extensions will need Maine DEP approval. GAUD will deliver plans to DEP after receiving GAUD approval.

d. PRESSURE SEWERS AND FORCE MAINS

1. Minimum of six feet of cover will be required over the tops of all force mains and pressure sewers.

2. A cleanout manhole will be required at the end of all Pressure Sewers. See Detail.

3. All pressure sewer lead connections at the pressure main shall be in a precast valve box. See Detail.

e. STORM DRAINS

1. Plan sheet shall be 24" x 36".

2. Scale: 1" = 40' or 20' horizontal and 1" = 4' vertical. Other scales may be considered upon request.

3. Number and Station each catch basin.

4. Profile – Elevations for existing ground elevation and finish grade shall be centerline of pipe. Plan and Profile shall be on same drawing.

5. Station 0+00 shall be at the low point in each system (Lowest CB, Outfall, etc.) and stationing shall be along centerline of pipe.

6. Location of all existing or proposed underground utilities shall be shown in plan and in profile where utility crosses storm drain.

7. For design purposes it shall be assumed that the maximum inlet flow for a standard frame and grate shall be 1.5 cfs. Multiple grates or oversized grates must be provided for inlet flows in excess of 1.5 cfs.

8. When Storm Drain pipes cross over or under water pipes and there is less than two feet of clearance between the pipes the Contractor shall install 2 inch thick x width of sewer trench x 8 feet long insulation between the two pipes.

9. Drain manholes or catch basins shall be installed at all changes in grade and/or alignment of the pipe. Maximum distance between catch basins or drain manholes shall be 350 feet.

10. Drain manholes shall be either supplied with channels connecting all inlet pipes with the exit pipe or provided with a two-foot sump.

11. Minimum of four feet of cover is required over the tops of all storm drains.

12. DRAINAGE CHANNELS/SWALES

    Drainage channels may be utilized to convey storm water through a project area if designed for the peak flow generated by a 25-year storm (24-hour event as shown in Appendix B of TR-55). The size of the channel must be adequate to convey this storm event without exceeding 80 percent of the channel depth.

    a. If channels are utilized for relocation of existing streams or constructed in existing streambeds, provide them with an interior stone lined channel to carry the normal dry weather flow of the existing stream (as defined by calculation or field measurement). Developer must obtain all State and Federal permits required to relocate all existing streambeds.

    b. Design drainage channels with a stable bottom and slope that will resist erosion.

    c. Use grass-lined channels if velocities during the design storm event is less than 6 feet per second (fps). If channels have a design velocity greater than 6 fps, provide them with stone riprap on the bottom and side slopes at a depth of 90 percent of the channel height.

    d. Ensure that all stone riprap used in channels has a minimum D50 stone of six inches and is provided with a 6-12 inch filter layer of three-fourths inch stone.

    e. In channel construction use stone that is angular in shape. Rounded stones shall not exceed 10 percent of the number of stones in the channel.

    f. Design channel side slopes for a drop of no more than one vertical foot to three horizontal feet. In the event that steeper slopes are required due to project constraints, the slopes must be stabilized with riprap.

    g. If using gabion stone walls in the design of stone lined channels, follow the manufacturer's design criteria.

    h. Ensure that all stone riprap has a minimum D50 stone of six inches minimum and is supported by calculation as to D50 stone size.

13. Benchmark shall be shown on all drawings.

f. DETENTION BASINS

Detention basins must be of a size and shape as to fit into the project site in accordance with established performance criteria yet not causing disruption of area aesthetics.

1. Design basins with grassed bottoms and side slopes.

2. Design Side slopes with a vertical drop of one vertical foot per three horizontal feet. Steeper slopes will not be allowed without adequate justification, satisfactory to the District. Steeper slopes may require slope stabilization at the discretion of the District.

3. Provide all basins with a flow channel designed to accommodate the two-year storm peak runoff flow from the tributary area. The low-flow channel must be stone-lined in accordance with previous criteria.

4. Ensure that basin outlet structures are designed to maintain predevelopment peak outflow rated for the 2, 10 and 25 year storm events at the predevelopment level. The use of non-restricted pipes of varying size and at varying elevation is the recommended control strategy. Outlet weirs are acceptable if constructed of durable, maintenance free material. Restricted outlet or orifice type outlets may be allowed in some cases.

5. Provide all detention basins with a stone-lined overflow spillway design to pass the 100-year storm event, peak discharge with a minimum of six inches of freeboard in the channel. (The stone-lined channel must be designed as previously outlined.)

Other types of detention facilities, such as in-line storage or underground storage will be considered on a case by case basis. These facilities must meet the performance criteria for detention basins.

All detention basins to be maintained by the District shall have a minimum twelve-foot wide by eighteen inches deep gravel based roadway from the public roadway to the basin. A turn around at the basin may be required and a fence around the basin may be required.

g. EASEMENTS AND LAND ACQUISITION

1. The District will require clear title to any land on which water or sewer pump stations to be owned and operated by the District are installed and also for detention ponds. Size requirements will be evaluated on a case by case basis.

2. Drainage easements will be required for all inlets and outlets of pipe on private property.

3. Easements will be required for all water mains, sewer lines and appurtenances except where installed within the public way of the State or the Municipality. Such easements shall not be less than forty (40) feet in width. Combined water and sewer easements shall be not less than forty (40) feet in width with both pipes located per the requirements of separation. The District reserves the right to require additional easement width if construction and maintenance activities require it. All appurtenances to be maintained by the District (blow-offs, hydrants, structures, discharge pipes etc,), if not within the pipeline easement limits, shall be provided with an easement centered around the appurtenance, of a width determined by the District.

4. The required easements may either be shown on the Subdivision Plot Plan or a separate Mylar for easements only, which must be recorded in the Kennebec County Registry of Deeds. Master Mylars (2 master mylars shall be supplied for each drawing being recorded) should be supplied to GAUD and this office will take the drawing to the Registry for recording. Cost of registering the drawing(s) will be borne by the owner and/or developer.

h. AS BUILT DRAWING

At the completion of all water, sanitary and storm sewer construction projects as-built drawings at a scale of 1" = 40' or 20' horizontally and 1"= 4' vertically or other approved scale shall be supplied to the District on reproducible mylar. Drawing shall show all pertinent information shown on the construction drawing plus ties to all valves, fittings, services and service leads, location of any ledge encountered during the installation, and rim and invert elevations. As-Built drawings shall also be supplied to the District in AutoCAD compatible format.

For individual sewer services installed by a contractor for a property owner, the contractor / owner shall submit a sketch of the service on the form provided with the Sewer Connection Application permit. Sketch shall include a minimum of two (2) lateral measurement "swing ties", as close to 90 degrees opposed as practical, prior to backfilling pipeline, from permanent fixtures such as house corners, telephone poles, fire hydrants, catch basins, manholes etc. to all fittings, couplings, tees, etc. for purposes of future location. Permanent fixtures shall be identified such as house numbers or description, pole numbers etc. Failure to submit sketch is a violation against the permit and could result in the District denying the use of the sewer service and / or any new water service not being activated to the property.

i. SEPARATION OF WATER AND SEWER LINES

1. Parallel Installation:

A. Normal conditions – Water mains shall be laid at least 10 feet horizontally from any sanitary sewer, storm sewer, or sewer manhole whenever possible; the distance shall be measured edge-to-edge.

B. Unusual conditions – When local conditions (such as ledge, bridges, etc.) prevent a horizontal separation of 10 feet, a water main may be laid closer to a sanitary or storm sewer provided that:

I. The bottom of the water main is at least 18 inches above the top of the sewer and a minimum of 5 feet edge-to-edge horizontally is provided.

II. Where the vertical separation cannot be obtained, the sewer shall be constructed of materials and with joints that are equivalent to water main standards of construction and shall be pressure tested to assure water tightness prior to backfilling.

III. The Department of Human Services agrees that local conditions warrant less than 10 feet horizontal separation and approves the plans and specifications for the work.

2. Crossings:

A. Normal conditions – Water mains crossing house sewers, storm sewer, or sanitary sewers shall be laid to provide a vertical separation of at least 18 inches between the bottom of the water main and the top of the sewer, whenever possible.

B. Unusual conditions – When local conditions prevent a vertical separation as described in 1.i.B.I. the following construction shall be used:

   a. Sewers passing over or under water mains shall be constructed of the materials described in 1.i.B.II above.

   b. Water mains passing under sewers shall, in addition, be protected by providing:

      i. A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water main.

      ii. Adequate structural support for the sewers to prevent excessive deflection of joints and settling on and breaking the water mains.

      iii. That one full length of water pipe (min. 18 feet) be centered at the point of crossing so that the joints will be equidistant and as far as possible from the sewer.

3. The following minimum separations from water mains, water services and hydrants shall be observed at all times unless directed by GAU personnel:

<u>Horizontal Separation from Water Mains</u>
a. Sanitary Sewers – refer to requirements outlined above
b. Storm Drains – 3’ face to face for mains; 1’ at contact points for CBs and DMHs
c. Gas mains – 6’ face to face
d. Underground electric and telephone – 6’ face to face
e. Utility poles – 6’ face to face

<u>Vertical Separation from Water Mains</u>
a. Sanitary Sewers – refer to requirements outlined above
b. Storm Drains – 6” over and under
c. All other crossings – 12” minimum

<u>Horizontal Separation from Water Services</u>
a. Sanitary Sewers - refer to requirements outlined above
b. Storm drains – 3’ face to face; 2’ at contact points for CBs and DMHs
c. Gas mains – 6’ face to face
d. Underground electric and telephone – 6’ face to face
e. Property lines – 10’
f. Utility poles – 6’ face to face
g. Curb stops for multiple services – 18”

<u>Horizontal Separation from Hydrants</u>
a. Gas mains – 4’ face to face from hydrant branches
b. Underground electric and telephone – 3’ behind hydrant; 6’ face to face from branch

Section II: Work Associated with Water Main Construction

1 - DESIGN CRITERIA

1.1 Pipe Size and Type:

i. All distribution mains 4" and larger shall be ductile iron per material specifications except under special site conditions where the District may specify a different pipe material. All main distribution pipe lines shall be of a size to adequately serve the needs of the proposed development and any potential extension thereof, but in any event shall not be less than eight (8) inches in diameter except as may be permitted by the District.

ii. The minimum size of the pipe where public fire protection is to be provided or required shall be eight (8) inches in diameter. Dead-ends shall be minimized by looping all mains where practical. Where dead-ends are necessary they shall be terminated with a fire hydrant or blow-off assembly. The nominal pipe diameter of water mains without fire protection shall not be less than four (4) inches unless pre-approved by the District.

iii. The District may request that the size of the main be increased beyond the required size for the project if necessary to facilitate the future expansion of the system beyond the scope of the developer's project. In such case, the District will pay to the developer the difference in cost of the materials between the two sizes.

iv. The minimum service line size shall be 1" inside diameter. The District will calculate and/or verify all service line, meter and backflow prevention device sizes based on the proposed plumbing fixtures in each building.

Depth of Cover:

Water pipe shall be laid with a minimum cover of five and one-half (5 ½) feet as measured from established finished grade to the top of the pipe and a maximum cover of seven (7) feet to the top of the pipe. The contractor shall establish adequate elevation control to ensure that upon final grading the appropriate cover over water lines has been maintained. It shall be the Contractor's responsibility and expense to verify the cover at any location questioned by the District. Any potential changes in alignment or grade of roadways shall be considered in the original utility design. Any deviation from the required cover must be approved by the District.

Gate Valve Locations:

Gate valves shall be located at all pipe junctions and street intersections in such a manner as to control and isolate flows in all segments of the system. A minimum of two (2) valves are required at tees. A valve will be required beyond the last service if the main can be extended in the future. In all other areas, gate valves will be required every 1000 feet, except as otherwise may be determined by the District. The District shall make the final determination as to the number of valves required and their location.

Hydrants:

The design engineer shall consult with the fire department having jurisdiction during the design process as to the number of fire hydrants that may be required for public fire protection and their probable location if the project is within the public way. All hydrants within the public way will be considered as public fire hydrants and will be owned and maintained by the District after the initial installation and acceptance by the District. All proposed public fire hydrants within a project must receive written approval of their addition to existing public fire protection from the municipality having jurisdiction. Such written approval shall be addressed to and submitted to the District prior to project approval by the

District. All hydrant installations located within the public way shall be paid for by the owner / developer and must meet the specifications of the District.

Private hydrants (those installed on private property for the sole purpose of the owner / developer) shall be owned and maintained by the owner / developer. It is highly recommended that private hydrants meet the specifications of the District for simplicity of maintenance should the owner / developer contract with the District for maintenance. All private hydrants connected to mains owned and maintained by the District will be considered as an individual fire protection service and be billed accordingly.

Air Release Valves:

Air release valve assemblies shall be installed at all high points of the new main as determined by the District. The size and design of the valve and piping will be determined by the District.

2 - DESCRIPTION OF WORK:

The work to be done consists of trenching, laying ductile iron water mains, services, hydrants and other necessary appurtenances, backfilling the trench, and properly completing the work of water main construction at locations called for in accordance with plans approved by and at a time required by the Greater Augusta Utility District (hereinafter called the "District"), all according to the District's Specifications and Procedures.

3 - DUTIES OF THE DISTRICT:

The District will furnish and perform the following services at the Contractor's expense:

3.1 The District will locate for the contractor terminal points or connection points of the work and will also locate for the contractor any of its facilities lying in close proximity to the work which would in any way be a hazard to the contractor's operations. (Generally no charge for this work).

3.2 The District will review all required contractor submittals of plans, specifications, and materials specifications. (Generally no charge for this work, except for re-submittals)

3.3 The District will provide on site inspection and approval of materials and installation procedures, including leak repairs. Filling will **always** be done by the District. The contractor will be billed on a direct time and materials basis for such work.

3.4 The District will operate **all** valves which may be found desirable or necessary to be used for any purpose. The contractor will be billed on a direct time and materials basis for such work.

3.5 The District will generally conduct all pressure testing and disinfecting operations in accordance with AWWA standards. See sections 10.1 and 11.1. The contractor will be billed on a direct time and materials basis for such work.

3.6 The District will conduct all required bacteriological tests on water samples from the completed new mains and appurtenances. All tests will be paid for by the contractor on a direct time and materials basis.

4 - DUTIES OF THE CONTRACTOR:

The contractor will:

4.1 Submit for District approval a set of plans showing plan and profile of the proposed main,

right-of-way boundaries, other utilities, limits of paving (existing and/or proposed), ledge profile or test borings and any other physical or topographic feature relevant to the installation and maintenance of the water main. All plans must be submitted to the District per the requirements of Section I, 1, a and b unless otherwise specifically requested by the District. All final approved plans must be submitted in AutoCAD format prior to construction.

4.2 Install the water mains so as to supply the District, upon completion, with a satisfactory, watertight pipeline, laid to the proper grade and alignment as shown on the plans and in accordance with these Specifications and Procedures. Submit a copy of scaled "as built" drawings upon completion of the job per requirements of Section I, 1, h.

4.3 For water mains and appurtenances to be owned and maintained by the District, the contractor / developer shall turn said water mains and appurtenances over to the District free and clear of liens, damage claims or law suits. In addition, the contractor shall provide the District with easements for all water mains and appurtenances that will be within the public right-of-way of newly constructed streets and roadways. Said easements shall be granted to the District prior to the acceptance of said streets by the authority having jurisdiction and shall be in the form specified by the District.

4.4 Obtain all street opening permits from cities, towns, or MDOT, as may be applicable, covering any pipelines and appurtenances to be laid in the public way and shall be responsible for fees levied by any of these agencies which are applicable to the work covered by this specification.

4.5 Establish line and grade for the pipeline and right-of-way boundaries where the pipeline is to be laid in the right-of-way outside of a public way.

4.6 Purchase all materials in accordance with the District's Materials and Installation Specifications.

4.7 Furnish all labor, materials and equipment in order to construct water mains, services, hydrants and appurtenances as may be required to complete the work in accordance with said plans and specifications.

4.8 Record a minimum of two (2) lateral measurement “swing ties”, as close to 90 degrees opposed as practical, prior to backfilling pipeline from permanent fixtures such as house corners, telephone poles, fire hydrants, catch basins, manholes etc. to all valves, fittings, couplings, tees, corporations etc. for purposes of future location. Permanent fixtures shall be identified such as house numbers or description, pole numbers etc. These ties must be legibly recorded in sketch form or recorded within the as-built drawings and submitted to the District prior to final project acceptance.

4.9 Furnish all borrow material (sand, gravel, etc.) to bed pipe and completely backfill trench in accordance with Section 8. All water mains containing water must be provided with five and one-half (5 ½) feet of cover to the top of pipe prior to November 15.

4.10 Shall guarantee the workmanship of the pipeline and appurtenances for one (1) year from the date of acceptance by the District and any charges incurred during that year shall be billed to the Contractor.

5 - MATERIALS:

5.1 See "Materials and Installation Specifications” for materials generally associated with water main installation. Additional materials that may be required will be evaluated on

a case by case basis as the need arises.

5.2 Materials which do not meet the District's specifications will not be accepted.

6 - EXCAVATION:

6.1 PERMITS AND REPAVING

The contractor shall make application and pay for all necessary street or highway opening permits necessary for the pursuit of the work. No opening shall be made by the contractor until the appropriate permit has been obtained, and when such opening shall be made it shall be done in strict accordance with the terms of the permit. The contractor shall pre-mark the area of excavation and contact Dig-Safe a minimum of 3 business days prior to the scheduled excavation. The contractor shall also contact all utilities that **are not** members of Dig-Safe with the same minimum 3 business day notice.

6.2 CUTTING OF PAVEMENT

Pavement shall be cut by a method approved by the authority having jurisdiction.

6.3 RIGHT-OF-WAY

For water mains to be owned and maintained by the District, a minimum 40 foot right-of-way, centered over the water main(s), shall be included in the easement transferring ownership of said water main(s) to the District and obtained by the Developer/Contractor prior to installation of said water main.

6.4 TRENCHING

The trench shall be dug so that the pipe can be laid to the alignment and depth required and shall be excavated in advance only to the extent necessary for the proper pursuit of the work. The trench shall be kept dewatered, such that no drainage water shall enter the open end of the pipe and said open end of the pipe shall be temporarily plugged off at night and over the weekends, or whenever the work is suspended, or in cases where unstable material could cause a cave-in to enter into the exposed end of the pipe. The trench width shall be in accordance with the District's "Typical Trench Detail". The bottom of the trench shall be smooth and even and should be as nearly undisturbed as possible. The pipe shall be blocked approximately 18" behind the bell such that the pipe barrel is 4 to 6" off the trench bottom to permit bedding material to be worked in and compacted under the pipe invert. For pipe installation in ledge or boulder areas, the blocking shall be arranged to provide a minimum 6" clearance between the barrel invert and any ledge or boulders. All bedding material placed under and around the pipe shall be compacted by mechanical means, as approved by the District, so as to give it a solid base, precluding future settlement. When the bottom of the trench at subgrade is found to be unstable or to include cinders, refuse, vegetable, organic or any such undesirable material, such materials shall be removed and replaced with suitable material (bankrun gravel - 4" minus, screened gravel - 4" minus, crushed gravel or crushed stone) prior to the pipe being placed. Such replacement material shall be placed in maximum 12" lifts and compacted by approved mechanical means.

6.5 BLASTING

Blasting for excavation shall be done at the sole discretion of the contractor. Damage caused to existing water mains and services by blasting shall be repaired by the District and paid for by the contractor.

6.6 METHOD OF EXCAVATING

Excavating may be done by any acceptable and method of excavation, by machine or otherwise as may be desired by the contractor. Excavation adjacent to nearby water mains or service laterals shall be done by hand to protect these from damage.

6.7 INTERRUPTION OF SERVICE

When, as the result of the contractors scheduled work, the District must shut down part of its system affecting its customers or fire protection, the contractor shall provide the District with a minimum 48 hours notice prior to conducting such work. No valve, hydrant or other facility of the Greater Augusta Utility District shall be operated by the contractor or his agents. The District will, upon 24 hours advance notice, furnish men and equipment for such activity as necessary, at the contractor's cost.

7 - PIPE LAYING:

7.1 ALIGNMENT AND GRADE

Pipelines, fittings, valves and other accessories shall be laid to the alignment, grade and location as shown on the plans as approved by the District. All valve stems shall be plumb with the vertical plane and all fittings, likewise shall be oriented such that their center lines shall be at the proper grade and alignment. The main shall be provided with a minimum 5 1/2 feet of cover from finish grade as measured to the top of pipe. Any deviation from line and/or grade caused by the encountering of obstructions such as other utilities shall be done so only after the approval of the District. See "Specification - Ductile Iron Pipe" and "Specification - Ductile Iron Fittings, Including Bends, Reducers, Off-sets, Tees and Sleeves" for general installation instructions regarding these items.

7.2 HANDLING OF MATERIAL INTO TRENCH

Proper implements, tools and facilities, satisfactory to the District, shall be provided and used by the contractor for the safe and convenient handling of all materials. Pipe fittings and accessories shall be carefully lowered into the trench, piece by piece, by means of crane, slings and other suitable tools and equipment, in a manner such as to prevent damage to the materials or to its protective coatings and linings. No chain or slings shall be passed through any pipe, valve, or fittings. Under no circumstances shall piping materials be dropped or dumped into the trench.

8 - BACKFILLING:

8.1 BACKFILL - GENERAL

All backfill material to be placed in maximum 12" lifts and compacted to 95% proctor under and around pipe. Compaction densities from the top of pipe to the top of the trench shall also be 95% proctor unless otherwise specified by authorities having jurisdiction. Do not place frozen materials in backfill or place backfill (and pipes) upon frozen material. Remove all frozen material or allow to thaw and then compact prior to placing new backfill material.

8.2 BACKFILLING PIPE TRENCH

Start backfilling and proceed until complete as soon as practicable after the pipes have been laid, and structures such as thrust blocks have had sufficient time to cure.

The contractor shall be required to backfill the entire trench as part of the scope of work. Upon testing of pipe, if such deficiencies as leaking joints exist, the contractor shall excavate, expose and

repair leaking joints and then backfill the trench to the original specifications - all at his own expense.

a) Material Placement: Do not place stone or rock fragment larger than 2" in backfilling under and around the pipe (bedding) nor drop large masses of backfill material into the trench in such a manner as to endanger the pipeline. Wet material by sprinkling when necessary to ensure proper compaction by tamping or rolling, etc. However, no compaction shall be done when material is too wet as determined by the District. At such times, suspend the work until previously placed materials have dried out.

b) Tamping and Rolling: Before compaction, deposit and spread material in uniform parallel layers not exceeding 12" thickness prior to compaction. Before the next layer is placed, uniformly tamp by mechanical means to obtain a thoroughly compacted mass of the specified density. Additional care shall be taken to ensure all material under the pipe and close to the trench sidewalls is thoroughly compacted. When the trench width and depth to which backfill has been placed make it feasible, and it can be done effectively without damage to the pipe, backfill may be compacted by use of vibratory rollers or other approved methods.

8.3 BACKFILL MATERIAL

Backfill material used from bottom of trench to 1 foot above top of pipe shall be a well graded gravel or sand material with maximum stone or rock fragment size of 2". This material shall be similar to an MDOT Type A aggregate. Backfill material used from 1 foot above the top of pipe to the top of trench (bottom of base) shall be similar to an MDOT Type D aggregate with maximum stone or rock fragment size of 6" or common borrow with a maximum rock fragment size of 12” out of paved areas, unless otherwise specified by authorities having jurisdiction. In no case shall materials containing organic or vegetable matter, refuse, cinders or similar friable materials be used as backfill. Exclude pieces of bituminous pavement from backfill unless use is expressly permitted.

9 - FILLING AND TESTING:

9.1 **The District will operate all valves and facilities necessary to fill and flush the water main(s) and appurtenances. The contractor will be billed on a direct time and materials basis for such work.** The District requires a minimum 48 hours advance notice be given prior to such work.

10 - PRESSURE AND LEAKAGE TESTING

10.1 **The District will conduct all pressure and leakage testing in accordance with AWWA standards and bill the contractor on a direct time and materials basis for such work.** The District reserves the right to require the contractor to conduct all pressure and leakage testing by certified individuals in accordance with District’s standards and specifications and the following information is included for such purposes. The contractor shall provide all necessary tools, equipment, and materials to conduct all required testing.

10.2 The pressure and leakage test shall be conducted as follows:

10.2.1 Decrease pressure in the main to be tested approximately 20 psi. Observe test gauge to ensure the pressure doesn’t rise due to an existing valve or tapping valve leaking by. This is done to ensure that no undisinfected water from the installed main enters the existing main while performing the actual test.

10.2.2 A pressure test pump shall be connected to the new main at the testing point. The pressure will be slowly increased to 150 psig and allowed to stabilize (+/- 2.5 psig) for a minimum of 15 minutes.

10.2.3 A reservoir of potable water shall be connected to the test pump and the initial level of water recorded.

10.2.4 The pump pressure shall be maintained at 150 psig for a minimum of 1 hour with all makeup water withdrawn from the reservoir.

10.2.5 After one hour, the water level in the reservoir will be measured and the volume of water drawn down from the reservoir calculated and compared with the following allowable leakage:

$$\text{Allowable Leakage (ounces per hour)} = \frac{\text{Pipe Length (feet)} \times \text{Nominal Diameter (inches)} \times 128}{10{,}900}$$

10.2.6 If any test discloses leakage greater than that specified above, the contractor, at his own expense, shall locate the leak and make repairs as necessary until the leakage is within the specified allowance. Written certification of leakage and pressure testing shall be submitted to the District upon completion.

11 - DISINFECTION:

11.1 **The District will conduct all disinfecting procedures of water mains and appurtenances in accordance with AWWA standards and bill the contractor on a direct time and materials basis.** The District reserves the right to require the contractor to conduct all disinfecting procedures by certified individuals in accordance with District's standards and specifications and the following information is included for such purposes. The contractor shall provide all necessary tools, equipment, and materials to conduct all required testing.

Upon satisfactory completion of the pressure and leakage test, all new water mains, hydrants, services and branches larger than 2" diameter shall be flushed and disinfected prior to being placed in service in accordance with AWWA continuous feed method.

11.2 The contractor shall hire certified individuals to chlorinate the new main and appurtenances in accordance with the continuous feed method specified in Section 5.2 of AWWA Standard C651 (latest revision), using a 5% to 15% sodium hypochlorite solution or properly mixed concentration of calcium hypochlorite solution.

11.2.1 The chlorinated solution shall be injected into the new main within 10 feet on the connection to the existing main with potable water at a minimum concentration of 50 ppm (100 ppm maximum) of free chlorine. District personnel will operate all valves required to set disinfection flow rates, etc. The contractor will be charged on a direct time and materials basis for such work. The District requires a minimum 48 hours advance notice for this purpose. All discharge and flushing locations shall be monitored to ensure a minimum concentration of 25 ppm free chlorine throughout the new main including hydrants, branches longer than 10 feet, and services larger than 2" diameter.

11.2.2 After a 24 hour detention period, the new main, hydrants, branches and large services shall be flushed (valve operation by the District) until all heavy chlorinated

water has been removed. The contractor shall furnish all necessary materials to perform the flushing and/or dechlorination. The discharge of water to the environment with chlorine concentrations greater than the ambient distribution system chlorine residual is prohibited. The highly chlorinated water must be dechlorinated before being discharged to the environment. The method of dechlorination is at the discretion of the contractor as long as the procedure does not cause harm to the environment.

Written certification of disinfection must be submitted to the District for our records once completed.

12 - BACTERIOLOGICAL SAMPLING AND TESTING:

12.1 After the final flushing, and with a minimum 24 hours advance notice, the District will take one set of bacteriological tests on the completed new mains and appurtenances; and any additional tests required as the result of improper disinfection. All tests will be paid for by the contractor on a direct time and materials basis.

12.2 The new main(s) shall not be activated and placed into service until successful bacteriological testing and completion of the "Certificate of Title and Project Acceptance."

Section III: Water Main Materials & Installation Specifications

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Review Date: January 2008
Approved By: MAM

GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
BRASS COMPRESSION UNIONS,
COUPLINGS, M.I.P. & F.I.P. ADAPTERS

1.0 SPECIFICATIONS:

1.1 This specification covers all brass compression unions in sizes ranging from ¾" to 2" diameter, inclusive.

1.2 All compression unions with iron pipe thread end connections shall have such thread for the full depth of the threaded ends in accordance with AWWA C-800.

1.3 Outlet connections shall be copper pipe compression unless otherwise specifically specified. The District prefers compression connections in which the brass compression nut "shoulders" tight against the body when fully made up. Compression connections utilizing set screws or split clamps **are not** permitted.

1.4 All compression unions shall have heavy brass walls constructed of 85-5-5-5 ASTM B62 brass for strength and durability.

1.5 Rated working pressure shall be 150 psig minimum.

1.6 Acceptable brass compression union manufacturers are Mueller Company (Series 110 compression connection), Ford Meter Box Company (Quick Joint), A.Y. McDonald Mfg. Co. (McQuik, “Q” series) and Cambridge Brass (CB Compression series). All other submittals must be pre-approved by the District in writing.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

2.1 Brass compression unions shall be firmly supported on wooden blocking unless the trench bottom is firm.

2.2 All compression nuts shall be made up in accordance with the manufacturers specifications unless otherwise specified by the District.

2.3 Fittings shall be installed in accordance with standard practice. Soft set pipe thread compound shall be used on all threaded connections to ensure a drip tight seal. Pipe thread compound shall be compatible with potable water.

2.4 Prior to backfilling, the brass compression unions shall be placed under a static head pressure test unless otherwise waived by the District.

2.5 A minimum of 2 lateral measurement “swing ties” shall be taken to all buried compression unions prior to backfilling in accordance with Section II, 4, 4.8.

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GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
BRASS FITTINGS WITH IRON PIPE THREAD

1.0 SPECIFICATIONS:

1.1 All domestic brass service fittings with iron pipe threads shall be constructed of 81-3-7-9 ASTM B584 semi-red brass machined from solid castings.

1.2 All import brass service fittings with iron pipe threads shall be constructed of 85-5-5-5 ASTM B62 red brass.

1.3 Threaded bar stock fittings with iron pipe threads made from free cutting brass rod, bar, or shapes shall be constructed in accordance with ASTM B16 specifications.

1.4 All fittings shall be rated for 150 psig meeting or exceeding ANSI B16.15. Each fitting shall be air or water pressure tested to the pressure class rating prior to shipment to ensure consistent high quality.

1.5 Acceptable products are Lee Brass cast threaded fittings as manufactured by the Lee Brass Company of Anniston, Alabama or a pre-approved equivalent.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

2.1 Fittings shall be installed in accordance with standard practice. Soft set pipe thread compound shall be used on all threaded connections to ensure a drip tight seal. Pipe thread compound shall be compatible with potable water.

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GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
M.I.P. BRASS NIPPLES

1.0 SPECIFICATIONS:

1.1 All brass nipples shall be manufactured in accordance with ASTM B584 or ASTM B62 specifications as applicable. The minimum working pressure rating shall be 150 psig in accordance with ANSI B16.15.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

2.2 Brass nipples shall be installed in accordance with standard industry practice. Soft set pipe thread compound shall be used on all threaded connections to ensure a drip-tight seal. Pipe thread compound shall be compatible with potable water.

2.3 Never place a pipe wrench on the threaded ends when tightening a brass nipple.

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GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
CORPORATION STOPS

1.0 SPECIFICATIONS:

1.1 All corporation valves shall be of the 1/4 turn ball valve design and meet or exceed the latest revision of ANSI/AWWA Standard C-800.

1.2 Corporation stops shall have "CC or AWWA taper" threads on the inlet unless otherwise specifically specified.

1.3 Outlet connections shall be copper pipe compression unless otherwise specifically specified. The District prefers compression connections in which the brass compression nut "shoulders" tight against the corporation valve body when fully made up. Compression connections utilizing set screws or split clamps **are not** permitted.

1.4 The corporation body and components shall be of heavy brass constructed of 85-5-5-5 ASTM B62 brass for strength and durability. The ball mechanism shall be constructed of Teflon coated brass and provide a full port opening.

1.5 The valve stem shall be provided with double Buna-N rubber O-rings to insure a permanent watertight seal. The ball seats shall also be molded Buna-N rubber.

1.6 Rated working pressure shall be 250 psig minimum.

1.7 Acceptable corporations are the Mueller 300 B-25008, the Ford FB 1000-Q, McDonald 4701BQ and the Cambridge Brass 301 series in CB Compression. All other submittals must be pre-approved by the District in writing.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

2.1 The District only permits 1" diameter direct tapped corporations into cast iron and ductile iron mains. The use of larger tapping nipples and ball valves will be evaluated on a case by case basis.

2.2 Corporation taps shall be located within 0 and 10 degrees up from horizontal on the main.

2.3 Corporations shall be "screwed" into ductile iron pipe water mains such that no more than 4 threads are exposed.

2.4 A minimum of 2 lateral measurement “swing ties” shall be taken to all buried corporation stops prior to backfilling in accordance with Section II, 4, 4.8.

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GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
CURB STOPS

1.0 SPECIFICATIONS:

1.1 All curb stop valves shall be of the 1/4 turn ball valve design and meet or exceed the latest revision of ANSI/AWWA Standard C-800.

1.2 Curb stop bodies for iron pipe ball valve sizes 1 1/4" to 2" shall have full depth F.I.P. thread ends on both ends. This is an optional item occasionally used by the District.

1.3 Outlet connections for sizes ¾" to 2" shall be copper pipe compression unless otherwise specifically specified. The District prefers compression connections in which the brass compression nut "shoulders" tight against the ball valve body when fully made up. Compression connections utilizing set screws or split clamps **are not** permitted.

1.4 The curb stop valve body and components shall be of heavy brass constructed of 85-5-5-5 ASTM B62 brass for strength and durability. The ball mechanism shall be constructed of Teflon coated brass and provide a full port opening.

1.5 The valve stem shall be provided with double Buna-N rubber O-rings to insure a permanent watertight seal. The ball seats shall also be molded Buna-N rubber.

1.6 The curb stop valve shall not have a drain (waste hole).

1.7 Rated working pressure shall be 250 psig minimum.

1.8 Acceptable curb stop valves are the Mueller 300 B-25209, the Ford B44-Q, McDonald 6100Q and the Cambridge Brass 202 series in CB Compression. All other submittals must be pre-approved by the District in writing.

1.9 All curb stop valves shall be **"open left"**

2.0 GENERAL INSTALLATION INSTRUCTIONS:

2.1 Curb stop ball valves shall be firmly supported on wooden blocking, set plumb and positioned such that the operator key is vertical prior to backfilling.

2.2 All curb stop ball valves shall be provided with S.S. rods and service boxes (see Service Box Specification) unless otherwise specified by the District.

2.3 Prior to backfilling, the curb stop ball valve shall be placed under a static head pressure test unless otherwise waived by the District.

2.4 A minimum of 2 lateral measurement "swing ties" shall be taken to all curb stops prior to backfilling in accordance with Section II, 4, 4.8.

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GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
SERVICE BOXES

1.0 SPECIFICATIONS:

1.1 Reference "TYPICAL SERVICE BOX DETAIL" sheet in the Typical Standard Details section of this specification package.

1.2 Service Box Specifications

- Shall be 1.0" I.D. black A-36 steel pipe with top having N.P.I. threads for 1.0" screw on cover.
- Shall be Arch Pattern Style with 5 ½' -6 ½' slide type adjustable riser.
- All boxes shall be heavily coated with asphalt-base coal tar type corrosion resistor.

1.3 Service Box Cover Specifications

- Cast iron construction with N.P.I. female threads to accept service box (1.2 above).
- Shall be tapped with a 1" rope thread with a solid brass plug with pentagon operating head.
- Shall have the word "WATER" integrally cast into the cover.

1.4 Service Box Foot-Piece Specifications

- The standard foot-piece shall be heavy duty (Ford style or equal) cast iron design.
- The large heavy foot-piece shall have an arch that will fit over 2" ball-valve curb stops and used on all curb stops sizes 1 ¼" – 2".

1.5 Service Rod Specifications

- Shall be 36" long, 1/2" diameter # 304 stainless steel and provided with yoke as integral part of the rod.
- Shall be provided with a brass cotter pin to secure the S.S. rod to the curb stop ball valve.
- The rod "wrench flat" shall have a minimum thickness of 1/4" tapered to 1/16" and width of 1/2".

1.6 Service Box Extension Specifications

- Shall be black A-36 steel pipe sized to fit over service box as outlined in Section 1.2 above and be provided with N.P.I. threads to accept standard cover as outlined in Section 1.3 above.
- Shall be provided with 2 set screws to attach to service box.
- Shall be provided in lengths from 3" to 24".
- All extensions shall be heavily coated with asphalt-base coal tar type corrosion resistor.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

2.1 Service box bases shall be placed on the same blocking that supports the curb stop ball valve and set plumb with the vertical plane in all directions.

2.2 Service box tops shall be set 3" below finish grade, magnetized and painted florescent blue (standard water works color) prior to burial.

2.3 A minimum of 2 lateral measurement "swing ties" shall be taken to all service boxes, in accordance with Section II, 4, 4.8.

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GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
COPPER SERVICE LINE TUBING

1.0 SPECIFICATIONS:

1.1 Type K copper tubing for service lines shall meet or exceed the latest revision of AWWA Standard C-800.

1.2 Underground service line malleable tubing shall be seamless Type K copper exclusively and conform to ASTM Standard B-88.

1.3 3/4", 1" and 1 1/4" diameter Type K copper tubing shall be available in 100' long coils. 1 ½ " diameter Type K copper tubing shall be available in 60' long coils and 2" diameter Type K copper shall be available in 40' long coils.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

2.1 Extreme care shall be taken during installation to ensure that copper tubing is not crimped, gouged or otherwise detrimentally damaged.

2.2 The Contractor shall minimize the use of couplings by using the longest continuous coils available as specified above in 1.3 for the specific job unless otherwise approved by the District.

2.3 Soldering of underground copper tubing joints is **not** permitted. All unions of underground copper tubing shall be done so using brass compression type couplings (see specification for "Brass Compression Unions, Couplings, M.I.P. & F.I.P. Adapters"). Flared couplings are not permitted.

2.4 Copper tubing ends shall be de-burred and re-rounded prior to installing fittings to ensure strong, water-tight connections.

2.5 Bedding material for copper service line tubing shall be sand, free from fines, clays, loam or rocks in excess of 2". Gravel with maximum 2" nominal diameter stones shall also be permitted. Bedding material shall extend to 12" above service line tubing.

2.6 The District will size all service lines during the plan review process.

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GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
POLYETHYLENE SERVICE LINE TUBING

1.0 SPECIFICATIONS:

1.1 All polyethylene plastic service line tubing (Copper Tube Size - CTS) shall meet or exceed the latest revision of AWWA Standard C-900. The use of polyethylene pipe (Iron Pipe Size - IPS) will be evaluated on a case by case basis and usage must receive prior written approval from the District.

1.2 Polyethylene plastic tubing shall be pressure rated for a minimum of 200 psig at 73.4 Degrees F.

1.3 High quality stainless steel insert stiffeners shall be used at all compression connections for the installation of valves, couplings and similar type fittings. All compression type fittings shall be brass as specified in the appropriate section. The use of plastic compression fittings and plastic or brass friction insert fittings with S.S. clamps are prohibited.

1.4 An exception to 1.3 above would be the use of fusion welded joints, valves, and fittings. The use of fusion welded joints must be pre-approved in writing by the District.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

2.1 The contractor shall take extreme caution in the field to minimize the exposure of polyethylene plastic tubing to the harmful effects of degrading ultra violet light prior to burial.

2.2 All polyethylene plastic service lines shall be buried with a metallic "tracer" cable acceptable to the District, preferably copper, to aid in their future location unless otherwise not required by the District. The tracer cable shall be located approximately 3 ft. above the service line and shall rise up to finish grade along side the service box.

2.3 The District shall size all service lines during the plan review process.

2.4 All polyethylene lines shall be installed in a loose "snake" pattern to allow for movement due to thermal expansion and settlement.

2.5 Bedding material for polyethylene service line tubing shall be sand, free from fines, clays, loam or rocks in excess of 2”. Bedding material shall extend to 12” above service line tubing.

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GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
DUCTILE IRON FITTINGS: BENDS, REDUCERS, PLUGS, CAPS, OFFSETS, TEES

1.0 SPECIFICATIONS:

1.1 Mechanical joint compact fittings shall be ductile iron class 350 (350 psig rated working pressure) in accordance with ANSI/AWWA C-153/A-21.53-00 (or latest revision) for fittings 3" through 24" and ANSI/AWWA C-104/A-21.40-95 (latest revision) double cement lining.

1.2 Flanged joint fittings shall be ductile iron class 250 (250 psig rated working pressure) in accordance with ANSI/AWWA C110/A21.10-98 (latest revision) for fittings 3 thru 24" and ANSI/AWWA C-104/A-21.40-95 (latest revision) double cement lining.

1.3 The District **does not** permit the use of push-on type fittings with or without retaining type gaskets.

1.4 Interior seal coated with a minimum of 2 mils dry film thickness in accordance with AWWA C104.

1.5 Exterior petroleum asphaltic coated with a minimum of 2 mils dry film thickness. The finished coating shall be continuous, smooth, neither brittle when cold or sticky when exposed to the sun, and strongly adherent to the fitting.

1.6 Mechanical joint and flanged joint nuts and bolts shall be high strength, low alloy steel per AWWA C-111, 11-7.5 and ANSI 21.11 unless otherwise specified.

1.7 All fittings shall be of standard grade 70-50-05 ductile iron construction with the following minimum characteristics: 70,000 psi minimum tensile strength; 50,000 psi minimum yield strength; 5 % minimum elongation. Test results shall be made available upon request. Cast iron fittings are **not** permitted.

1.8 All fittings shall be supplied with appropriate number of standard MJ glands, gaskets and T-bolts as "standard accessories" unless otherwise specifically declined by the District at the time of order. Such "standard accessories" shall be shipped as a packaged unit and not as individual or loose items.

1.9 Acceptable ductile iron fitting manufacturers include: Griffin, Star, Tyler, Union and U.S. Pipe. Due to past experience, the District prohibits the use of all fittings manufactured by Sigma, Nappco and their affiliates.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

2.1 All fittings shall be inspected prior to installation to ensure the gasket seats are free of excess coating. Excess coating, if present, shall be manually removed so as to ensure proper seal of gasket, however, all bare metallic surfaces created as the result of removing the excess coating shall be re-coated with similar material to prohibit corrosion.

2.2 The District accepts only the use of "compact" fittings as specified in 1.1 above for all fittings 3" to 24". The contractor must seek prior written from the District approval for the use of "standard" size fittings in the 3" to 24" range.

SPECIFICATION – DUCTILE IRON FITTINGS: Cont.

2.3 Fittings shall be placed, supported and installed in strict accordance with the manufacturers instructions and as directed by the District. All bolted joints shall be torqued as follows:

- Mechanical Joint 4"-24" Diameter Pipe
  - 3/4" bolts; Torque = 75 to 90 ft.-lbs.
- Flanged Joint 4"-24" Diameter Pipe.
  - 5/8" bolts; Torque = 40 to 60 ft.-lbs.
  - 3/4" bolts; Torque = 60 to 90 ft.-lbs.
  - 7/8" bolts; Torque = 70 to 100 ft.-lbs.
  - 1" bolts; Torque = 70 to 100 ft.-lbs.
  - 1 1/4" bolts; Torque = 90 to 100 ft.-lbs.

2.4 After bolts are inserted and made finger tight, tighten diametrically opposite nuts progressively and uniformly around joint with properly calibrated torque wrench to the values as specified above. **A properly sized and calibrated torque wrench is an explicit requirement of the District.**

2.5 Coat all bolt threads for flanged connections with never-seize or an approved equal product.

2.6 All ductile iron fittings shall be restrained by means of wedge action retaining glands (see "Ductile Iron Retainer Glands" and “Thrust Restraint Requirements”) with a minimum 16-foot continuous length of ductile-iron pipe entering and exiting the fitting whenever possible unless entering or exiting another fitting or valve. The use of threaded rods will be evaluated on a case by case basis and must receive prior written approval from the District. The size and location of the rods will be determined by the District or its’ inspector prior to installation.

2.7 A minimum of 2 lateral measurement “swing ties” shall be taken to all ductile iron fittings prior to backfilling in accordance with Section II, 4, 4.8.

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GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
THRUST RESTRAINT REQUIREMENTS

Thrust restraint shall be provided on all bends, tees, valves, and dead ends for pipe diameter sizes 3" and greater. Thrust restraint shall be accomplished utilizing a combination of wedge-action retainer glands and concrete bearing thrust blocks wherever thrust forces are an issue. Each component (wedge action retainer glands and concrete thrust blocks) shall be designed to independently restrain the entire thrust force of the specific item to be restrained. Each component shall be designed to withstand a test pressure of **150 pounds per square inch (psi).** Wedge action retainer glands shall be as specified in the "DUCTILE IRON RETAINER GLANDS" section of the materials specifications. Wedge action retainer glands depend on soil friction on the skin of the pipe to restrain, therefore, it is imperative that a full length of pipe (greater than 16') enter and exit all fittings and appropriate backfill material is thoroughly compacted around pipe. Some larger diameter fittings and valves may require a longer restrained length than can be obtained from a single full length of pipe, therefore, subsequent push-on joints will need to be restrained as directed by the District or its Inspector. Concrete bearing thrust blocks shall be designed as to the amount of bearing area required to restrain the resultant thrust force of the fitting. Soil bearing strength for design purposes shall be 1500 lbs/sq.ft. unless otherwise specified by a soils engineer. Pounds of thrust on fittings can be found in the table below. Concrete bearing thrust blocks must be cast against undisturbed soil. If casting against undisturbed soil is not possible, than backfill material behind thrust block shall be crushed stone or a well graded gravel compacted to a minimum 95% modified proctor density. Cast-in-place concrete thrust blocks shall be formed up to obtain the appropriate bearing area prior to placing concrete. **Under no circumstances shall concrete be cast around (encase) mechanical joint glands or bolts.** The use of an approved pre-cast concrete thrust block of appropriate design shall be an acceptable alternative to cast-in-place. The use of gravity concrete thrust blocks will be evaluated on a case by case basis and must be pre-approved by the District after reviewing design of such.

Resultant Thrust At Fittings
At 150 psi Water Pressure

	Total Pounds				
Nom. Pipe Dia. (in.)	**Dead End**	**90 Deg. Bend**	**45 Deg. Bend**	**22 ½ Deg. Bend**	**11 ¼ Deg. Bend**
3"	1,848	2,613	1,414	721	361
4"	2,715	3,838	2,077	1,059	532
6"	5,608	7,932	4,293	2,188	1,100
8"	9,649	13,645	7,384	3,765	1,891
10"	14,515	20,527	11,109	5,664	2,845
12"	20,527	29,029	15,711	8,010	4,024
16"	35,668	50,442	27,298	9,278	6,991
20"	54,966	77,733	42,069	21,447	10,775
24"	78,418	110,901	60,019	30,597	15,373

Notes:

Thrust forces on a valve and along the branch line of a tee is the same as thrust on a "Dead End".

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GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
DUCTILE IRON RETAINER GLANDS

1.0 SPECIFICATIONS:

1.1 Mechanical joint valves and fittings shall be restrained with wedge action type retainer glands only. Acceptable wedge action retainer glands are the “Mega-Lug” retainer gland as manufactured by EBBA Iron Sales, Inc. of Eastland, Texas, the Uni-Flange “Series 1400” as manufactured by Uni-Flange, a subsidiary of The Ford Meter Box Co., Inc. of Wabash, Indiana and the RomaGrip pipe restrainer as manufactured by Romac Industries of Bothell, WA.

1.2 Flanged joint valves and fittings shall be restrained with flange adapters in lieu of threaded or welded flanges on plain end ductile iron pipe when so specified.

- Flange adapters shall be cast from 60-42-10 ductile iron per ASTM 536-77 and shall have bolt holes to meet ANSI B16.1. Flange adapters shall be 125 lb. faced. These flange adapters shall contain set screws made from ductile iron. The screws shall have a Rockwell hardness of C40-45 converted from Brinnell. Safety factor shall be minimum of 2:1.

1.3 All restrained joint devices shall include a gasket, t-bolts and set screws/foot pads as "standard accessories." Such “standard accessories” shall be shipped as a packaged unit and not as individual or loose items.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

2.1 All restrained joint devices shall be installed in strict adherence to the manufacturer’s instructions. Torque wrenches must be used in the tightening of t-bolts, set screws/ foot pads and flange bolts in all cases.

2.2 The contractor shall thoroughly inspect all restrained joint devices for stress cracks and similar physical defects or mechanical damage prior to their installation.

2.3 All set screw / foot pads around the retainer gland shall be tightened until the foot pad rests against the pipe prior to fully tightening the foot pad onto the pipe to the correct torque.

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GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
RETAINER GLANDS FOR PVC PIPE

1.0 SPECIFICATIONS:

1.1 Mechanical joint ductile iron valves and fittings on PVC C905 pipe shall be restrained with wedge action type retainer glands manufactured specifically for PVC pipe only. Acceptable wedge action retainer glands are the “Mega-Lug Series 2000PV” retainer gland as manufactured by EBBA Iron Sales, Inc. of Eastland, Texas, the Uni-Flange “Series 1500 C” as manufactured by Uni-Flange, a subsidiary of The Ford Meter Box Co., Inc. of Wabash, Indiana or the “PVC RomaGrip” retainer gland as manufactured by Romac Industries of Bothell, WA.

1.2 All restrained joint devices shall include a gasket, t-bolts and set screws/foot pads as "standard accessories." Such “standard accessories” shall be shipped as a packaged unit and not as individual or loose items.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

2.4 All restrained joint devices shall be installed in strict adherence to the manufacturers instructions. Torque wrenches must be used in the tightening of t-bolts, set screws/ foot pads and flange bolts in all cases.

2.5 The contractor shall thoroughly inspect all restrained joint devices for stress cracks and similar physical defects or mechanical damage prior to their installation.

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GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
DUCTILE IRON PIPE

1.0 SPECIFICATION:

1.1 Ductile iron pipe shall meet the requirements of AWWA Standard C-151/A21.51-96 (or latest revision) and be double cement lined and sealed coated to meet AWWA Standard C-104 (latest revision). Joints shall meet the requirements of AWWA C-111 (latest revision).

1.2 Interior seal coat shall be at least 2 mils thick and meet the specification 1.1 as stated above.

1.3 Exterior of pipe shall be petroleum asphaltic coated with a minimum of 2 mils dry film thickness. The finished coating shall be continuous, smooth, neither brittle when cold or sticky when exposed to the sun, and strongly adherent to the pipe.

1.4 Class 52 wall thickness, 4" diameter through 10" diameter inclusive.

1.5 Class 51 wall thickness, 12" & 16" diameter.

1.6 Class 50 wall thickness, 20" diameter and larger.

1.7 Nominal laying length shall average no less than 18 ft. per pipe. The District prefers the nominal laying length of 20 ft. per pipe.

1.8 Approximately 20 percent of the pipe shall be specified as "gauge full length" and **clearly** marked indicating such.

1.9 Mechanical joint pipe shall be furnished with standard gland, gasket and Cor-Ten bolts and nuts as "standard accessories."

1.10 Push-on joint pipe shall be furnished with gasket and gasket lubricants as "standard accessories."

1.11 Special order pipe shall be specified as to the standard accessories required.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

2.1 Push-on joint pipe shall be assembled in strict accordance with the manufacturers instructions as described below.

a) Thoroughly clean the groove and bell socket and insert the gasket, making sure that it faces the proper direction and that it is correctly seated.

b) After cleaning dirt or foreign material from the plain end, apply lubricant in accordance with the pipe manufacturers recommendations. The lubricant is supplied in sterile cans and every effort shall be made to keep it sterile.

c) Be sure that the plain end is beveled; square or sharp edges may damage or dislodge the gasket and cause a leak. When pipe is cut in the field, bevel the plain end with a heavy file, grinder or pipe saw to remove all sharp edges. Push the plain end into the bell of the pipe. Keep the joint straight while pushing. Make deflection after the joint is assembled.

SPECIFICATION – DUCTILE IRON PIPE – Cont.

d) Small pipe can be pushed into the bell socket with a long bar. Large pipe (generally 12" diameter or greater) require additional power, such as a pipe jack, lever puller or backhoe. The pipe supplier may provide a pipe jack or lever puller on a rental basis. A timber header should be used between the pipe and jack or backhoe bucket to avoid damage to the pipe.

2.2 Mechanical joint pipe shall be assembled in strict accordance with manufactures instructions as described below:

a) Wipe clean the socket and the plain end. The plain end, socket, and gasket shall be washed with a soap solution to improve gasket seating. Place the gland on the plain end with the lip extension toward the plain end, followed by the gasket with the narrow edge of the gasket toward the plain end.

b) Insert the pipe into the socket and press the gasket firmly and evenly into the gasket recess. Keep the joint straight during assembly. Make deflection after joint assembly but before tightening bolts.

c) Push the gland toward the socket and center it around the pipe with the gland lip against the gasket. Insert bolts and hand-tighten nuts.

d) Tighten the bolts to the normal range of bolt torque (75-90 ft.- lbs. for 4" to 24" diameter pipe) while at all times maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. This can be accomplished by partially tightening the bottom bolt first, then the top bolt, next the bolts at either side, finally the remaining bolts. Repeat the process until all bolts are within the appropriate range of torque. Generally 3 to 4 repetitions are required.

2.3 For other types of pipe joints that may be specified for "specialty" type jobs, specific instructions will be given as needed.

2.4 Pipe cleanliness. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. No debris, tools, clothing, or other material (or people) shall be placed in the pipe at any time.

2.5 Pipe placement. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be held in place via blocking behind the bell prior to backfilling.

2.6 Direction of bells. It is common practice to lay pipe with the bells facing the direction in which work is progressing.

2.7 Temporary pipe plugs. At times when work is not in progress, the open end of the pipe shall be closed by means of a watertight plug or other means acceptable to the District. When practical, the plug shall remain in place until the trench is pumped completely dry. Care must be taken to prevent pipe floatation should the trench fill with water.

2.8 Pipe deflection. When it is necessary to deflect pipe from a straight line in either the horizontal or vertical plane, the amount of deflection shall not exceed 75% of the maximum allowable deflection as specified by the manufacturer. For example, for 12" DIPCL push-on pipe, the manufacturers maximum allowable deflection is 5 degrees or 21" for a 20' length of pipe. Therefore, the District will permit 75% of 21" or 15" maximum deflection per joint. Please keep in mind that deflections are cumulative in the horizontal and vertical plane.

2.9 Polyethylene encasement. Polyethylene encasement of DIPCL water mains shall only be done when specifically specified by the District.

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GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
POLYVINYL CHLORIDE (PVC) PRESSURE PIPE C905

1.0 SPECIFICATION:

1.1 Polyvinyl Chloride (PVC) pressure pipe shall meet all the requirements of AWWA Standard C905-97 (or latest revision) and have a Dimension Ratio (DR) of 18 and a Pressure Rating (PR) of 235 psi for diameters 14" through 24" and be provided with an outside diameter the equivalent of cast iron pipe. The use of Polyvinyl Chloride (PVC) will be reviewed on a case by case basis and must receive written approval from the District.

1.2 Each piece of pipe shall be provided with a factory installed elastomeric gasket meeting the Standards of ASTM F477 (latest revision). Gaskets shall not be removed from the pipe joint.

1.3 Dimensions and tolerances for each nominal pipe size shall be in accordance with Table 2 Dimensions for PVC Transmission Pipe with CI Outside Diameter of Section 3 Pipe Requirements in AWWA C905-97 (or latest revision).

1.4 Pipe shall be furnished in standard laying lengths of 20 feet unless otherwise noted. Each pipe shall have an integral bell formed on the pipe end and be designed to be at least as strong as the pipe wall.

1.5 Each length of pipe furnished shall bear identification markings that will remain legible after normal handling, storage and installation. Markings shall be applied in a manner that will not weaken or damage the pipe. Markings shall be applied at intervals of not more than 5 feet on the pipe. Marking requirements shall be in conformance with Section 6.1 Marking of AWWA C905-97.

1.6 Pipe shall be bundled in pallets for ease of handling and storage. Pipe bundles shall be packaged to provide structural support to insure that the weight of upper units shall not cause deformation to pipe in lower units. No pipe bundles shall be accepted which show evidence of degradation from ultraviolet radiation on exposed pipe as may be caused from extended unprotected storage conditions.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

2.1 PVC Pressure Pipe shall be assembled in strict accordance with the manufacturers instructions and per the AWWA Standard C605-94 (or latest revision) and as briefly described below.

a) Proper care shall be used to prevent damage in handling, moving and placing the pipe. Pipe shall be hoisted with mechanical equipment using a cloth belt sling or continuous fiber rope which avoids scratching the pipe. A chain is not permitted. Pipe shall not be dropped or dumped into the trench.

b) Thoroughly inspect the bell end of the pipe to insure the gasket is properly seated in the bell groove and not damaged. Clean entire joint to insure there is no debris, sand or silt in which to cause the gasket to not properly seal.

c) Inspect and clean spigot end of pipe. Wipe with a clean dry cloth around entire circumference from the end to at least one inch beyond the reference mark.

d) Lubricate the spigot end of the pipe using only lubricant supplied and approved by the pipe manufacturer. Do not allow the lubricated spigot end of the pipe to come in contact with anything before assembly. Do not lubricate the gasket or ring groove as this may result in displacement during assembly.

SPECIFICATION – POLYVINYL CHLORIDE (PVC) PRESSURE PIPE – Cont.

e) Assemble the joint only to the reference mark provided on the spigot end.

f) Insert the beveled spigot end into the bell so that it is in contact with the elastomeric gasket. Pipe must be aligned properly with previous pipe before assembling joint. Bell end of pipe must be protected with wood blocking while pushing lengths together. Care must be taken while pushing joints together that previously completed joints in the line will not be closed up or over-assembled. Previous lengths of pipe should either be braced or sufficiently backfilled to prevent any over-assembling. Apply a steady and constant force to the pipe until the reference mark is even with the bell end.

g) Once the joint is assembled, the District will allow a maximum of 1 degree of angular deflection to be taken in the joint. This will produce an offset in a 20 foot long section of approximately 4 1/4 inches. Joint deflection is achieved only after the joint is assembled in straight alignment and to the reference mark. It is important to note that horizontal and vertical angular deflections are cumulative.

h) Prior to backfilling, check to see that the reference mark is even with the end of the bell.

2.11 Pipe cleanliness. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. No debris, tools, clothing, or other material (or people) shall be placed in the pipe at any time.

2.12 Pipe placement. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be firmly supported along its entire length by the prepared bedding material prior to backfilling.

2.13 Direction of bells. It is common practice to lay pipe with the bells facing the direction in which work is progressing.

2.14 Temporary pipe plugs. At times when work is not in progress, the open end of the pipe shall be closed by means of a watertight plug or other means acceptable to the District. When practical, the plug shall remain in place until the trench is pumped completely dry. Care must be taken to prevent pipe floatation should the trench fill with water.

2.15 Mechanical Joint Ductile Iron Fittings. Only MJ DI fittings meeting the District's specifications may be used with C905 PVC pipe. Proper layout of the fittings must be accomplished in a sufficient manner as to insure that nearly a full section of pipe (min. 18 feet for PVC) enter and exit all fittings and valves to provide the necessary skin friction on the pipe walls required by the wedge-action retainer glands. Only wedge-action retainer glands designed specifically for C905 PVC shall be used. See "RETAINER GLANDS FOR PVC PIPE" for details.

2.16 Taps. All taps 1" – 2" in diameter performed on PVC pipe shall utilize a double stainless steel strap ductile iron service saddle of appropriate size to properly fit the pipe. Service saddles shall be provided with AWWA (CC) threads to accept an appropriately sized corporation. All taps 3" and larger on PVC pipe shall utilize mechanical joint ductile iron tapping sleeves. See "DUCTILE IRON TAPPING SLEEVES" for details.

2.17 Copper Tracer Wire. All PVC pipe must be provided with a minimum No. 6 AWG insulated copper wire laid along the top of the pipe and secured by means acceptable to the District. Tracer wire must be continuous as to not break conductivity. If wire must be cut and/or reconnected, splice wires with a minimum 6" overlap and use 2 u-bolt cable connecters that will not degrade conductivity. Tracer wire must be brought up and secured inside all valve gate boxes to within 3" of ground surface for connection to an electronic pipe locator.

Review Date: January 2008
Approved By: MAM

GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
RESILIENT SEAT WEDGE (GATE) VALVES

1.0 SPECIFICATION:

1.1 The District currently utilizes the American Flow Control Model 2500 and the U. S. Metroseal Model 250 resilient seat wedge (gate) valve for 4" through 16" diameter sizes inclusive. **Valves constructed of cast iron are not permitted.** Valve configurations include both mechanical joint and flanged type connections. The use of any valves others than those mentioned above will require prior written approval from the District.

1.2 All bolts shall be type 18-8 high strength stainless steel.

1.3 The valve stem shall be "open-right."

1.4 The valve shall be furnished with standard 2" AWWA operating nut color-coded ("red") as to valve opening.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

2.1 Prior to installation, the valve shall be physically operated to confirm operation of valve per section 1.3 above.

2.2 During installation, the valve body shall be set on wooden blocking, the supporting material of which has been thoroughly compacted. Valve body shall be set plumb and positioned such that the operating nut is vertical prior to backfilling.

2.3 All joint bolts shall be torqued using a calibrated torque wrench in accordance with the manufacturer's specifications.

2.4 Great care shall be taken to ensure that the fusion-bonded epoxy coated exterior is not damaged. Any damaged areas shall be repaired by the contractor in accordance with the manufacturers recommendation at the sole expense of the contractor.

2.5 All valves shall be restrained by means of wedge action retaining glands (see "Ductile Iron Retainer Glands" and "Thrust Restraint Requirements") with a minimum 16-foot continuous length of ductile-iron pipe entering and exiting the valve whenever possible unless entering or exiting another fitting. The use of threaded rods will be evaluated on a case by case basis and must receive prior written approval from the District. The size and location of the rods will be determined by the District or its' inspector prior to installation.

2.6 All resilient seat wedge (gate) valves shall be provided with valve boxes (see Valve Boxes, Extensions and Covers specification) to the surface unless specifically requested not to by the District.

2.7 A minimum of 2 lateral measurement "swing ties" shall be taken to all valves prior to backfilling in accordance with Section II, 4, 4.8.

Review Date: January 2008
Approved By: MAM

GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
BUTTERFLY VALVES

1.0 SPECIFICATION:

1.1 This specification includes mechanical joint and flanged butterfly valves from 16" through 24" diameter inclusive. All butterfly valves shall be of the rubber seated tight closing type. They shall meet or exceed AWWA Standard C504 (latest revision).

1.2 All valves must use full AWWA C504 Class 150B valve shaft diameter, and full Class 250 underground service operator torque rating throughout entire travel, to provide capability for operation in emergency service.

1.3 All butterfly valves shall be **"open right"**.

1.4 All butterfly valve manufacturers shall have a minimum of five (5) years experience in the manufacture of butterfly valves for the size and type of service as specified herein.

1.5 The valve body shall be ASTM - A48, Class 40 or A126, Class B high tensile cast iron. The body shall have integral hubs for housing shaft bearings and seals.

- Mechanical joint ends shall conform to AWWA C-111.
- Flanged ends with short body laying length per AWWA C-504, and with flanges designed for installation between ANSI B16.1 Class 125 cast iron flanges.

1.6 The butterfly valve disc shall be of the "off-set" design to provide a full 360 degree seating surface uninterrupted by shaft holes. The disc shall be constructed of ASTM A56, grade 65-45-12 ductile iron. There shall be no external ribs to the flow. Non-metallic discs are not acceptable.

1.7 The resilient seat shall be Buna-N or natural rubber designed to provide tight shutoff at the specified pressures. The rubber seat can be on the disc edge or in the valve body but in either case, must be retained by positive mechanical means with corrosion-resistant hardware. Seats must be capable of mechanical adjustment in either direction without the use of special tools. The should be capable of complete replacement in the field without chipping, grinding, or burning out the old seat or its retaining mechanism. The rubber mating surface in all cases must be 300 series stainless steel (minimum).

1.8 All valve shafts shall be of single piece "through" type construction. The shafts shall be composed of round stock, 18-8 stainless steel, type 304 material. Valve shafts shall be securely attached to the disc by means of dowel pins composed of 18-8 stainless steel. Shaft bearings shall be contained in the valve body integral hubs. The bearings shall be of the self-lubricated sleeve type.

1.9 The valve assembly shall be furnished with a single two-way thrust bearing designed to center the disc in the body at all times and adsorb thrust forces. The drive end shaft shall be of the cartridge type with O-rings to provide positive sealing.

1.10 All valves shall be tested per AWWA C-504, including hydrostatic, performance, and leakage tests.

SPECIFICATION – BUTTERFLY VALVES – Cont.

1.11 Valves shall have all internal and external surfaces shop coated with a high performance, one-part, heat-curable thermosetting epoxy coating which provides superior corrosion resistance protection for metal parts (Federal Specification TT-V-51C) except for furnished bearing surfaces. The coating material shall be a suitable, non-toxic epoxy resin consisting of 100% solids. It is impervious to and imparts no taste to potable water. The coating is formulated from materials deemed acceptable in the Food and Drug Administration Document Title 21 of the Federal Regulations on food additives, Section 175.300 entitled "Resinous and Polymeric Coatings." The coating thickness shall be a minimum of 9 mils in thickness.

1.12 The valve actuator shall be integrally mounted on the valve mounting flange and shall be of the self-locking traveling nut type in complete accordance with AWWA C-504 requirements. The housing, housing cover, and shaft shall be sealed or gasketed to prevent water entry to a 25 ft. head pressure.

- Buried service valve actuators (mechanical joint) shall be furnished with standard 2" AWWA operating nuts. Operator design must permit repositioning of the actuator in 90 degree increments, and must permit adjustment of the valve disc seating.

- Flanged valves shall be supplied with all the necessary gaskets, nuts and bolts required to install the valves. Flanged valves shall be supplied with either the standard 2" AWWA operating nut or a handwheel with integrally cast 2" nut which is pinned to the input shaft. The size of the handwheel shall meet AWWA C-504 rim pull limitations.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

2.1 All butterfly valves shall be installed in accordance with the manufacturers specifications and instructions and as directed by the District.

2.2 Valves delivered to the job site shall be stored undercover and on pallets unless otherwise approved in writing by the District.

2.3 Restraint for mechanical joint valves shall be in accordance with the “Thrust Restraint Requirements” section of these specifications.

2.4 A minimum of 2 lateral measurement “swing ties” shall be taken to all new butterfly valve installations in accordance with Section II, 4, 4.8.

Review Date: January 2008
Approved By: MAM

GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
HORIZONTAL SWING CHECK VALVES

1.0 SPECIFICATION:

1.1 Horizontal swing check valves shall meet or exceed the requirements of AWWA Standard C-508. Construction shall consist of a cast iron body, bronze mounted, single gate for non-shock working pressure of 150 psig and tested at double the working pressure.

1.2 Check valve ends shall be flanged (generally) or mechanical joint as specified.

1.3 All check valves shall be supplied with the appropriate ring gaskets, nuts, and bolts as "standard accessories" required for installation. The gaskets, nuts, and bolts shall comply with the specifications for "Ductile Iron Fittings."

1.4 When there is no flow through the main, the swing gate shall hang lightly against the seat.

1.5 The valve shall be constructed such that all components may be adjusted/ removed by lifting off the top access cover without removing the valve from the line.

1.6 Check valves shall be supplied with the same internal and external epoxy coatings as specified for "Butterfly Valves."

1.7 Check valves shall be suitable for mounting horizontally or vertically, depending on the direction of water flow.

1.8 Check valves shall have stainless steel hinge pins. The hinge pins shall operate in babbitt style support bearings.

1.9 Check valves shall be outside weight and lever unless otherwise specified.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

2.1 Check valve applications will generally be for interior use via flanged end connections. The District will specify maximum laying length limits when applicable.

2.2 Check valve gross weights shall be provided as part of the standard submittal package (i.e. manufacturers spec. sheets, etc.).

2.3 The contractor shall be provide, at no additional cost to the District, temporary supports under large check valves until such permanent supports such as cast-in-place concrete cradles can be placed and made ready for service.

2.4 A minimum of 2 lateral measurement “swing ties” shall be taken to all buried check valves prior to backfilling in accordance with Section II, 4, 4.8.

Review Date: January 2008
Approved By: MAM

GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
FIRE HYDRANTS

1.0 SPECIFICATION:

1.1 The District, in an effort to minimize the quantity and diversity of repair parts, maintenance tools, etc. has standardized around the Waterous WB-67-250. Approved equal products may be submitted for review. The hydrant shall be supplied with a 1 5/8" pentagon style top nut, 5 1/4" main valve **open right**, 6" MJ shoe, 6'-6" bury, two 2 1/2" NST and one 4 1/2" NST connection ports. The shoe and lower valve shall be coated inside and out with fusion bonded epoxy paint. The shoe shall be attached to the lower barrel with stainless steel nuts and bolts. All drain ports shall be plugged at the factory.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

2.1 All hydrants shall be installed in accordance with the “Hydrant Installation Detail” unless otherwise specified. Hydrants shall be installed plumb and true in the vertical plane in all directions. Finish grade around hydrant shall be 2” below breakaway flange of hydrant.

2.2 Color code painting of the hydrant shall be done by the District once the installation is complete.

2.3 The distances between the hydrant, the hydrant valve and the distribution main shall be recorded and submitted to the District. If the hydrant branch is other than perpendicular to the distribution main, then a legible sketch shall be recorded accurately showing all distances and angles from the distribution main to the hydrant.

Review Date: January 2008
Approved By: MAM

GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
DUCTILE IRON COUPLINGS (SLEEVES)

1.0 SPECIFICATION:

1.1 Mechanical joint style straight and transition type couplings shall be constructed entirely of ductile iron (center body ring and end rings).

1.2 Center rings shall be grade 65-45-12 ductile iron meeting or exceeding ASTM Standard A536-80. All areas of the center ring shall receive a heavy shop coat of primer and epoxy paint at the factory.

1.3 End rings shall be grade 68-45-12 ductile iron meeting or exceeding ASTM Standard A536-80. End rings shall be color coded as to the outside diameter range of pipe: Red, steel size PVC; Black, cast iron, ductile iron & CL150 asbestos cement; Yellow, CL 200 asbestos cement.

1.4 Gaskets shall be virgin SBR compounded for water service. Gasket material shall meet or exceed ASTM Standard D2000 3 BA715.

1.5 Bolts and nuts shall be high strength, low alloy steel trackhead type bolts. National coarse rolled thread and heavy hex nuts with black finish. The steel shall meet AWWA C111-80 composition specifications.

1.6 Acceptable products are the Romac 501 style coupling as manufactured by Romac Industries, Inc. and the Ford style FC1 and FC2A as manufactured by the Ford Meter Box Co. Inc. All other submittals must pre-approved by the District in writing.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

2.1 Couplings shall be installed in strict accordance with the manufacturers instructions. All nuts shall be tightened in an alternating star pattern with a properly calibrated torque wrench as specified.

2.2 Off-set marks shall be made on coupling pipe at all times to allow for the coupling to be centered over the joint between the two sections of main being coupled.

2.3 A minimum of 2 lateral measurement “swing ties” shall be taken to all buried couplings prior to backfilling in accordance with Section II, 4, 4.8.

Review Date: January 2008
Approved By: MAM

GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
DUCTILE IRON TAPPING SLEEVES

1.0 SPECIFICATION:

1.1 Tapping sleeve shall be a mechanical joint, split sleeve with outlet flange conforming to AWWA C-110 Sect. 10-14 with drilling recessed for tapping valve.

1.2 The sleeve must be of ductile iron construction and include a 3/4" F.I.P. threaded test plug so that sleeve and valve can be pressure tested before the tap is made.

1.3 Sleeves up to 12" x 12" shall be rated for a minimum working pressure of 200 psig.

1.4 The side rubber gaskets shall be rectangular in cross-section and fit into grooved channels in the casting. These gaskets shall extend the entire length of the sleeve and shall not require cutting or trimming to match MJ end gaskets.

1.5 Sleeves shall be furnished with standard accessories including: glands, gaskets for both ductile and oversized pit-cast pipe, and Cor-Ten T-bolts and nuts or equivalent. All flange bolts shall be 316 stainless steel.

1.6 Interior and exterior to be bituminous coated with a minimum 2 mils dry film thickness.

1.7 For resilient seat tapping wedge valves, in order to avoid damage to the valve sealing surface, use recommended cutters with the following maximum dimensions:

Valve Size:	4"	6"	8"	10"	12"
Cutter Size:	3.75"	5.75"	7.75"	9.75"	11.75"

1.8 Stainless steel tapping sleeves (non-mechanical joint) are **not** permitted.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

2.1 Mechanical joint tapping sleeves shall be installed in strict accordance with the manufacturers instructions.

2.2 Once installed, the tapping sleeve shall be pressure tested prior to making the tap.

2.3 The tapping sleeve shall be installed such that the flanged face of the sleeve is plumb with the vertical plane. The contractor shall use a level to check for plumbness and make adjustments as necessary.

Review Date: January 2008
Approved By: MAM

GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
MJ TAPPING SLEEVE VALVES

1.0 SPECIFICATION:

1.1 Mechanical joint tapping sleeve valves shall be resilient seat wedge (gate) type valves conforming to Resilient Seat Wedge Valve specifications. As is the case with tapping sleeve valves, one valve end will be flanged and the other end mechanical joint.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

2.1 The tapping sleeve valve shall be installed in full compliance with the manufacturers specifications. The valve face must be plumb with the vertical plane.

2.2 All MJ Tapping Sleeve Valves shall be provided with valve boxes (see Valve Boxes, Extensions & Covers specification) to the ground surface unless specifically requested not to by the District.

2.3 A minimum of 2 lateral measurement “swing ties” shall be taken to all MJ Tapping Sleeve Valves prior to backfilling in accordance to Section II, 4, 4.8.

Review Date: January 2008
Approved By: MAM

GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
REPAIR CLAMPS

1.0 SPECIFICATION:

1.1 Repair clamps shall have a carbon steel body adhering to ASTM A 285 Grade A or ASTM A 283 Grade C or full circumference 18-8 type 304 Stainless Steel band. The body finish for the carbon steel body shall be fusion bonded epoxy with an average 12 mil thickness. The gasket shall be Nitrile (Buna-N), 100% circumferential waffle-type gasket with stainless steel bridging plates that afford a permanent seal.

1.2 Acceptable products are the Smith-Blair 267 and 268 Full-Circle Repair Clamps in sizes 4" to 12" as manufactured by Smith-Blair, of Texarkana, Arkansas.

1.3 All repair clamps shall be delivered to the District complete within a sealed box. Repair clamps delivered unboxed shall be rejected and returned to the Supplier at their cost.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

2.1 Prepare pipe surface, ensuring that the damaged pipe is free from loose surface deposits, mud, scale, rust, etc.

2.2 Place a reference mark on the pipe to check for proper positioning of the clamp over the damaged area during installation.

2.3 Install half housings around the pipe, ensuring that the leading edges of the gaskets are fed into the mating side of the opposite half housing. Note: For 10" & 12" sizes, install top half housing first and then offer up the bottom housing ensuring that both gasket sections are mated within it.

2.4 Push half housings together by hand locating captive clamp bolts in the bolt holes. Fit the washers and loosely tighten the nuts. Note: For 10" & 12" sizes, do not disassemble nuts & washers. Simply loosen off the nuts to allow the bolt heads to be swung over and located in the top housing slot holes.

2.5 Position clamp over the damaged area and seat firmly in place. Rotate the clamp as necessary to allow access to the nuts for tightening.

2.6 Commence bolt up. Tighten bolts per manufacturers recommendations starting at the center of the clamp and working to the outside. Torque bolts to manufacturers specifications per the size clamp used.

Review Date: January 2008
Approved By: MAM

GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
VALVE BOXES, EXTENSION & COVERS

1.0 SPECIFICATION:

1.1 Valve boxes shall be heavy cast iron, two piece, sliding type with a top flange and a minimum inside shaft diameter of 5".

1.2 The bottom section shall be 36" long and provided with a belled (buffalo) base in accordance with the “Typical Valve Box Detail”. Longer bottom sections may be required in lengths of 48” or 57”, based on depth of valve.

1.3 The top section shall be 26" long and designed to slide over the base section. See "TYPICAL VALVE BOX DETAIL". Longer top sections may be required in lengths of 36” or 54”, based on depth of valve.

1.4 The cover shall be a heavy 2" drop type, non-tilting cast iron unit that is recessed in the box top to prevent plow breakage. The cover shall be provided with two pick holes for easy removal and have the word "WATER" clearly cast into the cover.

1.5 Valve box extensions shall be slide type top extensions designed to be installed inside of a standard valve box top as detailed in 1.3 above. Valve box extensions shall be able to accept a standard valve box cover as detailed in 1.4 above.

1.6 All valve box components shall be generously coated with a corrosion resistant bituminous coating.

1.7 The District only accepts valves boxes, extensions & covers manufactured within North America.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

2.1 Valve boxes shall be installed concentric to the operating nut and plumb with the vertical plane. The belled base section shall be placed on blocking in such a way that no additional loading is transferred to the valve. Valve boxes shall have a minimum overlap of 6” between the bottom and top sections. In no cases shall valve boxes be stacked or contain more than one base section, one top section and one extension.

2.2 Longer valve box bottoms and/or tops will be specified as required for water mains at depths that exceed the limitations of the above specified valve box.

2.3 Valve boxes located in paved areas shall be left 1" below finish grade or even with the top of the base pavement and paved over when the finish pavement is applied unless otherwise specified.

2.4 Valve boxes located in non-paved gravel shoulders shall be left 4" below finish grade and covered with gravel unless otherwise specified.

2.5 Valve boxes located in other non-paved areas shall be left 3" below finish grade and covered with earth unless otherwise specified.

2.6 Valve boxes shall be left clean from debris on the inside to allow unobstructed access to the valve operating nut.

Section IV: Water Main Installation Documents

CERTIFICATE OF TITLE AND PROJECT ACCEPTANCE

KNOW ALL MEN BY THESE PRESENTS: that a corporation doing business as _____ of _____, and State of _____, hereinafter called "DEVELOPER" and a corporation doing business as _____ of _____, County of _____, and State of _____, hereinafter called "CONTRACTOR" in consideration of One Dollar ($1.00) and other valuable considerations paid by GREATER AUGUSTA UTILITY DISTRICT (the "DISTRICT"), a quasi-municipal corporation with a principal office in Augusta, Maine, the receipt of which consideration is hereby acknowledged, does hereby, GREANT, SELL, TRANSFER, AND DELIVER unto the said DISTRICT, its successors and assigns, the following personal property:

New _____ water main extension in _____ in _____, Maine
_____ new _____ inch water services installed from the new mains.
_____ public fire hydrants.

TO HAVE AND TO HOLD, all of the said personal property to the said GREATER AUGUSTA UTILITY DISTRICT, its successors and assigns to its and their own use and behold forever.

AND, the Developer/Contractor hereby covenants with the said DISTRICT, its successors and assigns, that it is the lawful owner of all the said personal property, that it is free from all encumbrances; that Developer/Contractor has good right to sell the same as aforesaid; and that it will WARRANT AND DEFEND the same unto the DISTRICT, its successors and assigns against the lawful claims and demands of all persons.

AND, the said GREATER AUGUSTA UTILITY DISTRICT, having inspected the installation of the said personal property, and having received certification verifying satisfactory results with regards to testing of said installation, finds that it substantially complies with the terms of the AGREEMENT between the District, the Developer and the Contractor dated as of the _____ day of _____.

This date shall mark the commencement of all warranties and guarantees required by the Contract Documents and such warranties and guarantees shall be fully effective, notwithstanding the fact that the District has inspected such property.

IN WITNESS WHEREOF, the parties hereto have caused this Certificate of Title and Project Acceptance to be executed by their duly authorized officials.

(SEAL)

DEVELOPER

By_____

_____ Its_____

Witness

(SEAL)

CONTRACTOR

By_____

_____ Its_____

Witness

(SEAL)

GREATER AUGUSTA UTILITY DISTRICT

By_____

_____ Its_____

Witness

GREATER AUGUSTA UTILITY DISTRICT

WATER MAIN EXTENSION AGREEMENT

MEMORANDUM OF AGREEMENT made this _____ day of _____, 20___, by and between the Greater Augusta Utility District, a quasi-municipal corporation duly established under the laws of the State of Maine, hereinafter referred to as the "District" and _____, hereinafter referred to as the "Applicant".

WITNESSETH: Whereas the Applicant desires to have the District extend its water facilities on _____ in _____, Maine as follows:

Install _____ DICL water main in _____
Install _____ domestic water services
Install _____ public fire hydrants

NOW THEREFORE, it is agreed between the Applicant and the District as follows:

1. The Applicant shall submit an adjustable deposit of $ _____ to the District, which is the estimated total cost of the extension and includes materials, labor, equipment, permits, inspection, testing and sub-contractor fees. All construction within the public R.O.W. shall be done by the District, or the Applicant's contractor, at the Applicants expense and District's full inspection. The full amount of the adjustable deposit shall be paid to the District upon execution of this Agreement. The estimated cost (does) (does not) include an allowance for ledge removal.

2. Within 60 days following determination of the final costs incurred for the extension, including the water main and District portion of the service line, the amount advanced (adjustable deposit) shall be adjusted to the actual cost of construction, by the District's return to the Applicant of any excess amount, or by additional payment of the Applicant to the District to cover any deficiency.

3. Should the water main extension cross property other than that owned by the Applicant, including the public R.O.W., prior to reaching the Applicant's property, and customers located on property other than the Applicant's property are connected to the watermain extension within ten (10) years following connection of the Applicant (normally the first connection), then those customers shall be required to make a contribution to the Applicant. The customer contribution shall be calculated in accordance with the requirements of Maine Public Utilities Commission (MPUC) Rule, Chapter 650, Section 4, Paragraph D.

4. The documents which comprise the entire agreement between the District and the Applicant consist of the following attachments:

    - This Water Main Extension Agreement
    - Chapter 650 of the MPUC Rules and Regulations

5. This agreement is subject to the Rules and Regulations of the MPUC governing water main extensions (Chapter 650). In the event of a conflict between this agreement and the rules

and regulations of the MPUC, then the rules and regulations of the MPUC shall govern. The parties understand that the provisions of this agreement are subject to alteration by a decision or rule of the MPUC.

6. Disputes arising under this agreement or under the rules and regulations of the MPUC governing water main extensions may be referred pursuant to said rules and regulations to the MPUC for resolution.

7. The ownership of the water main extension service connections constructed under this agreement shall at all times remain the property of the District and the Applicant does not accrue any equity or value in said water mains and service connections.

8. The Greater Augusta Utility District shall have the right to further extend its water main beyond this extension or to tap and take-off from this extension laterally for any purpose including customer services connections, hydrant installations, etc.

9. This agreement shall be binding on the heirs, executors, administrators, successors or assigns, of the contracting parties.

Executed in duplicate by the parties hereto, upon the day and year above written.

APPLICANT **GREATER AUGUSTA UTILITY DISTRICT**

By:_____ _____

By: General Manager
Greater Augusta Utility District

Its:_____

Date:_____ Date:_____

Address for giving notice: _____

Personally appeared the above named Applicant, _____, and acknowledged the foregoing instrument to be his/her free act and deed.

Before me,

By:_____
Notary Public

Section V: Work Associated with Sewer Construction

1. DESCRIPTION OF THE WORK

All the work shall conform to these specifications and to the accompanying plans drawn by a professional engineer, based on plans and other information submitted by the Subdivider or Developer on file with the District.

The contractor shall furnish all labor, materials and equipment in order to construct gravity sewers, pressure mains, storm sewers, manholes, connections, catch basins and such other structures or features as may be required to complete the work in accordance with said plan and specifications.

Construction work shall start on a date and place mutually agreed upon between the District and the Contractor and only after the District has received approval of the extension from DEP. Work shall be continued with regularity until its completion. Sufficient labor and equipment shall be supplied to maintain a rate of progress satisfactory to the District. The District will assess the Project a Permit Fee, Service Availability Fee and Inspection Fee. The actual costs for these fees will be determined at the time the final plans are submitted.

Whenever the words “as directed”, “as permitted”, “as required” or words of like effect are used it shall be understood that the direction, permission or requirements of the District is intended and similarly the words “approved”, “acceptable”, “satisfactory”, or words of like import shall mean approved by or acceptable or satisfactory to the District.

Whenever the words “or equal” or words of like import are used it shall be understood that this means “equal” in the opinion of the District.

The Contractor shall employ at his own expense a competent surveyor or engineer, who shall stake out the lines and grades for all pipes, structures, and other portions of the work and establish all necessary controls. All reference marks shall be verified by an instrument at frequent intervals and the Contractor shall be responsible for the accuracy of all lines and grades relative to the project.

All gravity sewers and storm sewers shall be laid with laser beam unless other means are approved by the District.

Whenever the Developer, Subdivider, or Contractor is not present on any part of the work, a competent assistant shall be placed in charge with full authority to act for the Developer, Subdivider, or Contractor.

2. CONSTRUCTION PROCEDURES REQUIRED FOR SEWER

a. Plans must be approved by the District.

b. Sanitary plans may need to be approved by DEP. If so, the District will deliver the plans to DEP after its' approval.

c. All required easements and land title transfers to the Greater Augusta Utility District must be completed prior to final acceptance by the District.

d. Developer shall pay up front, before construction begins, the construction inspection fee. All sewer and storm drain related work shall be inspected by a representative of the Greater Augusta Utility District.

e. All new sewer and storm drain related work shall be tested as specified in these specifications.

f. As built drawings will be required at the completion of the project or each phase of project per Section I, 1, h.

g. The contractor and/or Developer shall guarantee all materials and equipment furnished and work performed for a period of one (1) year from the date of SUBSTANTIAL COMPLETION. The Contractor and/or Developer warrants and guarantees for a period of one (1) year from date of SUBSTANTIAL COMPLETION of the system that the completed system is free from all defects due to faulty materials or workmanship and the contractor and/or Developer shall promptly make such corrections as may be necessary by reason of such defects including the repairs of any damage to other parts of the system resulting from such defects. The District will give notice of observed defects with reasonable promptness. In the repairs, adjustments, or other work that may be made necessary by such defects, the District may do so and charge the Contractor and/or Developer the cost thereby incurred. The performance Bond shall remain in full force and effect through the guarantee period.

h. All construction work shall be in full compliance with the regulations of OSHA.

i. Contractor shall notify DIG SAFE and all non-member utilities three business days prior to starting construction work on project.

3. INSURANCE REQUIREMENTS

Before work is started under the contract the Contractor will be required to file with the District a Certificate of Insurance, executed by an insurance company or companies satisfactory to the District and licensed by the State of Maine Department of Business Regulation, Bureau of Insurance to do business in the State of Maine, stating that the Contractor carries insurance in accordance with the following requirements and stipulations:

a. Workers' Compensation Insurance. With respect to all the operations the Contractor performs and all those performed for him by subcontractors, the Contractor or the Subcontractor shall carry Workers' Compensation Insurance or shall qualify as a self-insurer with the State of Maine Workers' Compensation Commission, all in accordance with the requirements of the laws of the State of Maine.

b. Contractor's Public Liability and Property Damage Insurance. With respect to the operations he performs and also those performed for him by subcontractors, the Contractor shall carry regular Contractor's Public Liability Insurance and Contractor's Protective Public Liability Insurance, each covering bodily injury liability of not less than 1,000,000 dollars for damage arising out of bodily injuries to or death of one person and subject to that limit for each person, a total of 1,000,000 dollars damage arising out of bodily injuries to or death of 2 or more persons in any one accident or occurrence and covering property damage liability of not less than 1,000,000 dollars for all damages arising out of injury or destruction of property in one accident.

c. Automobile Liability Insurance. The Contractor shall carry Automobile Liability Insurance covering the operation of all motor vehicles, including those hired or borrowed, used in connection with the contract, covering bodily injury liability of not less than 300,000 dollars for all damages arising out of bodily injuries to or death of one person and subject to that limit for each person, a total of 300,000 dollars for all damages arising out of bodily injuries to or death of two or more persons in any one accident or occurrence and covering property liability for a limit of not less than 300,000 dollars for all damages arising out of injury to or destruction of property in one accident or occurrence.

d. Contractual Liability Insurance. The Contractor shall carry Contractual Liability Insurance covering the liability he has assumed under the contract to indemnify and save harmless the District, its officers and employees with respect to bodily injuries to or death of any persons or injury to or destruction of property. The limits for such insurance shall be not less than those specified for Contractor's Public Liability Insurance in paragraph (b) above.

e. Blasting. All blasting must be in complete compliance with the Municipality having jurisdiction. When explosives are to be used in the progression of the work, the insurance required under paragraphs (b), (c) and (d) above shall also contain provisions for protection, in the amounts stated, against damage claims due to such use of explosives.

f. Each policy shall be signed by the President and Secretary of the insurance company and shall be countersigned by a licensed resident agent in the State of Maine as an authorized representative of the company.

g. Termination or Change of Insurance. Each insurance policy shall be endorsed to provide that the insurance company shall notify the District at least 30 days in advance of cancellation of or any change in the policy. No change shall be made without prior written approval of the District.

The Contractor shall keep all the required insurances in continuous effect until 31 days after the date of final acceptance of the project or until such earlier time as may be established by the District.

h. Claims. Each insurance policy shall state that the insurance company shall agree to investigate and defend the insured against all claims for damages, even if groundless.

i. Compliance with the requirements of the section may be met by procurement of insurance covering all work under contract with the District or may be met by procurement of separate insurance for each individual contract. In either case a Certificate of Insurance must be filed for each contract to show evidence that all required insurance has been obtained.

4. CLEARING, EXCAVATION, BACKFILL AND MISCELLANEOUS FOR SEWERS AND STORM DRAINS

a. General

The work covered by this section comprises the furnishing of all materials, labor, and equipment required to perform all operations in connection with the clearing, grubbing, topsoil removal, pavement removal, excavating, trenching, site grading, removal of unsuitable materials, and backfilling for all piping, manholes, catch basins, and other such structures, as may be required.

The trench grade referred to in the specifications is defined as being six inches (6”) below the bottom of the barrel of the sewer coupling unless otherwise specified.

b. Trees

All trees adjacent to the project, including tree roots, shall be carefully protected from damage.

c. General Excavation

All excavations shall be made to such depth and width as will provide suitable room for building the structures they are to contain for sheeting, shoring, pumping and draining, and for removing peat, silt, or other materials which the District may deem unsuitable for foundation. The width of the excavation shall be kept as small as practicable to carry on the work.

d. Trench Excavation

Trench excavation shall be made by open cut sufficient to accommodate the pipe or structure at the depths indicated on the plans. Excavations shall be made to such a point as to allow a minimum of six inches (6”) of bedding material to be placed beneath the bottom of all barrels, bells or couplings of all pipes installed. The banks of the excavation shall be properly braced and sheeted. The maximum clear width of trench at the top of the pipe shall not be more than the outside diameter of the pipe plus two feet. The bottom of the trench shall be accurately graded to provide a uniform layer of bedding material for each section of pipe. Trench excavation shall include the satisfactory removal and disposal of all surplus material.

e. Rock Excavation

Rock excavation shall be to the minimum depths previously specified for bedding material. In all excavations for sewers, ledge or boulders shall be removed from insides of trenches to a plane eight inches (8”) outside the inside wall of the pipe, unless permission to do otherwise is expressly given by the District.

Where rock is encountered in excavation it shall be removed by blasting methods, unless directed otherwise by the District. The Contractor is to check with all existing utilities adjacent to blasting area for acceptable time period for blasting prior to each blast.

Blasting operations shall be in complete compliance with all OSHA requirements. The proper signing procedures warning oncoming traffic of blasting shall be strictly enforced.

All rock blasts shall be covered with suitable cover and proper precautions shall be taken to avoid damage.

Where sewers, water, steam, telephone, electrical or other utility ducts or lines, manholes or other structures have been exposed during excavation, such structures shall be adequately protected from damage before proceeding with the blasting. The Contractor at the Contractor's expense shall promptly repair any structures damaged by blasting.

Selected fill material shall be furnished to replace the excavated ledge.

f. Experimental Excavation

The Contractor, at the direction of the District, shall make excavations and backfill at such locations as directed, without furnishing or laying pipe in same. These excavations are, in general, to be used as test holes to locate existing pipelines, structures, other underground utilities, etc., for properly carrying out the work.

g. Trenching Machinery

Excavating machinery shall be of such kind and used in such a way and only in such locations as not to injure road surfaces, fences, poles, trees, shrubs, buildings, walks, conduits, posts, pipes, etc.

The only machinery allowed on any paved areas shall be rubber tired except for the backhoe digging the main sewer trench.

h. Water in Trenches

The excavations are to be kept free from water, and pumps, well points or other suitable methods are to be used when necessary, and shifted frequently to avoid drainage from too long a distance. All water pumped or bailed from the excavation is to be conveyed to a suitable point of discharge, in a manner satisfactory to the District. Pump wells in proper locations and sufficiently removed from the line of work and at sufficient depth shall be constructed and maintained as required. Wells are to be securely refilled upon the completion of the work. Disposal of excavation water shall not enter any District Storm Drain without the permission of the District. No excavation water will be allowed into the Sanitary sewer under any conditions.

No pipe or masonry is to be laid in water and water is not to be allowed to rise onto or flow over any pipe or masonry until such time as approved by the District.

i. Backfilling Around Structures

The Contractor shall not place backfill against any structures without obtaining the express permission of the District. Unsuitable material (such as excessive moisture content, large rocks, and ledge.) will not be acceptable for backfill. Approved backfill material shall be deposited in twelve inch (12") horizontal layers, thoroughly compacted by adequate mechanical means to the satisfaction of the District.

j. Backfilling Trenches

The Contractor shall first place and consolidate a six inch (6") layer of approved screened stone on all trench bottoms. After the pipe has been laid, additional screened stone shall be placed and consolidated to the top of the pipe. The trench shall then be carefully backfilled with cover sand deposited in six inch (6") layers, thoroughly consolidated by mechanical tampers, until the pipe has at least twelve (12) inches of cover sand over the top of the pipe. The use of all screened stone to 6" over the pipe is also acceptable.

The remainder of the trench shall be backfilled as follows:

In Roads, Walks, Drives, Etc.

The area between a line 12 inches over the top of the pipe and a

line twenty-four (24) inches below the top of the trench or bottom of pavement shall be carefully backfilled in not over twelve (12) inch layers using suitable material taken from the excavation or approved bank run sand or gravel hauled in for the purpose.

Cross Country Areas

The area between a line 12 inches over the top of the pipe and a

line below the topsoil shall be carefully backfilled in not over twelve(12) inch layers using suitable material taken from the excavation or approved bank run gravel or sand hauled for the purpose.

No mud, frozen earth, or stone larger than ten (10) inches in diameter is to be used for backfilling.

All trench backfill above the top of the pipe shall be consolidated by a vibratory compaction system, proposed by the Contractor subject to approval of the District. The approval by the District of the proposed method of compaction for the backfill shall in no way be construed as relieving the Contractor of responsibility for settlement of trenches, and any settlement which may occur shall be repaired by the Contractor at his own expense. Regardless of the method of compaction the backfill from the top of the pipe must be consolidated to a minimum density of 95 percent of the maximum density determined by ASTM Method D1557 (Modified Proctor). The remaining twenty-four (24) inches to the top of the trench shall be filled with 21" of road gravel and 3" of surface gravel. The gravel shall be placed, graded and tamped in 6-inch layers to the finished surface.

After the completion of all backfilling operations, the Contractor shall grade the site to the lines, grades and elevations shown on the Contract Drawings, taking into account any subsequent topsoil and paving requirements.

k. Material below Trench Grade

The Contractor shall furnish and place selected fill material or screened rock below trench grade, as directed and to such depths as determined by the District. These materials shall be used only when existing material below trench grade is unsuitable for properly placing bedding material and laying pipe.

l. Selected Material

Any selected material required for filling above trench grade, in addition to surplus earth from trench excavation, shall be placed by the Contractor. Selected material shall be clean granular material free from loam, sod, roots, or other organic material

and from stones larger than 6-inches in diameter and shall conform to the following table:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieve
6”	100%
No. 40	0-70%
No. 200	0-10%

m. Screened Stone

All screened stone shall be clean granular material free from loam, sod, roots, or other organic material and shall conform to the following table:

Screen Size Square Openings	Percentage by Weight Passing Square Mesh Sieve
1”	100%
¾”	90-100%
½”	20-55%
No.4	0-5%

n. Road Gravel

All road gravel shall be clean granular material free from vegetable matter, roots, or other organic material and shall conform to the following table:

Screen Size Square Openings	Percentage by Weight Passing Square Mesh Sieve
3”	100%
½”	35-75%
¼”	25-60%
No. 40	5-25%
No. 200	0-5%

o. Surface Gravel

All surface gravel shall be clean granular material free from vegetable matter, roots, or other organic material and shall conform to the following table:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieve
1 inch	95-100%
¾” inch	90-100%
No. 4	40-65%
No. 10	10-45%
No. 200	0-5%

p. Cover Sand

The fine granular material required for cover above the screened rock to a point twelve (12) inches over the top of the sewer pipe shall contain no stones over ¾-inch diameter and shall be of such gradation to be free draining and readily compactible.

q. Sheeting and Bracing and Shoring

The Contractor shall furnish, install complete, and maintain timber or steel sheeting and bracing where such sheeting and bracing is required to prevent disturbance, damage or settlement of adjacent pipelines, structures and all other existing facilities. Sheeting and bracing to be of adequate size and strength for the conditions encountered and shall be driven to true alignment in a workmanlike manner. Timber sheeting shall be straight and sound and shall be tongued and grooved where semi-fluid material is encountered. Minimum thickness of wood sheeting shall be a nominal three inches. All sheeting and bracing shall be removed unless ordered by the District to be left in place. All sheeting and bracing ordered left in place shall be cut off at least 2 feet below the ground surface unless otherwise ordered by the District.

r. Clean Up

All surplus material shall be removed and disposed of as specified after refilling of trenches. The removal of surplus material, cleaning up of trench surfaces along streets and premises shall closely follow the pipe laying. If cleaning operations are not carried out the District will suspend pipe laying until the clean-up is satisfactory. Where hardened surfaces or roadways, driveways, or walls are dug up or interfered with, special attention is to be given to the refill and the consolidation before its resurfacing and it shall be done and redone as may be required to make the premises safe at all times and to give the required result.

The Contractor shall continually provide street sweeping on roadways used by his vehicles in order to reduce dust, siltation and nuisance problems.

5. GRAVITY SEWERS (Sanitary & Storm)

a. General

Sewers shall be furnished and installed at locations shown on plan, and to the line and grade indicated on plan. All piping shall be complete, including fittings, connections to existing structures, and other miscellaneous items of work. Gravity sanitary sewers with more than twelve feet of cover shall be ductile iron.

b. Pipe

1. PVC-SDR-35

Pipe shall conform to ASTM D 3034 for sizes 4” – 15” and ASTM F679 for sizes 18” – 27”. PVC resin compound shall conform to ASTM D 1784 and rubber gaskets shall conform to ASTM D 3212 and F 477. Standard laying lengths shall be 13 ft. The pipe shall be colored green to identify it for sewer applications.

2. Ductile Iron Pipe

Pipe shall be manufactured in accordance with the requirements of ANSI / AWWA C151 / A21.51 Ductile Iron Pipe, Centrifugally Cast, for Water and Other Liquids. Pipe shall be manufactured in accordance with the requirements of ANSI / AWWA C111 / A21.11 Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings. Pipe thickness shall be designed in accordance with the requirements of ANSI / AWWA C150 / A21.50 Thickness Design of Ductile Iron Pipe and shall be based on laying conditions and internal pressure as specified in the project plans. Pipe shall have cement mortar lining and seal coating, unless otherwise specified, in accordance with the requirements of ANSI / AWWA C104 / A21.4 Cement Mortar Lining for Ductile Iron Pipe.

3. Concrete Pipe

Concrete pipe shall be Class IV reinforced concrete pipe meeting ASTM Designation C-76.

4. Corrugated Polyethylene Storm Sewer Pipe

Pipe shall have a smooth interior and annular exterior corrugations. Sizes 4" – 10" shall meet AASHTO M252, Type S. Sizes 12" – 60" shall meet AASHTO M294, Type S or ASTM F2306. Manning's "n" value for use in design shall be 0.012. Virgin material for pipe and fitting production shall ne high density polyethylene conforming with the minimum requirements of cell classification 424420C for 4" – 10" diameters, or 435400C for 12" – 60" diameters, as defined and described in the latest version of ASTM D3350, except that carbon black content should not exceed 4%. The 12" – 60" virgin pipe material shall comply with the notched constant ligament-stress (NCLS) test as specified in Section 9.5 and 5.1 of AASHTO M294 and ASTM F2306, respectively.

c. Service Fittings

Contractor shall furnish and install wyes or teewyes as required in the pipe lines. These will be used for service connections. Wyes and teewyes, shall be made of the same material as the main line pipe.

d. Chimneys

Chimneys shall be located where directed by the District, and constructed in accordance with the details shown on the plans. Concrete encasement shall be 3,000 pounds class. Ends of chimney shall be capped with standard caps.

e. Pipe Installation

Excavations shall be made to a point at least 6 inches below the pipe to accommodate the bedding material as previously specified.

All excavations are to be kept dry while pipe is being laid and until each joint and pipe has been observed by the District, and approval given to commence backfilling operations. Pipe shall be laid in strict accordance with the pipe manufacturer's published recommendations. Any pipe which is not laid to grade and alignment shall be relaid to the satisfaction of the District.

All Gravity sewers and storm sewers shall be laid with laser beam unless other means are approved by the District.

No pipe laying will be allowed to begin at any point other than a manhole or other appurtenance without the expressed consent of the District.

If a new sewer extension is tying into an existing system, a plug shall be kept installed in the new line until all new construction is accepted and or approved by the Greater Augusta Utility District and all piping and manholes have been cleaned and tested.

f. Pipe Testing

1. General

All gravity sewers shall be tested for water tightness. Testing shall be by internal tests. Where groundwater is high the District may elect to accept infiltration measurements in lieu of exfiltration tests.

The Contractor shall furnish at his own expense, the necessary facilities for making the test including the furnishing and placing of bulkheads, furnishing and placing of water and other necessary materials, labor and equipment.

A section under these specifications shall mean a length of sewer between any two manholes.

2. Low Pressure Air Test For Gravity Sewers

The Contractor shall test the gravity sewers with a low-pressure air test. It shall be conducted in compliance with the following:

After completing backfill of a section of wastewater line, the Contractor shall, at his own expense, conduct a Line Acceptance Test using low pressure air. The test shall be performed using the below stated equipment, according to stated procedures and under the supervision of the District.

3. Equipment

The equipment to be used for the line acceptance test will be Cherne Air-Loc Equipment, as manufactured by Cherne Industrial, Inc. of Edina, Minnesota or approved equal. Equipment used shall meet the following minimum requirements:

a. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be tested.

b. Pneumatic plugs shall resist internal pressures without requiring external bracing or blocking.

c. All air used shall pass through a single control panel.

d. Three individual hoses shall be used for the following connections:

1. From control panel to pneumatic plugs for inflation.

2. From control panel to sealed line for introducing the low pressure air.

3. From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.

4. Procedures

All pneumatic plugs shall be seal tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs to 25 psig. The plugs shall hold against this pressure without bracing and without movement of the plugs out of the pipe.

After a manhole to manhole reach of pipe has been backfilled and cleaned, and the pneumatic plugs are checked by the above procedure, the plugs shall be placed in the line at each manhole and inflated to 25 psig. Low pressure air shall be introduced into this sealed line until the internal air pressure reaches 4 psig greater than the average back pressure of any ground water that may be over the pipe. At least two minutes shall be allowed for the air pressure to stabilize.

After the stabilization period (4.0 psig minimum pressure in the pipe), the air hose from the control panel to the air supply shall be disconnected. The portion of line being tested shall be termed "Acceptable" if the time required in minutes for the pressure to decrease from 4.0 to 3.5 psig (greater than the average back pressure of any ground water that may be over the pipe) shall not be less than the time shown for the given diameters in the following table:

Pipe Dia. In Inches	Minutes
4	4.0
6	4.0
8	5.0
10	8.0
12	11.5
15	17.0
18	25.0
21	35.0
24	45.0
30	60.0

The Contractor shall furnish all labor, materials and equipment for making infiltration and leakage tests.

THE ATTENTION OF THE CONTRACTOR IS DIRECTED TO THE STRICT REQUIREMENTS RELATIVE TO MAXIMUM RATES OF THE INFILTRATION AND TO THE IMPORTANCE OF THESE SPECIFICATIONS RELATIVE TO TIGHT JOINTS REQUIRED. SEWERS NOT MEETING THE ABOVE REQUIREMENTS SHALL BE REPAIRED AS NECESSARY AT THE CONTRACTOR'S EXPENSE.

6. FORCE MAINS

a. General

The work of this section includes furnishing all labor, materials and equipment required to furnish and install the pipe specified herein for a force main from the Pumping Stations to the gravity sewers.

b. Pipe

1. PVC Pipe

PVC Ring-tite shall be minimum of 200 p.s.i. SDR-21 pressure pipe meeting the requirements of ASTM Designation D2241, D1784, and D1869.

Provisions must be made for contraction and expansion at each joint with a rubber ring and integral bell as part of each joint. Pipe and fittings must be assembled with a nontoxic lubricant, manufactured by the pipe manufacturer.

2. Ductile Iron Pipe

Pipe shall be manufactured in accordance with the requirements of ANSI / AWWA C151 / A21.51 Ductile Iron Pipe, Centrifugally Cast, for Water and Other Liquids. Pipe shall be manufactured in accordance with the requirements of ANSI / AWWA C111 / A21.11 Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings. Pipe thickness shall be designed in accordance with the requirements of ANSI / AWWA C150 / A21.50 Thickness Design of Ductile Iron Pipe and shall be based on laying conditions and internal pressure as specified in the project plans. Pipe shall have cement mortar lining and seal coating, unless otherwise specified, in accordance with the requirements of ANSI / AWWA C104 / A21.4 Cement Mortar Lining for Ductile Iron Pipe.

3. HDPE Pipe

Polyethylene pipe shall be made from high density, extra high molecular weight compound equaling a PE 3408 designation and shall conform to ASTM-1248 and ASTM-3350; with a cell classification of 34543C. Minimum SDR of 9.0

4. Tracer Wire

All non-conductive pipe materials used for force sewer mains shall be provided with a minimum No. 6 AWG insulated copper or approved equal tracer wire laid along the top of the pipe and secured by means acceptable to the District. Tracer wire must be continuous as to not break conductivity. If wire must be cut and/or reconnected, splice wires with a minimum 6” overlap and use 2 u-bolt cable connecters that will not degrade conductivity. Tracer wire must be brought up to within 3” of ground surface and secured at all manholes or other access points for connection to an electronic pipe locator.

c. Bracing and Blocking

See Thrust Restraint Requirements under Section III of the Water Main Specifications.

d. Pipe Testing

1. General

All force mains throughout the entire length of lines shall be tested for water tightness. Testing shall be by internal pressure tests.

The Contractor shall furnish, at his own expense, the necessary facilities for making the test including the furnishing and placing of bulkheads, furnishing and placing of water and other necessary materials, labor and equipment.

2. Internal Pressure Test for Force Mains

All force mains shall be tested per the testing requirements of Section II, 10, "Pressure and Leakage Testing"

7. MANHOLES

a. General

The Contractor shall furnish, construct and install all manholes, complete, including the excavation, precast reinforced concrete base, barrel sections, cone section at the top of the chimney, cast in place concrete slabs for drop manholes, manhole steps, frame and cover, backfill and all accessories to complete the manholes as shown of the Drawings and as specified.

b. Materials

Brick – shall be Grade H (hard) brick conforming to the Federal Specifications for Building Brick (common) Designations SS-B-656 and amendments thereto, new and of first quality, solid, sound, hard burned throughout of uniform color, and equal in quality to samples which shall have been approved by the District.

Precast Concrete Chimney – The precast concrete sections shall conform to ASTM C478, Standard Specifications for "Precast Reinforced Concrete Manhole Sections".

Manhole Steps – Manhole steps shall be aluminum and shall conform to ASTM B221, Alloy 6061-T6 or steel reinforced polypropylene.

Precast Concrete Grade Rings – Grade Rings shall be precast reinforced concrete with a minimum 4,000 psi after 28 days.

Frame and Cover

1. Manhole covers and frames shall be Etheridge No. E265S or equal.
2. Set to final grade as shown on the Drawings and as specified. Provide adequate temporary covers to prevent accidental entry until final placement of frame and cover is made.
3. Set manhole frames and covers to final grade only after pavement base course has been applied, or after final grading of gravel roads.

Mortar – Mortar, except as otherwise specified, shall consist of one part Portland Cement Type II, and one part Mortar Cement, and four parts Mortar Sand. Sand shall be approved by the District.

c. Installation

a. Manhole Concrete Barrel Sections & Bases
Manholes of precast reinforced concrete sections and bases shall be furnished with steps 12" o.c.; with a minimum 5-inch wall thickness for all barrel sections; and with a wall thickness varying from minimum 5-inches at the bottom to 8-inches at the top of all cone sections.

All joints shall be sealed with a double strip of self-sealing butyl rubber based flexible joint sealant in rope form. Lifting holes in all sections shall be filled solid with an approved non-shrink grout, both

inside and out. Exterior surface of all concrete manholes shall be painted with two coats of Bituplastic No. 28 or an approved equal.

The top six feet of the exterior surface of the manhole structure shall be wrapped with a minimum of 4 layers of U.V. resistant, 6 mil high grade polyethylene.

The top uppermost reinforced concrete section shall be set at a grade that will allow minimum of 2 courses and a maximum of 5 courses of brick and mortar before setting the cast iron frame and cover.

The Contractor shall furnish and faithfully use suitable slings, hooks, cable, or such other means as necessary, for proper handling of reinforced barrel sections and bases. No cracked, damaged or defective sections will be allowed in the work. Each section must be inspected and approved by the District immediately prior to final placement. Any sections not approved for use in this work shall be removed from the site and satisfactorily disposed.

d. Tables and Inverts

Tables and inverts shall be as shown on plans and shall be constructed of brick, concrete or fiberglass. Inverts shall have the exact shape of the sewers which are connected, and any change in size or direction shall be gradual and even.

e. Protection of the Work

Adequate precautions shall be taken during freezing weather to protect the masonry from damage by frost. No water shall be allowed to rise in excavations for manholes until all mortar and cement has set sufficiently. Upon completion, all debris shall be removed from each manhole.

f. Watertight Work Required

The entire work of constructing manholes must be carried on in a manner to insure watertight work. Any leak in manholes shall be caulked and completely repaired from the exterior of the manhole or the entire work shall be removed and rebuilt. All pipe openings shall have an approved neoprene boot meeting ASTM C-443 to insure a watertight seal between the pipe and manhole.

g. Manhole Testing

All manholes shall be tested as to water tightness as follows:

VACUUM TESTING OF MANHOLES

1. Each manhole shall be tested immediately after assembly and prior to backfilling.

2. All lift holes shall be plugged with an approved non-shrink grout.

3. All pipes entering the manhole shall be plugged, taking care to securely brace the plug from being drawn into the manhole.

4. The test head shall be placed at the inside of the top of the cone section and the seal inflated in accordance with the manufacturers recommendations.

5. A vacuum of 10 inches of Hg shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to 9

inches. The manhole shall be considered to have passed the test if the time for the loss of 1 inch of Hg vacuum is as follows:

Depth of Manhole (feet)	Time (min.)
0 – 10	3.0
10 – 15	3.5
15 – 20	4.0
20 – 25	4.5
>25	5.0

6. If the manhole fails the initial test, necessary repairs shall be made with a non-shrink grout while the vacuum is still being drawn. Retesting shall proceed until a satisfactory test is obtained.

8. CATCH BASINS

a. General

Work included: The work included under this section is the excavation for and backfilling of the widened trench at catch basin locations, together with the furnishing and installing of all materials for catch basins as shown on the Drawings. When catch basins are installed adjacent to curbs the District prefers the precast top to be an eccentric flat top.

The work includes furnishing the precast reinforced concrete cone at the top of the chimney, the precast concrete chimney, the precast catch basin base, and all accessories to complete the catch basins shown on the Drawings and as specified.

b. Materials

The precast reinforced concrete sections shall conform to ASTM Designation C478. All pipe connections to either catch basins or drain manholes shall have an approved neoprene boot meeting ASTM C-443.

Precast concrete blocks of proper radius shall conform to ASTM Specification C-139.

Mortar, except as otherwise specified, shall consist of one part Portland Cement Type II and one part mortar cement and four parts mortar sand. Mortar sand shall be approved by the District.

Cast Iron catch basin frames and grates shall be Etheridge Type M or equal.

Brick shall be Grade H (hard) brick conforming to the Federal Specifications for Building Brick (common) Designations SS-B-656 and amendments thereto, new and of first quality, solid, sound, hard burned throughout of uniform color, and equal in quality to samples which shall have been approved by the District.

Precast Concrete Grade Rings – Grade Rings shall be precast reinforced concrete with a minimum 4,000 psi after 28 days.

All concrete shall meet the requirements of Section V, 12 – Concrete.

c. Installation

The precast base and chimney shall be installed together with precast concentric concrete cone or flat top.

All joints shall be sealed with a minimum of one strip of self-sealing butyl rubber based flexible joint sealant in rope form. Lifting holes in all sections shall be filled solid with an approved non-shrink grout, both inside and out. .

The top six feet of the exterior surface of the catch basin structure shall be wrapped with a minimum of 4 layers of U.V. resistant, 6 mil high grade polyethylene.

9. SERVICE CONNECTIONS

a. General

Service connection pipe shall be furnished and installed as required. Connections shall be complete including excavation and backfill, pipe, fittings, connections and

other miscellaneous items of work. All fittings and service leads shall be installed at the same time the main sewer line is installed.

b. Materials

Pipe shall be either 4 or 6 inches in diameter as approved by the District and the same material as the main sewer. All pipe and fittings shall be connected by standard couplings and gaskets furnished by the manufacturer. All elbows used for service connections shall be bends or sweeps.

c. Installation

All work in regards to joints, laying, etc. shall be as specified under Section V, 5 above. Pipe shall be installed at a slope of at least ¼ inch per foot unless otherwise approved by the District. The end of each service lead shall be properly capped to prevent any objectionable material from entering the pipe. The end of the pipe shall not be covered until its location has been inspected by the District. Contractor shall furnish and install a 2” x 4” wood strip at the end of the connection, extending from the pipe to a point 2 feet above the finish surface of the ground. All sewer service lines shall be buried with a metallic "tracer" tape acceptable to the District to aid in their future location. The tracer tape shall be labeled “sewer” and be located approximately 3 ft. above the service line and shall extend from the connection of the service to the main, to the foundation wall.

10. RESURFACING

a. General

The work shall consist of furnishing and installing temporary surfacing, complete in place, where existing paved surfaces are removed or damaged during the process of any part of the construction.

Temporary surfacing shall closely follow the completion of laying sewers and shall not be delayed until the completion of the entire Contract.

b. Preparation

All trenches in paved areas shall be backfilled as required under Section V, 4. The edges of all pavements along the line of the trench shall be cut back from exposed edges thereof, a sufficient distance to form a clean, sharp, straight edge essentially parallel to the centerline of the trench. The minimum lateral cut back to be allowed will be 6-inches. Cut back pavement shall be carefully removed to minimize any disturbance to foundation materials. The exposed surface of the foundation material shall then be rolled with a power tandem roller, weighing not less than 240 pounds per inch width of thread, wetting the surface as necessary to obtain a firm, even surface.

Any depressions or uneven areas shall be regraded and re-rolled until the surface is tight and parallel to the existing surface.

c. Temporary Surfacing

Temporary surfacing shall consist of 1 ½" hot bituminous base mix (MDOT Grade B) placed over trenches and other areas where directed. When hot mix is not available 3" of cold patch shall be used. Road Gravel at top of trench shall be removed to allow for placing temporary surfacing.

Contractor shall maintain temporary surfacing in good condition until the final surface is placed. Trenches shall be inspected daily for holes and settlements. Holes and settlements shall be promptly repaired with bituminous mixture. Hot mix shall be used when available; otherwise, cold mix.

d. Final Surfacing

Final surfacing shall be as specified by the authority having jurisdiction.

11 PUMP STATION SPECIFICATIONS

a. General

1. Extent of Work

The work specified and/or referred to under this Section includes all materials, labor, tools and equipment necessary to: furnish and install one submersible pump station with all equipment as indicated on the drawings and specified herein. The contractor shall fully coordinate all related field operations with the Pump Station Manufacturer. Coordination shall include: verifying dimensions of equipment furnished; interfacing with and connection of all exterior piping and utilities in the field; connecting external power to the pump station; and all other miscellaneous components as required for a complete, properly operating pumping facility. The pumping station manufacturer shall provide factory trained qualified personnel to assemble the pumping station in the field as the Contractor is placing it in the excavation.

2. Manufacturer's Qualifications

One (1) Manufacturer shall furnish the pumping station and all equipment contained within them as a complete packaged system. Alternate systems based on a built-in-place, field erected pumping stations utilizing precast or cast-in-place concrete shall not be accepted. The factory built pumping station shall be a standard product in regular production by the Manufacturer who shall have five years minimum, successful experience in the design and assembly of products similar to that specified herein. The Manufacturer shall have also

satisfactorily furnished a minimum of ten units of the type described herein within the last five years. The Manufacturer shall be reputable and thoroughly qualified in the manufacture, assembly and installation of the products and equipment specified herein.

3. Shop Drawings

Shop drawings for all products and equipment specified and/or referred to herein shall be submitted to the Owner's Engineer and the District for review prior to their manufacture and/or shipment. The Pump Station Manufacturer shall forward submittals for the prefabricated pumping station to the Owner's Engineer and the District for approval prior to production. Submittals shall contain complete detailed shop drawings and literature on all equipment, including descriptions, diagrams, parts and listing of construction material as required indicating full conformance with the specifications. Partial submittals of shop drawings or equipment data will not be reviewed or approved. Shop drawings and equipment data shall be complete with respect to dimensions, materials of construction, design/performance criteria, wiring diagrams, component parts, etc., to enable the Owner's Engineer and the District to conduct a complete review of all equipment specified. Submittals shall be comprehensive and must fully address and contain:

- Structural design calculations and floatation calculations.
- Schematic electrical wiring diagrams, piping layouts, and descriptive literature on each item of equipment to be furnished as specified for a complete installation.
- Certified performance or test data as may be prescribed for the select equipment components specified in the following sections.
- A comprehensive painting/finish schedule shall also be submitted, summarizing paints, damp proofing and waterproofing materials and/or special coatings to be utilized.
- Each submittal set shall be fully indexed and shall be bound in a three-ring vinyl binder.
- At the time of submission the Contractor shall, in writing, call the Owner's Engineer and the District's attention to any deviations from the requirements of these specifications that are contained in the submittal documents. Deviations or omissions in the submittal drawings and related data shall not relieve the Contractor from his responsibility for providing the specified requirements unless the Engineer has given written approval for the deviations or missions identified.

4. Guarantee

All products and / or equipment incorporated into the precast pump station and valve pit shall be guaranteed for a period of one (1) year from startup or 18 months after installation, whichever occurs first.

b. Products

1. Precast Concrete Structure

Precast concrete structure shall be constructed to the general lengths, widths and heights shown on the Contract Drawings. Special attention shall be given to equipment clearances and/or control dimensions noted on the Drawings and/or elsewhere herein. The structure shall be designed to adequately and safely support all live and dead loads to which the structure will be subjected, and to withstand all conditions which may be encountered. Design calculations shall verify that the structure have been designed to withstand the burial

depth, groundwater hydrostatic pressures, and seismic forces based on the information provided, and also the dead and live loads anticipated for the structure. The structure shall have adequate wall, floor, and rook thickness and steel reinforcement for the depth and conditions of burial shown of the Drawings. Design computations for uplift forces shall contain a minimum factor of safety of 1.15. Station to be cast with a monolithic extended base slab. Lock joint or Press-Seal Gasket Corp shall form all wall penetrations utilizing resilient rubber pipe connectors. Each precast module shall be provided with formed male and female joints in insure accurate joint surfaces and tolerance for a watertight seal. The pump station structures shall be fabricated and cast at the Manufacturer's facility in full accordance with approved structural designs and shop drawings. The Pumping Station Manufacturer shall have a facility of sufficient size to permit assembly of all structural components and interior mechanical equipment, with an environmentally controlled building. All work associated with fabricating, assembling and testing the pumping station shall be performed within the building except as otherwise noted herein, or allowed by the Owner. The building shall keep the structures protected from the elements and be maintained at an ambient temperature of at least 45° F. Concrete used in the manufacture of the various structural components of the precast concrete structures shall meet the following requirements:

- Cement shall be High Early Strength Portland Cement, Type II or Type III, conforming to ASTM C-150.
- Fine aggregate shall consist of natural sand conforming to ASTM specification C-33.
- Coarse aggregate shall consist of well-graded crushed stone conforming to ASTM specification C-33.
- Air entrainment shall be 4.5% plus or minus 1%.
- A super plasticizer may be used and if so, used per manufacturers recommendations.
- No concrete shall be placed when the ambient temperature in the building is less than 50° F.
- The concrete used for the structural components shall attain a minimum 28-day compressive strength of 5,000 psi.
- The pump station manufacturer to have on staff a PCI Certified Technician.
- As a minimum, six 4 x 8 concrete test cylinders shall be made for each production day from the same concrete batch used in actual components. Two cylinders shall be tested at time of product stripping, two at seven days cured in environment similar to the actual component, and two at 28 days cured in 100% humidity. Results shall be furnished to the Engineer. Test cylinders shall be cured in the same manner as the actual components are cured.

Reinforcing steel used in the manufacture of the various structural components of the precast concrete components shall meet the following requirements:

- Steel shall be a new billet steel, deformed steel bar conforming to ASTM A-615 (latest revision) Grade 60. Welded steel wire fabric reinforcing shall conform to ASTM A-185 (latest revision)
- Minimum cover of reinforcement shall be one inch.

2. Pump Station Pumps

Furnish and install 2 submersible non-clog wastewater pumps. Each pump shall be equipped with a submersible electric motor, connected for operation on 460 volts, 3 phase, 60 hertz, 4 wire, grounded neutral service, with the required length of submersible cable (SUBCAB) suitable for submersible pump applications as shown on the contract electrical drawings. The power cable shall be sized according to NEC and ICEA standards and also meet with P-MSHA Approval. The pump shall be supplied with a mating ductile iron discharge connection. Each pump shall be fitted with adequate feet of stainless steel cable. The working load of the lifting system shall be 50% greater than the pump unit weight.

B. PUMP DESIGN

The pumps shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal-to-metal watertight contact. **Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable**. No portion of the pump shall bear directly on the sump floor.

C. PUMP CONSTRUCTION

Major pump components shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be of stainless steel construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.

Sealing design shall incorporate **metal-to-metal contact** between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.

Rectangular cross-sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

D. COOLING SYSTEM

Each unit shall be provided with an integral motor cooling system. A motor cooling jacket shall encircle the stator housing, providing for dissipation of motor heat regardless of the type of pump installation. An impeller, integral to the cooling system and driven by the pump shaft, shall provide the necessary circulation of the cooling liquid trough the jacket. The cooling liquid shall pass about the stator housing in the closed loop system in turbulent flow providing for superior heat transfer. The cooling system shall have one fill port and one drain port integral to the cooling jacket. The cooling system shall provide for continuous pump operation in liquid or ambient temperatures of up to 104°F. (40°C.). Operational restrictions at temperatures below 104°F are not acceptable. Fans, blowers or auxiliary cooling systems that are mounted external to the pump motor are not acceptable.

E. MOTOR

The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be

insulated with moisture resistant Class H insulation rated for 180^{O}C (356^{O}F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31.The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable. The use of pins, bolts, screws or other fastening devices used to locate or hold the stator and that penetrate the stator housing are not acceptable. The motor shall be designed for continuous duty while handling pumped media of up to 104°F. The motor shall be capable of withstanding at least 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of aluminum. Three thermal switches shall be embedded in the stator end coils, one per phase winding, to monitor the stator temperature. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the motor control panel. The junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals. The use of wire nuts or crimp-type connectors is not acceptable. The same manufacturer shall produce the motor and the pump. The motor service factor (combined effect of voltage, frequency and specific gravity) shall be 1.15 (1.0 service factor when operated on VFD equipment and inverter duty rated). The motor shall have a voltage tolerance of +/- 10%. The motor shall be designed for continuous operation in up to a 40°C. ambient and shall have a NEMA Class B maximum operating temperature rise of 80° C. A motor performance chart shall be provided upon request exhibiting curves for motor torque, current, power factor, input/output kW and efficiency. The chart shall also include data on motor starting and no-load characteristics.

Motor horsepower shall be sufficient so that the pump is non-overloading throughout its entire performance curve, from shut-off to run-out.

F. BEARINGS

The integral pump/motor shaft shall rotate on two bearings. The motor bearings shall be sealed and permanently grease lubricated with high temperature grease. The upper motor bearing shall be a single ball type bearing to handle radial loads. The lower bearing shall be a two row angular contact ball bearing to handle the thrust and radial forces. The minimum L_{10} bearing life shall be 50,000 hours at any usable portion of the pump curve.

G. MECHANICAL SEALS

Each pump shall be provided with a positively driven dual, tandem mechanical shaft seal system consisting of two seal sets, each having an independent spring. The lower primary seal, located between the pump and seal chamber, shall contain one stationary and one positively driven rotating corrosion resistant **tungsten-carbide** ring. The upper secondary seal, located between the seal chamber and the seal inspection chamber, shall contain one stationary and one positively driven rotating corrosion resistant **tungsten-carbide** seal ring All seal rings shall be individual solid sintered rings. Each seal interface shall be held in place by its own spring system. The seals shall not depend upon direction of rotation for sealing. Mounting of the lower seal on the impeller hub is not acceptable. Shaft seals without positively driven rotating members or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces are not acceptable. The seal springs shall be isolated from the pumped media to prevent materials from packing around them, limiting their performance.

Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and shall provide capacity for lubricant expansion. The seal lubricant chamber shall have one drain and one inspection plug that are accessible from the exterior of the motor unit. The seal system shall not rely upon the pumped media for lubrication.

The area about the exterior of the lower mechanical seal in the cast iron housing shall have cast in an integral concentric spiral groove. This groove shall protect the seals by causing abrasive particulate entering the seal cavity to be forced out away from the seal due to centrifugal action.

A separate seal leakage chamber shall be provided so that any leakage that may occur past the upper, secondary mechanical seal will be captured prior to entry into the motor stator housing. Such seal leakage shall not contaminate the motor lower bearing. The leakage chamber shall be equipped with a float type switch that will signal if the chamber should reach 50% capacity.

H. PUMP SHAFT

The pump and motor shaft shall be a single piece unit. The pump shaft is an extension of the motor shaft. Shafts using mechanical couplings shall not be acceptable. The shaft shall be AISI type 431 stainless steel. Shaft sleeves will not be acceptable.

I. IMPELLER

The impeller shall be of gray cast iron, ASTM A-48 Class 35B, dynamically balanced, semi-open, multi-vane, back swept, screw-shaped, non-clog design. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The screw-shaped leading edges of the impeller shall be hardened to Rc 45 and shall be capable of handling solids, fibrous materials, heavy sludge and other matter normally found in wastewater. The screw shape of the impeller inlet shall provide an inducing effect for the handling of up to 5% sludge and rag-laden wastewater. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw. The impellers shall be locked to the shaft, held by an impeller bolt and shall be coated with alkyd resin primer.

J. VOLUTE/SUCTION COVER

The pump volute shall be a single piece gray cast iron, ASTM A-48, Class 35B, non-concentric design with smooth passages of sufficient size to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified. The volute shall have integral spiral-shaped, sharp-edged grooves that are cast into the suction cover. The spiral grooves shall provide the sharp edges across which each impeller vane leading edge shall cross during rotation so to remain unobstructed. The internal volute bottom shall provide effective sealing between the multi-vane semi-open impeller and the volute.

K. PROTECTION

Each pump motor stator shall incorporate three thermal switches, one per stator phase winding and be connected in series, to monitor the temperature of the motor. Should the thermal switches open, the motor shall stop and activate an alarm. A float switch shall be installed in the seal leakage chamber and will activate if leakage into the chamber reaches 50% chamber capacity, signaling the need to schedule an inspection.

The thermal switches and float switch shall be connected to a Mini CAS control and status-monitoring unit. The Mini CAS unit shall be designed to be mounted in the pump control panel.

L. MIX-FLUSH VALVE

At least one pump in each sump shall be equipped with an automatically operating valve that will provide a mixing action within the sump at the start-up of the pumping cycle.

This valve shall be mounted directly on the pump volute and shall direct a portion of the pump age into the sump to flush and re-suspend solids and grease by the turbulent action of its-discharge. The turbulent action caused by the flow shall also provide some sump

aeration benefits. The valve shall be mounted on the pump volute so that it can be removed from the sump along with the pump during normal and routine maintenance checks and shall be positioned on the volute to provide for non-clogging operation. The valve shall be equipped with an adjustable, wear-resistant discharge nozzle, which shall be used to direct flow from the valve to optimize mixing action within the sump.

The valve shall not require any external power source or control to operate, neither electric nor pneumatic. The use of the external power source is not acceptable. The valve shall be suitable for use in Class I, Division 1 hazardous locations.

The valve shall open at the beginning of each pumping cycle and shall automatically close during pump operation after a pre-selected time of operation. The valve shall operate automatically by differential pressure across the valve and shall be actuated through a self-contained hydraulic system, which uses an environmentally safe fluid. A method of adjusting the valve operating time shall be provided.

M. ACCESS HATCH

1. Access Hatch

A FDRND 300 PSF Rated Channel Style Hatch, as manufactured for ITT Flygt Corp., Trumbull, CT. (or equal) as noted on the contract drawing shall be supplied for access to the top of the pump station.

Material shall be 6061-T6 aluminum for bars, angles and extrusions. Diamond plate (1/4" thick) shall be 5086 aluminum.

Design of access hatch shall conform to O.S.H.A. standard 1910.23.

Unit shall be designed for 300 PSF. Channel frame and bearing must be cast into and supported by concrete. Hatch shall be designed using a maximum design stress of 17,300 psi as per the Aluminum Association, Inc. "Specifications for Aluminum Structures", with a safety of 2.2 applied to a minimum allowable tensile strength. Engineering calculations shall be supplied upon request.

Hatch door shall be supplied with a heavy duty, stainless steel pneu-spring, for ease of operation when opening cover. Cover shall be counterbalanced; so one person can easily open the hatch cover. Spring design shall accommodate ease of maintenance.

Hatch door shall be equipped with a grade 316 stainless steel hold open arm. Door shall loc open in the 90-degree position. Each hold open arm shall have red vinyl grip handle. Hold open arm shall be fastened to the frame with ½" grade 316 stainless steel bolts.

Channel frame shall be of extruded aluminum, with a continuous 1-1/4" anchor flange. Frame shall be a minimum of ¼" thick, with a minimum cross section of 7.5".

Each "FDRN-HD" style hatch shall be supplied with a 1-1/2" threaded drain coupler on the underside of the channel frame for pipe connection.

Hinges shall be heavy-duty design. Material shall be a brass alloy with a 65,000-psi tensile strength. Each hinge shall have a 3/8" grade 316 stainless steel pins. Hinges shall be bolted to the angle frame and diamond plate, with 316 stainless steel bolts and ny-lock nuts.

Each hatch shall be supplied with a grade 316 stainless steel slam lock, with keyway protected by threaded aluminum plug. Plug shall be flush with top of the ¼" diamond plate. Slam lock shall be fastened with four grade 316 stainless steel bolts and washers.

Each hatch shall be equipped with an aluminum lift handle. The lift handle shall be flush with the top of the ¼" diamond plate.

2. Hatch Safety Grate

The hatch shall be provided with a hinged aluminum "Safe Hatch" designed to combine covering of the hole per OSHA Standard 1910.23 and shall include fall through protection and controlled confined space entry.

Safety grates shall be as manufactured for ITT/Flygt Corp, shall be made of 6061-T6 aluminum with a minimum ultimate strength of 38,000 psi and minimum yield strength of 35,000 psi, as per ASTM B221. Grate design shall use safety factors as defined in the Specifications for Aluminum Structures, by the Aluminum Association Inc., 5th edition, December 1986 for Bridge Type Structures.

Aluminum grating shall be designed to withstand a minimum live load of 300 pounds per square foot. Deflection shall not exceed 1/150th of the span.

Aluminum grate opening shall be 5-inch by 5-inch, which will allow for visual inspection of the pit and level adjustment, once the access hatch is open.

Each grate shall be provided with a permanent hinging system, which will lock the grate in the 90-degree position once opened.

Design of the system must assure fall through protection is in place after the door has been closed, thereby protecting the next operator.

Each grate shall have an opening arm, with a red vinyl grip handle, which will allow opening of the grate, while providing the grate as a barrier between the operator and opening of the grate, while providing the grate as a barrier between the operator and the pit. The opening arm shall also be equipped with a controlled confined space entry-locking device (lock provided by owner). This locking device will prevent unauthorized entry to the confined space. The grating system will allow anyone to make visual inspection and level adjustments without entering the confined space.

Grate shall be painted with OSHA type safety orange paint.

Welding shall be in accordance with ANSI/AWS D1.2-90 Structural Welding Code for Aluminum.

2.03 OPERATIONS AND MAINTENANCE (O & M) MANUALS

A. The Manufacturer shall furnish three (3) Operations and Maintenance Instruction Manuals

B. O & M Manuals shall be prepared with clear instructions which will enable the Owner's personnel to operate and maintain the overall pump station and all equipment associated with each individual system installed within the station.

C. The manuals shall be prepared specifically for this installation. General literature from the equipment manufacturer, which is not specifically applicable to the operation and maintenance of the installed items, shall not be acceptable.

D. The manuals shall be bound in a three-ring vinyl binder with a heavy gauge clear vinyl overlay on the front cover and spine, which is insertable from the top. A title sheet tabulating project information including name and location of project; manufacturer's and consulting engineers' name and address; shall be placed in these pockets. Manuals shall contain an index, which list and locates all enclosed literature and drawings.

E. The manuals shall be comprehensive and as a minimum contain:

1. Descriptions and operating instructions for all system components within the station.
2. Instructions relevant to all modes of equipment operation.
3. Service and trouble-shooting instructions as may be available from select manufacturers of equipment supplied.
4. Procedures for the adjustment of equipment at initial start-up, during routine preventative maintenance, and following replacement or repair.
5. Instructions for testing and calibration of electronic components as may be required to determine proper performance.
6. As-Built Mechanical drawings and dimensional information showing the actual layout and location of all major equipment components within the structure.

7. As-Built Electrical schematic drawings of all wiring as supplied with the station. Motor controls, alarm system circuitry, electrical appliances, interconnections, etc. as well as all electrical components within the station to be fully identified and described.
8. Finish Schedule, listing all paints and / or special coatings utilized on the various components.

STANDARD CONTROL PANEL SPECIFICATION

SCOPE:

A control system shall be supplied by the pump manufacturer containing all of the mechanical and electrical equipment necessary to provide for the operation of the submersible pump or pumps as depicted on the drawings.

ENCLOSURE:

The control panel enclosure shall be Nema 4X 304 stainless steel. The enclosure door shall be gasketed with a rubber composition material around the perimeter and shall be installed with a retainer to assure a positive weatherproof seal. The door shall open a minimum of 180 degrees. A padlock hasp shall be provided.

A polished inner door shall be mounted on a continuous aircraft aluminum hinge and shall contain cutouts for the protrusion of the circuit breakers and provide protection of personnel from internal live voltages. All pump controllers, control switches, pilot indicators, elapsed time meters and other operational devices shall be mounted on the inner door. The inner door shall open a minimum of 150 degrees to allow for access to the equipment for maintenance. A ¾" break shall be formed around the perimeter of the inner door to provide rigidity.

A back plate shall be manufactured from 12-gauge sheet steel and shall be finished with a primer coat and two (2) coats of baked on white enamel. All hardware shall be mounted using stainless steel machine thread screws. Sheet metal or self-tapping screws shall not be acceptable. All installed devices will be permanently identified with engraved legends.

POWER DISTRIBUTION:

The panel power distribution shall include all necessary components and be wired with stranded copper conductors rated at 90 degrees C. Conductor terminations shall be as recommended by the device manufacturer.

The power system shall contain incoming power terminals, motor circuit breakers control circuit breaker and convenience outlet breaker. All circuit breakers shall be heavy-duty thermal magnetic or motor circuit protector similar and equal to Square D type FAL. Each breaker shall be sized to adequately meet the operating conditions of the load and have a minimum interrupting capacity of 10,000 amps at 230 volts and 18,000 amps at 460 volts. Breakers shall be indicating type, providing "on/off/tripped" positions on the handle. They shall be quick-make quick-break on manual and automatic operation and have inverse time characteristics. Breakers shall be designed so that tripping of one pole automatically trips all poles.

Motor starters shall be open frame, across the line NEMA rated with individual overload protection on each phase. Motor starter contacts and coil shall be replaceable from the front of the starter without removal of the starter from its mounted position. Overload heaters shall be block type, utilizing melting alloy spindles, sized for the full load amperage of the motor. Adjustable overloads, definite purpose contactors, fractional size starters and horsepower rated contactors or starters shall not be acceptable.

A lightning transit protector shall be provided. The device shall be a solid-state device with a response time of less than 5 nanoseconds with a withstanding surge capacity of 6500 amperes. Units shall be instant recovery, long life and have no holdover currents.

The following shall be supplied as standard equipment:

a. 12-pin plug in phase/voltage monitor with two (2) sets of double pole double throw contacts.
b. Nema 4 rated Hand Off Auto switches.
c. Pump Run/Failure pilot lights as required.
d. Elapsed Time meters for each pump.
e. 50-watt condensation heater and thermostat.
f. Control Power transformer minimum of 2kvA.
g. GFCI Duplex convenience outlet on inner door.
h. Laminated wiring schematic adhered to the inside surface of the outer door.

PUMP PROTECTIVE DEVICES:

Each pump shall be protected by a solid-state relay to monitor motor winding temperature and seal leakage. The relays shall have and 11 pin octal base and shall be flanged for mounting on the inner door. The relay shall be powered by 24VAC, 28VDC or 120VAC supply. LED indicators shall be provided on the relay for power on, overtemp and seal fail conditions. An overtemp-reset pushbutton shall be mounted on the relay. The sensor input circuitry shall contain both hardware and software filters to provide noise immunity, as well as sensor input short circuit protection. The relay shall be MiniCas 120, model 14-407129 by ITT Flygt.

PUMP CONTROLLER:

GENERAL:

The pump controller shall consist of all the components, hardware and software to provide a trouble-free pumping station. The system shall be designed and specifically produced for the surveillance of the pump station. The system shall provide for interface to other RTU's and SCADA systems for remote control and data collection. The RTU shall control the pumps as a

stand-alone unit in the event of a communications loss. The controller shall be an FMC as manufactured by ITT Flygt or pre-approved equal.

OPERATION:

Pump controller shall provide continuous monitoring of the wet well level via submersible pressure transducer. The pump controller shall start and stop pump based upon wet well level and operator programmed set points. The controller shall have provision for a float switch backup in event of transducer failure. The pump controller shall alternate pump cycles to ensure equal run times. The pump controller shall monitor pump protection features to provide alarms in event of impending pump failure. It shall also monitor pump performance data to provide operations personnel the ability to evaluate station performance.

HARDWARE:

The pump controller shall be programmed via built-in operator interface. The interface shall consist of pushbuttons in combination with a 2-line LCD backlit display in English. The front panel shall also include LED indicators for controller operation, communication status, alarm status, pump operation status, and individual critical alarms.

The front panel operator interface shall be rated IP65 (applicable to Nema 4 standard).

The pump controller shall contain a 486CPU, 32 bit 66 MHz processor, with a primary memory of 8 Megabytes D-RAM and a flash memory of 4 Megabytes. The memory shall be protected by a 3.6 VDC NiMH battery and have a watchdog function.

The pump controller shall provide 16 digital inputs, 8 digital outputs (6 relay normally open, 2 solid state normally open), and 4 analog inputs. The inputs/outputs shall meet the following:

a. All inputs/outputs shall be optically isolated.
b. Digital inputs shall be 11-30vdc, selectable logic.
c. Digital outputs shall have a max load of 2A at 250VAC/DC (relay) or have an output capacity of 100mA at 250VAC/DC (solid state).
d. Analog inputs shall be 4-20mADC with 12bit resolution and inaccuracy of 0.1%

In addition to the input/output features listed, the controller shall be expandable up to a total of 600 physical I/O points.

The pump controller shall operate from a supply voltage of 24VDC (-15% to +20%), and have a current consumption of 1A (no load). The controller shall be protected internally with a fuse rated at 2A.

The pump controller shall include 3 communications ports. One port shall be RS-232 and dedicated to service functions (local programming of controller with laptop). The other two ports shall be RS-232/485 capable, and available for use as communication interface to dialup modem, leased line modem, GSM modem, or radio. A PCMCIA slot shall also be provided for installation of internal modem.

The pump controller shall be UL listed.

The submersible transducer shall be a two wire device operating on 10-30VDC supply with a 4-20mADC level signal. The transducer shall have a temperature range of -20 to 80 degrees C and have an inaccuracy of plus or minus 0.1% of total range. The transducer shall be cable suspended and not dependent upon position. The sensor shall be ceramic, with a 316 stainless

steel sensor housing, Vitron o-ring and polyurethane vented cable. The transducer shall be LS 100, manufactured by ITT Flygt or pre-approved equal.

FUNCTIONS:

The pump controller shall operate the pumps in accordance with operator-programmed set points. The controller shall also be capable of remote start-stop functions via network. The following information shall be observed on the front panel display:

a. Cross-section areas of the wet well
b. Start-stop pump levels
c. Alarm levels for low, high and overflow
d. Nominal capacities of the pumps
e. Current flow and accumulated flow
f. Pumped volume for two days
g. Number of starts for each pump
h. Run time for each pump
i. Amp draws for each pump

The pump controller shall provide for local display, acknowledgement and remote notification of alarm conditions. The controller shall log up to 1000 alarm events. Alarm capabilities shall include:

a. Wet Well High Level
b. Wet Well Low Level
c. Wet Well Overflow
d. Pump Over current
e. Pump Undercurrent
f. Pump Fail to Start
g. Pump Over temperature
h. Pump Seal Fail
i. Pump Service Alarm (when pump run time exceeds preset service interval)
j. Intrusion Alarm
k. Personnel Alarm (adjustable time-delay alarm if not acknowledged by on-site personnel)
l. Communications Failure
m. Test Alarm (periodic test alarm for communications)

The pump controller shall be capable, via network, of blocking up to five upstream stations should local conditions prevent pumping operations.

The pump controller shall provide flow calculations based on the geometry of the wet well. Five cross-sectional areas shall be used for inflow calculation, which shall be updated every pumping cycle. Pump capacity shall be calculated from wet well discharge time and inflow. Pumped volume (total) shall be calculated from current pump capacity.

The controller shall calculate station overflow. A level sensor shall be installed at the overflow point, and the controller shall register overflow time, number of overflows and accumulated volume.

The controller shall provide a sump cleaning function. At preset intervals the pumps shall be allowed lower the wet well level to the bottom of the volute in order to remove built up solid debris in the sump. The controller shall also allow periodic timed pump cycles in low inflow stations to prevent the wet well from becoming septic.

The pump controller shall be capable of receiving an input from a rain gauge or tipping bucket. The controller shall log this data for piping analysis by operations personnel.

The pump controller shall calculate energy consumption from preset voltage level and motor current readings.

The pump controller shall contain a real-time clock and shall time and date stamp all logged data. The controller shall store logged data for a period of up to 30 days.

COMMUNICATIONS:

The pump controller shall be able to communicate via leased phone line, dialed phone line, GSM, radio or LAN.

The pump controller shall be capable of communicating via AquaCom, MODBUS or Comli protocols. The controller shall also be capable of sending SMS messages.

HMI SOFTWARE:

The pump controller shall communicate to HMI software that is Windows based with intuitive menu-type navigation. The software shall include templates to facilitate future system expansion by operations personnel. The software shall also be customizable to portray the system in realistic detail. The software shall provide the ability to observe station operating conditions, remote control of pumps and other station equipment, observe and change set points, monitor

and acknowledge alarms, log system historical data and generate reports and trend charts. The HMI software shall be AquaView by ITT Flygt or pre-approved equal.

Historical data trend charts shall be based on 1-30 minute time periods and shall include the following:

a. Wet well levels
b. Motor Currents
c. Calculated capacity of wet well
d. Inflow
e. Pumped Volume
f. Overflow

In addition to the available historical data, the following daily reports shall be provided:

a. Pump run times
b. Number of pump starts
c. Average value of pump capacity
d. Pumped volume
e. Number of overflow events
f. Overflow duration
g. Overflow volume
h. Station blocked events (time and date stamped)
i. Energy consumption

LOCAL ALARM:

A top mounted flashing red alarm light shall be provided. The alarm light shall be weatherproof and shatterproof with a minimum 4-inch diameter and 40 watt lamp.

An alarm horn shall be provided with an alarm silence button. The alarm horn shall be mounted on the left side of the enclosure with a weatherproof back box. The horn shall provide a signal of not less that 90db at 10 feet.

The alarm light and horn shall be used to signal those alarms indicated on the drawings.

MISCELLANEOUS:

A final as-built drawing encapsulated in Mylar shall be attached to the inside surface of the outer door. A list of all legends shall be included.

The control panel shall be UL508A listed.

12. CONCRETE

Concrete for inverts, thrust blocks, concrete encasement, concrete fill, etc. shall be minimum 3,000 psi @ 28 days.

13. RIPRAP

Description: This work shall consist of constructing a riprap as shown on the plans and in reasonably close conformity to the lines and grades as detailed or directed by the Engineer.

Material: Riprap shall consist of stones weighing from 10 pounds to 200 pounds except that when available, suitable stones weighing more than 200 pounds may be used. Approximately 50 percent of the stones by volume shall exceed a unit weight of 50 pounds.

Construction Requirements: Riprap shall be placed upon a slope properly graded and compacted as called for. Plain riprap shall be placed full depth in one operation without special handwork, shall be approximately true to the required slope line and grade and shall be uniform in appearance.

14. DUST CONROL

Dust control shall be exercised throughout the entire project by using brooms, water, calcium or any combination thereof to control all dust generated during the process of construction.

15. PIPE CLEANING

At the conclusion of the work, the Contractor shall thoroughly clean the sewers by flushing with water and flushing ball or other means to remove dirt, stones and other material. Prior to acceptance, all pipe lines shall be inspected for cleanliness and to be sure no sandbags, broken pipe or other obstruction exist.
The work area, property adjacent to the project and all grounds occupied by the Contractor in connection with the work shall be cleaned of all rubbish, excess material, temporary structures and equipment and the ground graded and restored to match the surrounding terrain.

16. LOAM, FERTILIZER AND SEED

a. General

The loaming, fertilizing and seeding shall consist of furnishing, placing, grading, seeding and fertilizing in all disturbed areas, except where pavement or gravel is installed, and where indicated on the drawings or as directed by the Engineer.

b. Loam

Loam shall be rototilled topsoil free of stones, large clods, roots of trees or shrubs or other foreign matter. Muck, peat or other excessively acid soils will not be used.

c. Grass Seed

Grass seed shall be fresh, clean, new crop seed. Seed shall be delivered to the work site with each container bearing the dealer's guaranteed analysis. Grass seed shall have minimum percentages of germination and of purity as listed below:

Proportion

Kind of Grass	**by Weight**	**Purity**	**Germination**
Annual Ryegrass	10-25%	97%	90%
Kentucky 31 Fescue	15-25%	97%	85%
Perennial Ryegrass	5-25%	97%	90%
Chewings Fescue	10-20%	95%	90%
Creeping Red Fescue	0-10%	95%	85%
Kentucky Bluegrass	8-30%	5%	80%

NOTE: Weeds and inert materials shall not exceed 2%.

d. Construction

The loam is to be spread and raked to a depth of at least three inches. Fertilizer shall be spread, graded at a minimum rate of 30 pounds per 1,000 square feet. Lime shall be spread at a minimum rate of 20 pounds per 1,000 square feet. After spreading the seed at a rate of three pounds per 1,000 square feet, the area shall be lightly raked and rolled.

The Contractor shall be responsible for the protection and maintenance of the seeded area until a satisfactory uniform stand of grass has been established. Where seed fails to germinate, resulting in bare spots, the Contractor shall reseed, at his own expense, until satisfactory to the Engineer.

17. MAINTENANCE OF TRAFFIC

a. General

Work included: Work under this section shall consist of maintaining traffic on the roads, streets or highways on which the work is being carried out. The work shall be carried out in accordance with the following paragraph:

The Contractor will be responsible for conducting the work in accordance with the requirements of the permits and any penalties due to the failure of the Contractor to comply with the permit.

b. Detours and Road Accessibility

The contractor shall contact the responsible heads of the Fire, Police, and other appropriate governing bodies of the municipality in order to obtain necessary permits and determine the requirements of said departments with respect to traffic control, alternate vehicular access routes, and the like. Wherever detours are permitted the size, construction and location of signs shall conform with local and state requirements and/or standards. Detour routes shall be adequately posted to assist the motorist to return to his route of travel. Where the roadway under construction is the only means of vehicular access to a particular area, the Contractor shall provide continual access to the area for residents and emergency vehicles.

c. Working Procedures

The contractor shall be responsible for continuous traffic control as directed by the State, City and the District. The methods of traffic control shall conform to State regulations and requirements and to the "Manual on Uniform Traffic Control Devices for Street and Highways". In general, the Contractor shall maintain continuous two-way traffic during working and non-working hours. In the event that two-way traffic cannot be maintained (i.e. highway crossings, etc.) the Contractor shall provide traffic officers to maintain traffic flow. Flagmen shall be provided at all times that work is being conducted within the limits of the highway.

A responsible representative of the Contractor shall be available during all periods of time that the Contractor is not actually working on the project. These periods of time shall include nights, weekends, holidays and other times the work may be suspended.

The representative shall have the authority and the means to repair and maintain the roadway, signs and lighting during the above periods of time, and the telephone number where he can be reached shall be given to the Local Police Department and the District.

The Contractor shall be responsible for barricades and warning signs with flashing lights, as may be required, to be furnished and installed subject to the approval of the District. Work areas signs shall be provided at local work sites. The size, legend and position of the various construction signs are shown in Plates C-MDOT-11, 12 and 13 and shall be in conformance with the Manual of Uniform Traffic Control Devices. All construction signs shall have a black legend with an orange background. The "Sewer Construction Ahead" sign and "End Construction" sign are to be placed 1500 feet from each end of the project and the "Sewer Construction Ahead" sign shall also be placed at each major intersection. All current work areas shall be provided with reflectorized signs overnight to facilitate traffic and maintain safety. A "Blasting Area" within three hundred feet of any traveled way shall be marked by approved signs with information similar to the following: "BLASTING AREA, TURN OFF RADIO TRANSMITTERS" and the reverse side "END OF BLASTING AREA".

d. No interference with Traffic

The Contractor shall conduct his work so as not to interfere with traffic, both vehicular and pedestrian. Traffic originating or having business along the section of the road under construction shall be provided with a passable and adequate road. To

accomplish this may necessitate the bridging over or the construction of structures in sections or the providing of short detours around them. The work shall be progressed in such a manner that the access to private or business driveways adjacent to the improvements will be interfered with as little as possible.

Where feasible, bridging over the trenches or completed work of other acceptable methods shall be used for this purpose. The Contractor shall furnish adequate protection to the public by installing and maintaining adequate warning signs, flags, lights, paths, railings, barricades, watchmen and signalmen where necessary or called for by the District.

At least one-way traffic shall be maintained at all times. All traffic controls shall be in accordance with the latest edition of the Manual on Uniform Traffic Control Devices for Streets and Highways, as issued by the Federal Highway Administration.

All equipment and material will be stored off the traveled-way and if on the shoulders, properly delineated at night.

All work in the traveled-way and shoulder shall be completed by sunset of each working day. At the close of each weeks work or before any holiday all open trenches will be completely backfilled and equipment and materials removed from the traveled-way and shoulders for the coming weekend or holiday.

No detours of any sort shall be used during the period of construction without prior permission from the proper authorities.

Failure to meet the requirements of this item will result in immediate suspension of work of the project until the requirements can be met.

18, STREET OPENINGS IN CITIES AND TOWNS

The Contractor shall obtain and pay all Street Opening Permits for any City or Town in the District's service area prior to starting actual construction in any roadway.

The District may assist the Contractor in obtaining the necessary permits.

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The District may assist the Contractor in obtaining the necessary permits. Pavement replacement in the State Highways will be done by the State of Maine Department of Transportation or by other arrangements made by Contractor and approved by the District.

Section VI: Standard Installation Details

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Sewer Index

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Section VI: Standard Installation Details

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RESIDENTIAL SERVICE ENTRANCE DETAIL

5/8", 3/4" & 1" METERS

GREATER AUGUSTA UTILITY DISTRICT

REVISED JAN. 2008 NTS

NOTES:

1. The Greater Augusta Utility District, (G.A.U.), recommends the use of 1 inch copper to the hot water tank and 3/4" copper hot and cold feed lines to the bathrooms and kitchen where the static pressure is less than 40 psig.

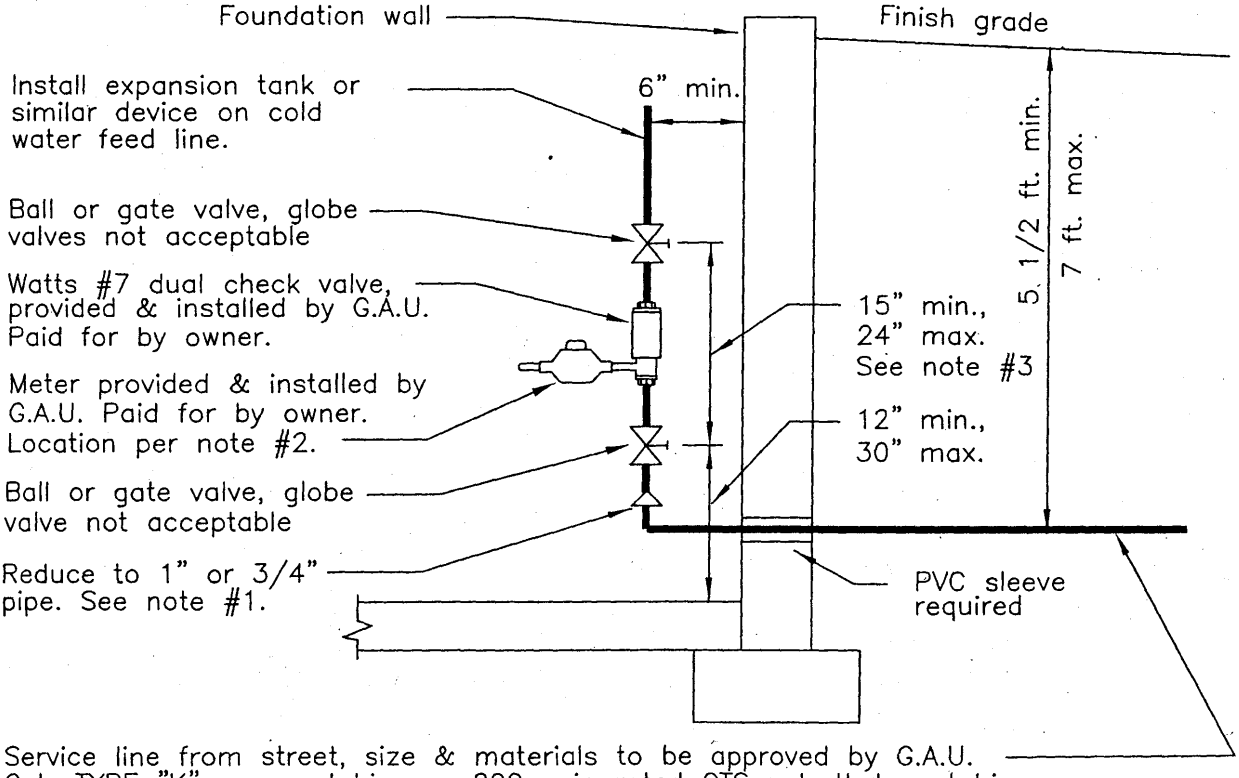
   Where the static pressure is between 55 and 40 psig, the above pipe sizes could all be changed to a minimum of 3/4 inch.

   Where the static pressure is 55 psig or greater, the line feeding the hot water tank should be a minimum of 3/4 inches while all feed lines after (downstream) of the hot water tank may be reduced to a minimum of 1/2 inches where runs to fixtures are not excessive.

2. The owner must provide a clean, dry, accessable and warm (continually above 45 degrees F) location for the meter installation.

   G.A.U. must install a 22 gauge wire from meter to radio read unit on exterior wall. This should be accomplished during construction, before interior insulation/ drywall is installed.

3. Provide a solid piece of copper between ball or gate valves of the same size as service line entering building or size service line has been reduced to.



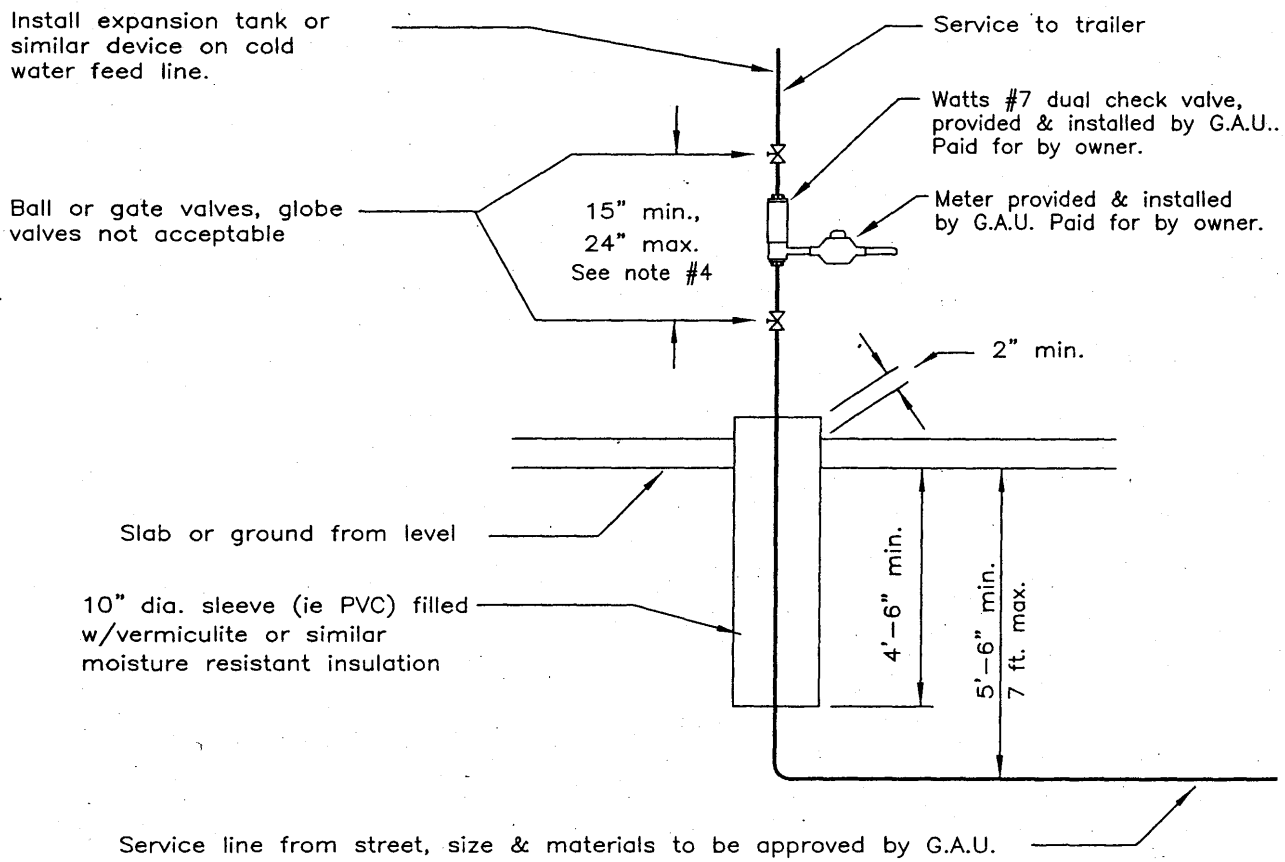
TRAILER OR SLAB SERVICE ENTRANCE DETAIL

GREATER AUGUSTA UTILITY DISTRICT

REVISED JAN. 2008 NTS

NOTES:

1. Heat trace and insulate service from approximately 2'–6" below slab to the top of the sleeve which abuts the base of the trailer.
2. Locate meter within 18 inches of outside skirting. Provide access door for installing and inspecting the meter.
3. Alternate meter location – inside trailer. For this, provide valves for meter as shown for inside installation, see RESIDENTIAL SERVICE ENTRANCE – 5/8", 3/4" & 1" METERS.
4. Provide a solid piece of copper between ball or gate valves of the same size as service line entering building or size service line has been reduced to.



RESIDENTIAL SERVICE ENTRANCE DETAIL
MULTI-METER ARRANGEMENT
5/8", 3/4" & 1" METERS
GREATER AUGUSTA UTILITY DISTRICT
REVISED JAN. 2008 NTS

NOTES:

1. The Greater Augusta Utility District, (G.A.U.), recommends the use of 1 inch copper to the hot water tank and 3/4" copper hot and cold feed lines to the bathrooms and kitchen where the static pressure is less than 40 psig.

   Where the static pressure is between 55 and 40 psig, the above pipe sizes could all be changed to a minimum of 3/4 inch.

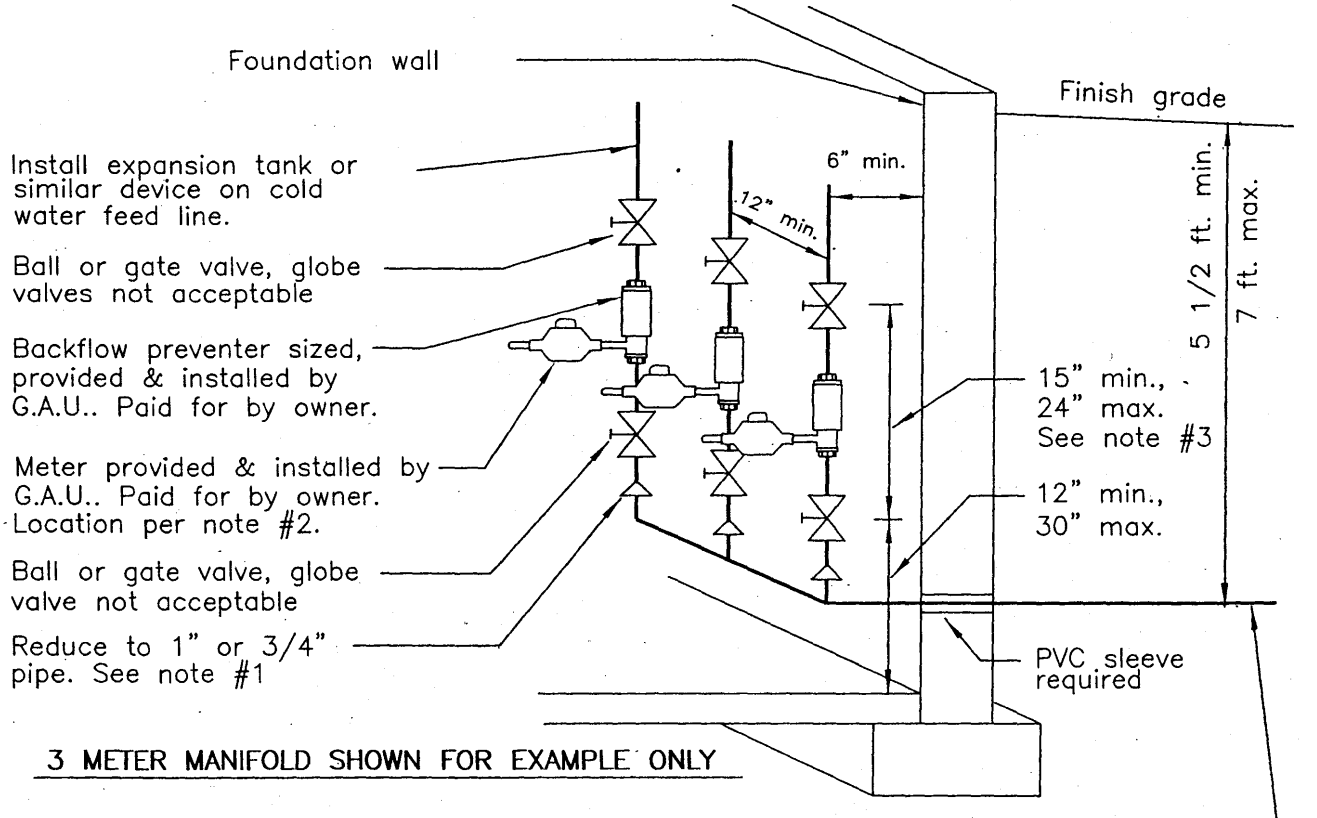
   Where the static pressure is 55 psig or greater, the line feeding the hot water tank should be a minimum of 3/4 inches while all feed lines after (downstream) of the hot water tank may be reduced to a minimum of 1/2 inches where runs to fixtures are not excessive.

2. The owner must provide a clean, dry, accessable and warm (continually above 45 degrees F) location for the meter installation.

   G.A.U. must install a 22 gauge wire from meter to radio read unit on exterior wall. This should be accomplished during construction, before interior insulation/ drywall is installed.

3. Provide a solid piece of copper between ball or gate valves of the same size as service line entering building or size service line has been reduced to.

4. This detail for multi-unit residential with 4 units or less. For multi-unit residential with more than 4 units, check valves shall be provided and installed by owner downstream of second valve.



3 METER MANIFOLD SHOWN FOR EXAMPLE ONLY

Service line from street, size & materials to be approved by G.A.U. Only TYPE "K" copper tubing or 200 psig rated CTS polyethylene tubing are acceptable for service lines. Sand to be used for backfill. Metalic tracer cable to be installed 3' above CTS PE if utilized.

COMMERCIAL SERVICE ENTRANCE DETAIL

5/8", 3/4" & 1" METERS

GREATER AUGUSTA UTILITY DISTRICT

REVISED JAN. 2008 NTS

NOTES:

1. The Greater Augusta Utiltiy District, (G.A.U.), recommends the use of 1 inch copper to the hot water tank and 3/4" copper hot and cold feed lines to the bathrooms and kitchen where the static pressure is less than 40 psig.

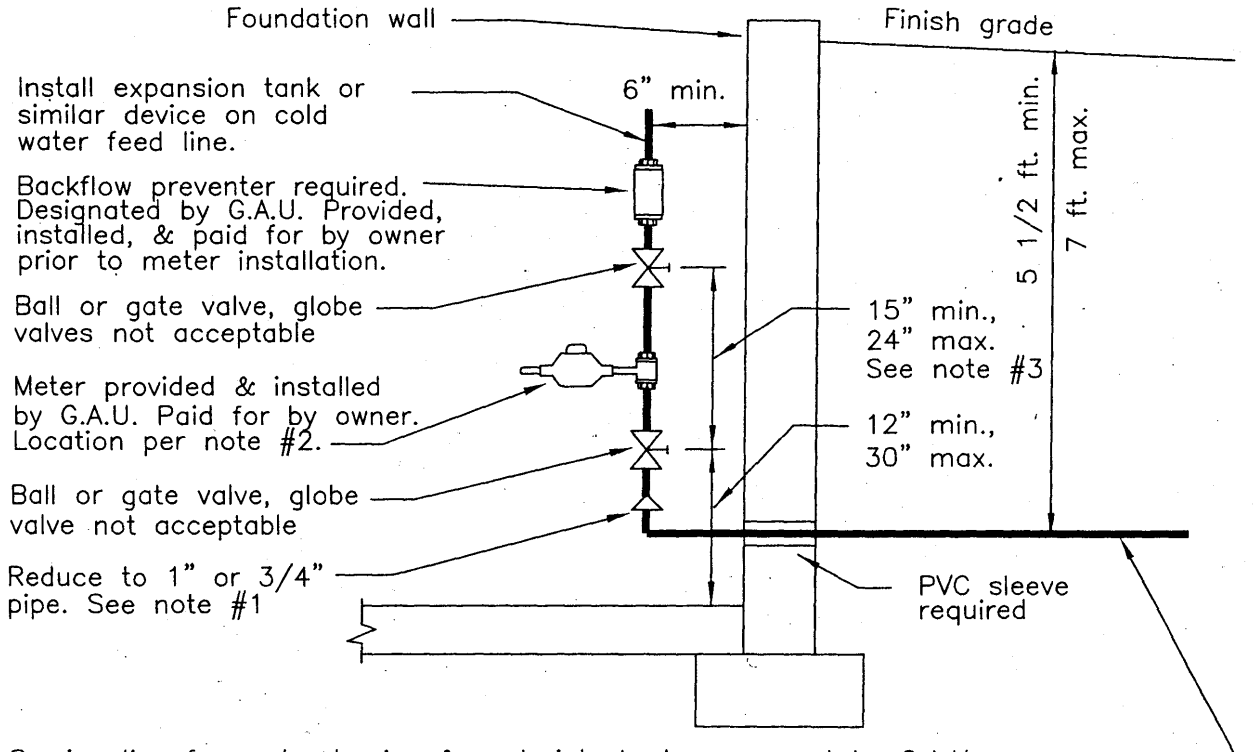
   Where the static pressure is between 55 and 40 psig, the above pipe sizes could all be changed to a minimum of 3/4 inch.

   Where the static pressure is 55 psig or greater, the line feeding the hot water tank should be a minimum of 3/4 inches while all feed lines after (downstream) of the hot water tank may be reduced to a minimum of 1/2 inches where runs to fixtures are not excessive.

2. The owner must provide a clean, dry, accessable and warm (continually above 45 degrees F) location for the meter installation.

   G.A.U. must install a 22 gauge wire from meter to radio read unit on exterior wall. This should be accomplished during construction, before interior insulation/ drywall is installed.

3. Provide a solid piece of copper between ball or gate valves of the same size as service line entering building or size service line has been reduced to.



COMMERCIAL SERVICE ENTRANCE DETAIL
SLAB ON GRADE
5/8", 3/4" & 1" METERS
GREATER AUGUSTA UTILITY DISTRICT
REVISED JAN. 2008 NTS

NOTES:

1. The Greater Augusta Utility District, (G.A.U.), recommends the use of 1 inch copper to the hot water tank and 3/4" copper hot and cold feed lines to the bathrooms and kitchen where the static pressure is less than 40 psig.

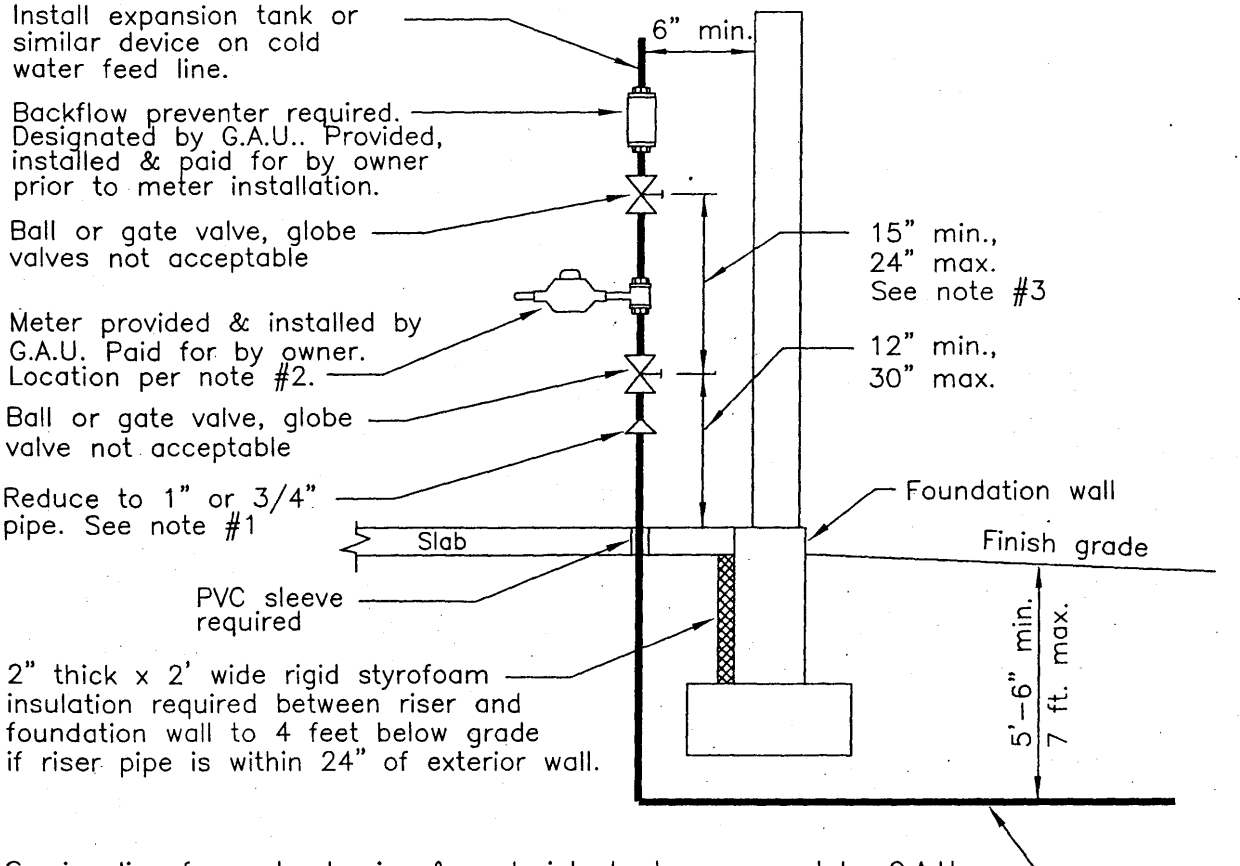
   Where the static pressure is between 55 and 40 psig, the above pipe sizes could all be changed to a minimum of 3/4 inch.

   Where the static pressure is 55 psig or greater, the line feeding the hot water tank should be a minimum of 3/4 inches while all feed lines after (downstream) of the hot water tank may be reduced to a minimum of 1/2 inches where runs to fixtures are not excessive.

2. The owner must provide a clean, dry, accessable and warm (continually above 45 degrees F) location for the meter installation.

   G.A.U. must install a 22 gauge wire from meter to radio read unit on exterior wall. This should be accomplished during construction, before interior insulation/ finished wall is installed.

3. Provide a solid piece of copper between ball or gate valves of the same size as service line entering building or size service line has been reduced to.

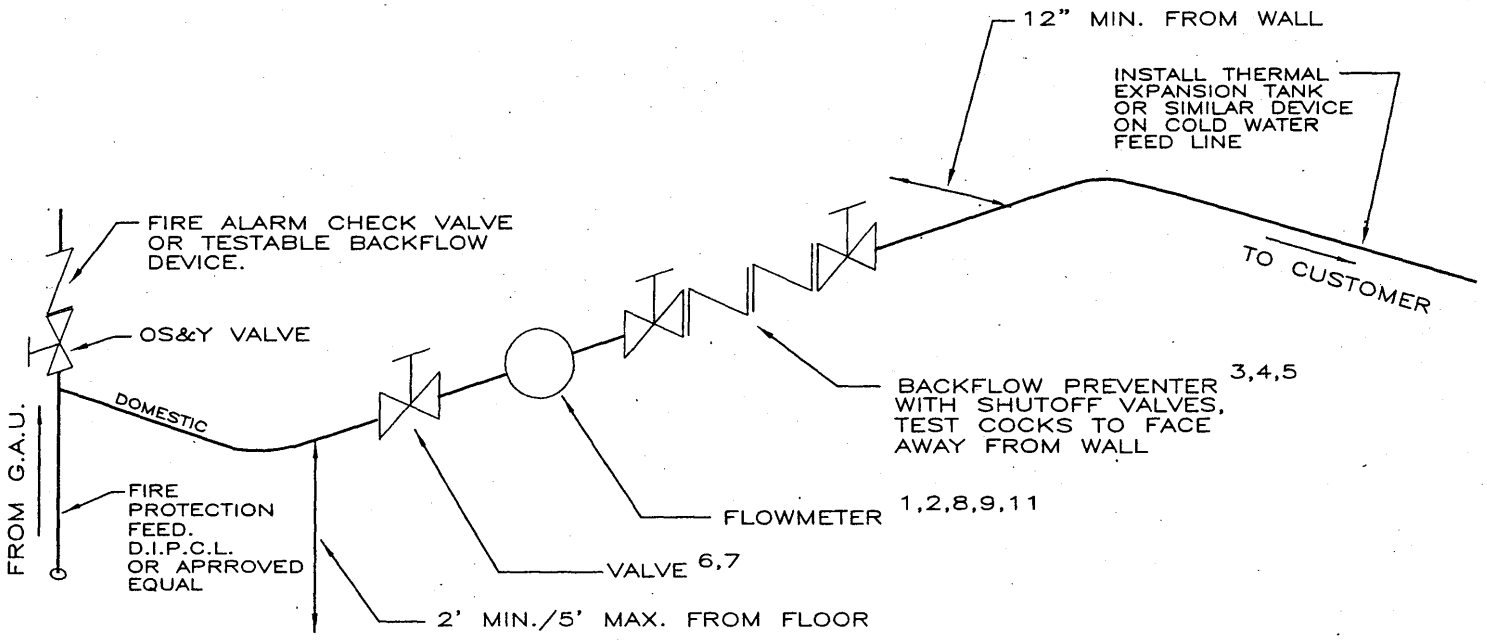


1556

COMMERCIAL FIRE SERVICE ENTRANCE WITH DOMESTIC FEED

GREATER AUGUSTA UTILITY DISTRICT

REVISED JAN. 2008 NTS



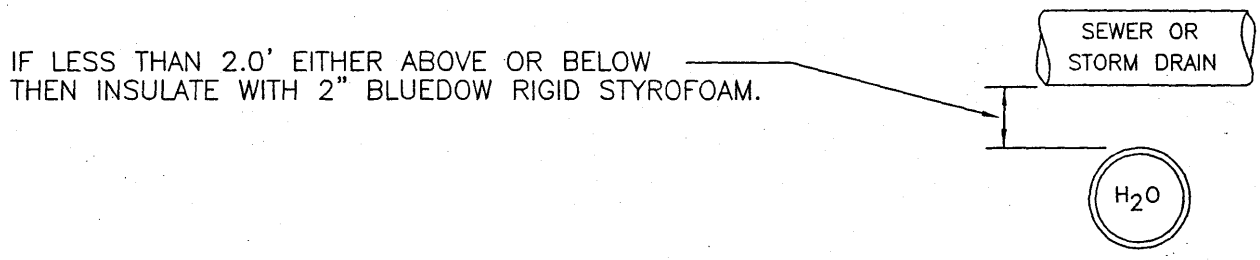
NOTES:

1. FLOWMETER TO BE SIZED, SELECTED, AND PLACED BY G.A.U. METER FLANGES, GASKETS, AND BOLTS, IF REQUIRED, PROVIDED BY G.A.U. & PAID FOR BY OWNER. METER TO BE LOCATED IN A WARM, DRY, ACCESSIBLE LOCATION.
2. FOR TURBO METERS: A MINIMUM OF FIVE(5) PIPE DIAMETERS STRAIGHT RUN SHALL BE PROVIDED BEFORE METER, AND A MINIMUM OF TWO(2) PIPE DIAMETERS STRAIGHT RUN SHALL BE PROVIDED AFTER THE METER.
3. BACKFLOW PREVENTER SHALL BE OF THE SIZE AND TYPE RECOMMENDED BY G.A.U. AND SHALL BE IN ACCORDANCE WITH STATE OF MAINE CROSS CONNECTION REGULATIONS. SEE SECTION V, ITEM E, PARAGRAPH 8 OF THE DISTRICT'S CROSS CONNECTION PROGRAM RELATIVE TO THE PROVISION OF A BYPASS TO THE BACKFLOW PREVENTER.
4. BACKFLOW PREVENTERS TO BE INSTALLED IN THE VERTICAL POSITION MUST BE PRE-APPROVED BY THE DISTRICT.
5. RPZ'S MUST BE TESTED SEMI-ANNUALLY, REQUIRING THAT THE WATER BE SHUT OFF FOR UP TO 20 MINUTES. IF LOSS OF WATER FOR THIS TIME FRAME IS UNACCEPTABLE, A SECOND PARALLEL RPZ SHOULD BE INSTALLED TO ALLOW FOR UNINTERUPTED WATER SERVICE.
6. ALL VALVES SHALL BE GATE OR BALL VALVES. GLOBE VALVES ARE NOT ACCEPTABLE.
7. NO VALVES WILL BE ALLOWED BETWEEN FLOOR AND METER OTHER THAN THE ONE SHOWN.
8. THE DISTRICT REQUIRES ALL NEW AND/OR RENOVATED MULTI-TENANT BUILDINGS BE INDIVIDUALLY METERED. THE INSTALLATION OF THE INDIVIDUAL METERS SHALL BE INSTALLED IN A COMMON LOCATION, WITH KEYED ACCESS FROM THE EXTERIOR OF THE BUILDING. THE UTILITY WILL PERMIT A SINGLE MASTER METER AT THE OWNER'S WRITTEN REQUEST, PROVIDED THE OWNER AGREES TO PAY FOR ALL WATER CHARGES AND CONSUMPTION.
9. G.A.U. MUST INSTALL A 22 GAUGE WIRE FROM THE METER TO A RADIO READ UNIT ON AN EXTERIOR WALL. THIS SHOULD BE ACCOMPLISHED DURING CONSTRUCTION, BEFORE INTERIOR INSULATION/FINISHED WALL IS INSTALLED.
10. G.A.U. WILL ADVISE TO THE LOCATION OF SUCH APPURTENANCES AS PRESSURE REDUCING VALVES, BOOSTER PUMPS, ETC. WHEN THEIR USE IS APPLICABLE.
11. COST OF METER, APPURTENANCES AND INSTALLATION SHALL BE BORNE BY THE OWNER / DEVELOPER.

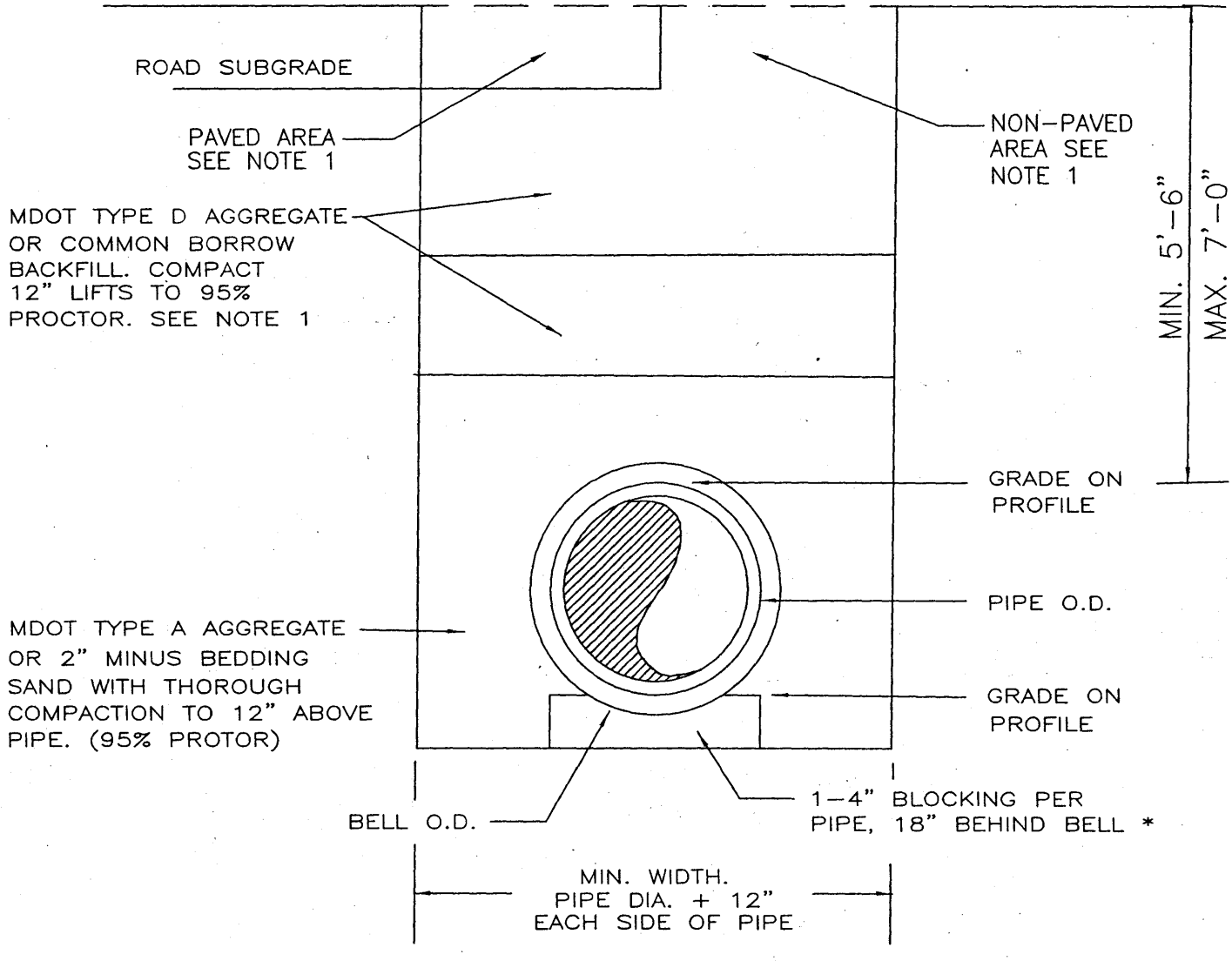
TYPICAL TRENCH DETAIL

GREATER AUGUSTA UTILITY DISTRICT

REVISED JAN. 2008 NTS

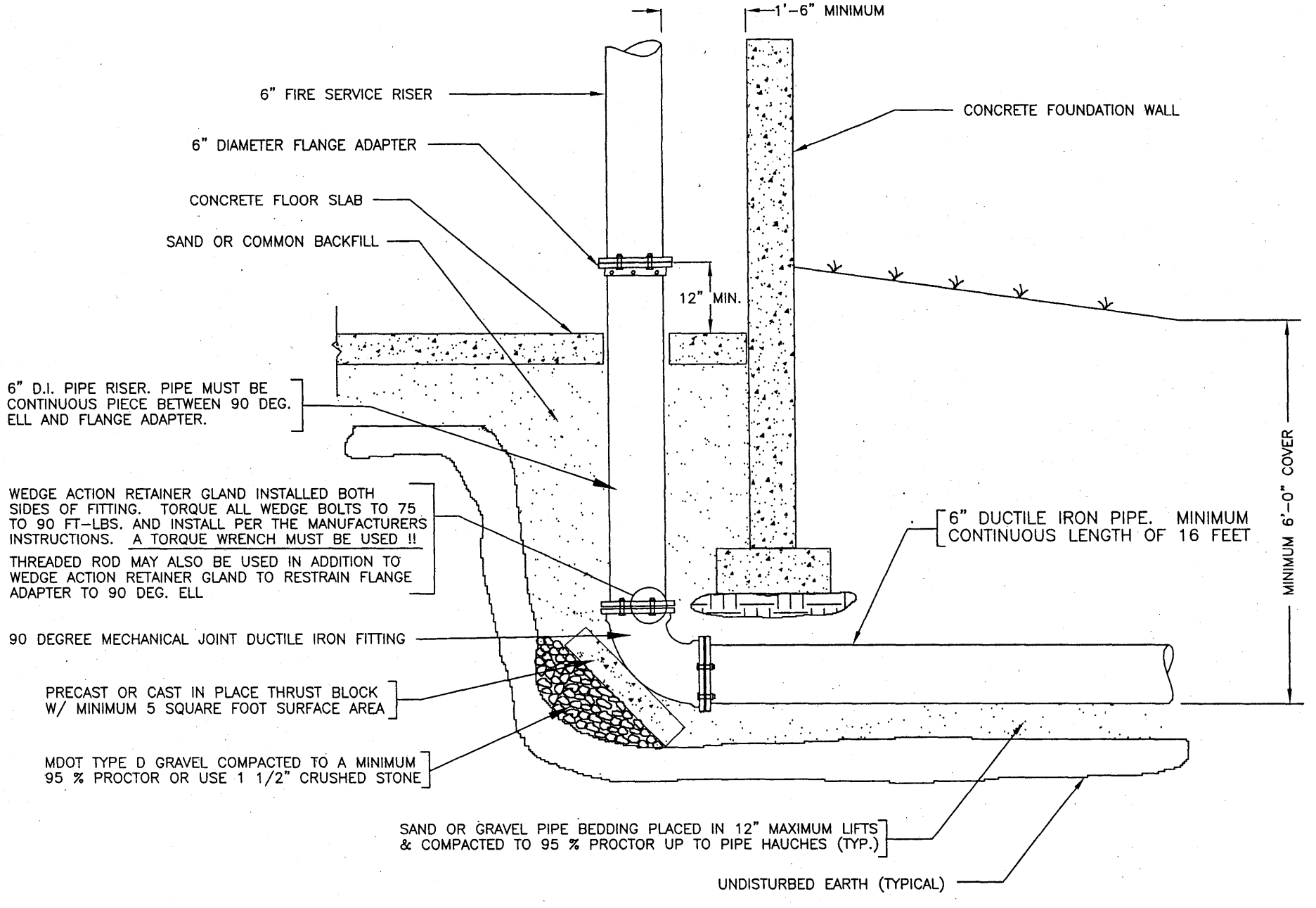


NOTE 1: MATERIAL TYPE AND PLACEMENT REQUIREMENTS TO BE IN ACCORDANCE WITH AUTHORITY HAVING JURISDICTION IN PAVED AREAS. GRAVEL, LOAM & OR SEED IN ACCORDANCE WITH AUTHORITY HAVING JURISDICTION IN NON-PAVED AREAS.



* 6" BLOCKING REQUIRED IN LEDGE OR BOULDER EXCAVATION AREA.

1558



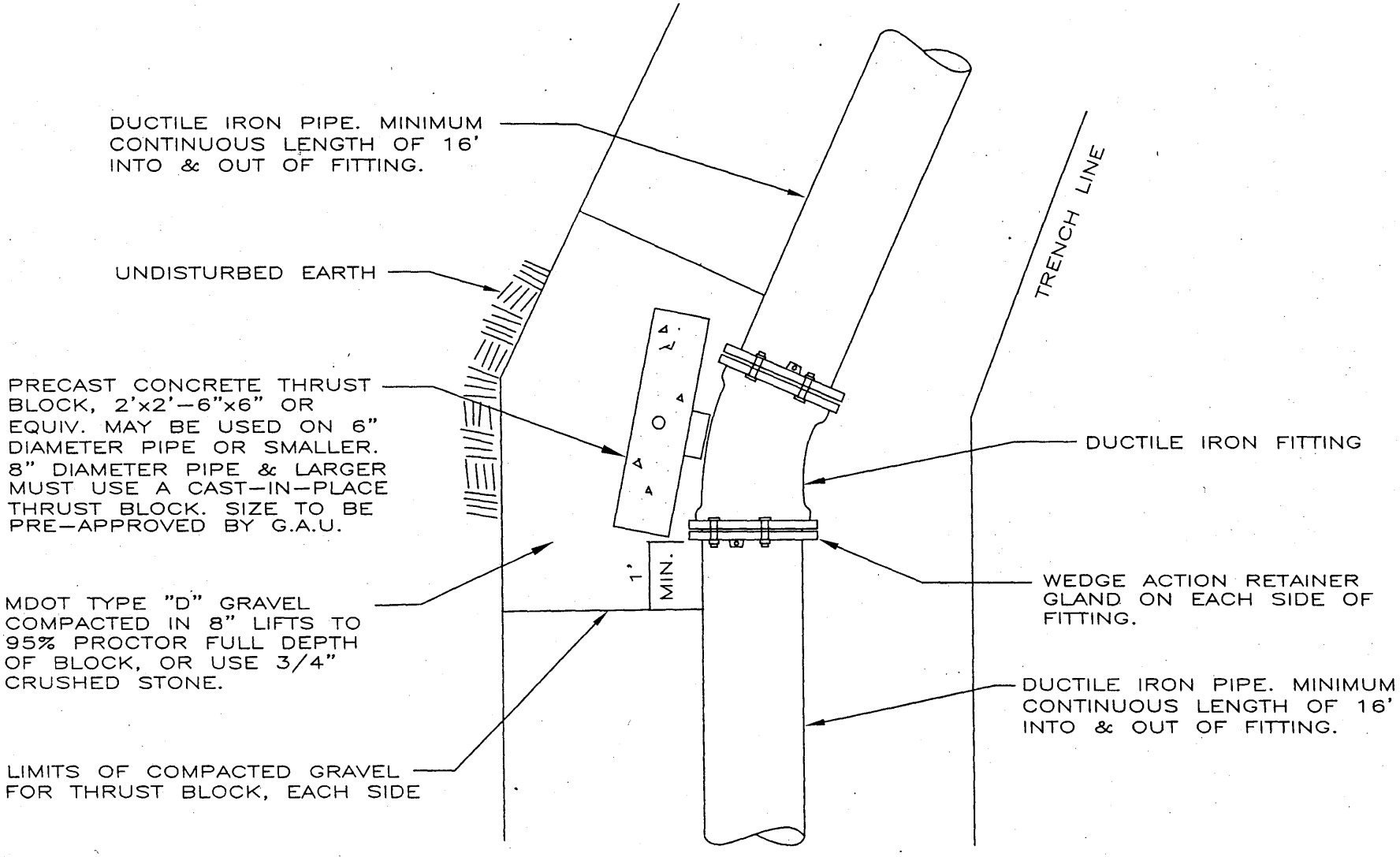
6" FIRE SERVICE THRUST RESTRAINT DETAIL

GREATER AUGUSTA UTILITY DISTRICT

REVISED JAN. 2008 NTS

06

1559



NOTE:
ALL CAST-IN-PLACE CONCRETE THRUST BLOCKS MUST BE SIZED PER THE THRUST RESTRAINT REQUIREMENTS OF SECTION III OF THE DISTRICT'S SPECIFICATION PACKAGE. CAST-IN-PLACE CONCRETE THRUST BLOCKS MUST BE FORMED UP WITH A SUITABLE MATERIAL SUCH AS PLYWOOD, PARTICLE BOARD ETC. AS TO NOT ALLOW CONCRETE TO ENCOMPASS THE FITTING.

FITTING & THRUST BLOCK DETAIL

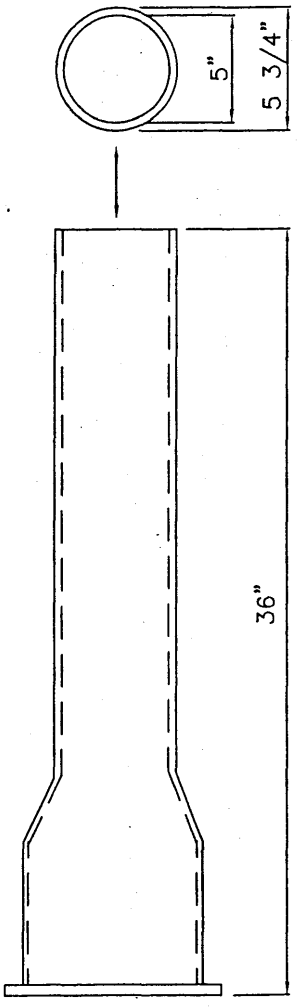
GREATER AUGUSTA UTILITY DISTRICT

REVISED JAN. 2008 NTS

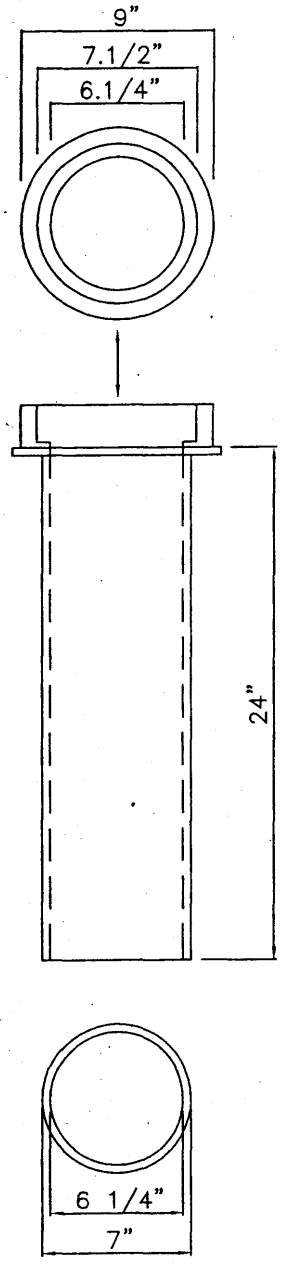
TYPICAL VALVE BOX DETAIL

GREATER AUGUSTA UTILITY DISTRICT

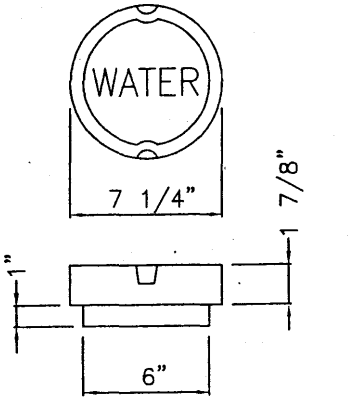
REVISED JAN. 2008 NTS



BASE SECTION *



TOP SECTION *



DROP STYLE COVER

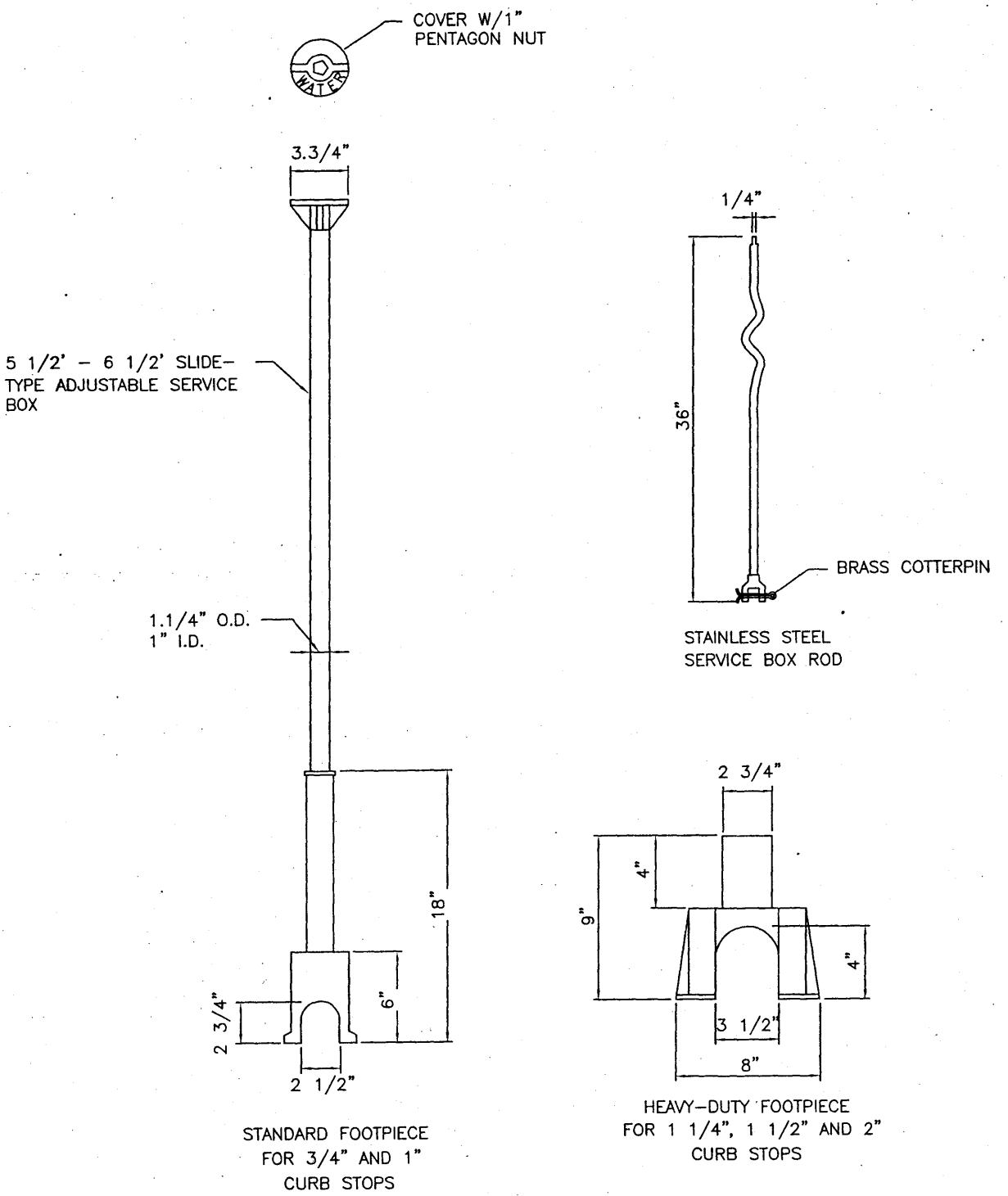
NOTE: COVER MUST BE MARKED "WATER"

* PARTS FOR STANDARD 5'–0" VALVE BOX COMPLETE, LONGER PARTS AVAILABLE IF NECESSARY

TYPICAL SERVICE BOX DETAIL

GREATER AUGUSTA UTILITY DISTRICT

REVISED JAN. 2008 **NTS**



STANDARD FOOTPIECE FOR 3/4" AND 1" CURB STOPS

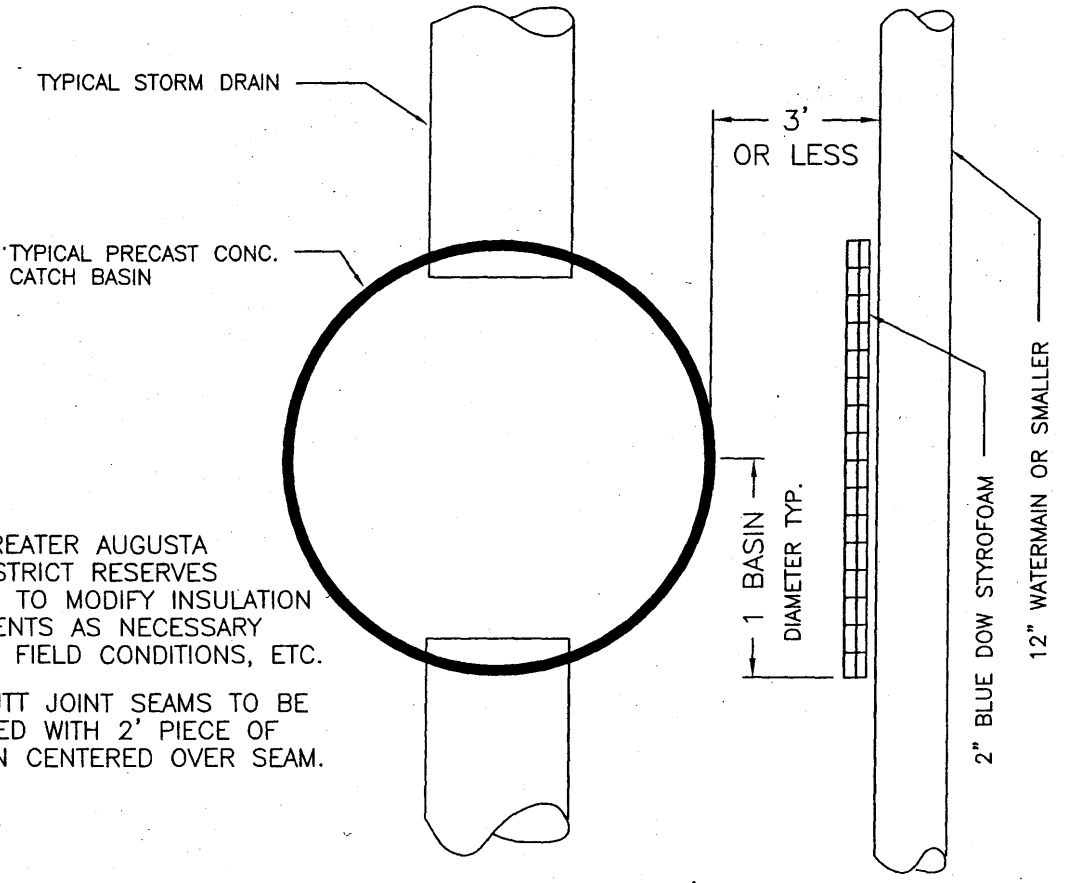
STAINLESS STEEL SERVICE BOX ROD

HEAVY-DUTY FOOTPIECE FOR 1 1/4", 1 1/2" AND 2" CURB STOPS

CATCH BASIN INSULATION DETAIL

GREATER AUGUSTA UTILITY DISTRICT

REVISED JAN. 2008 **NTS**

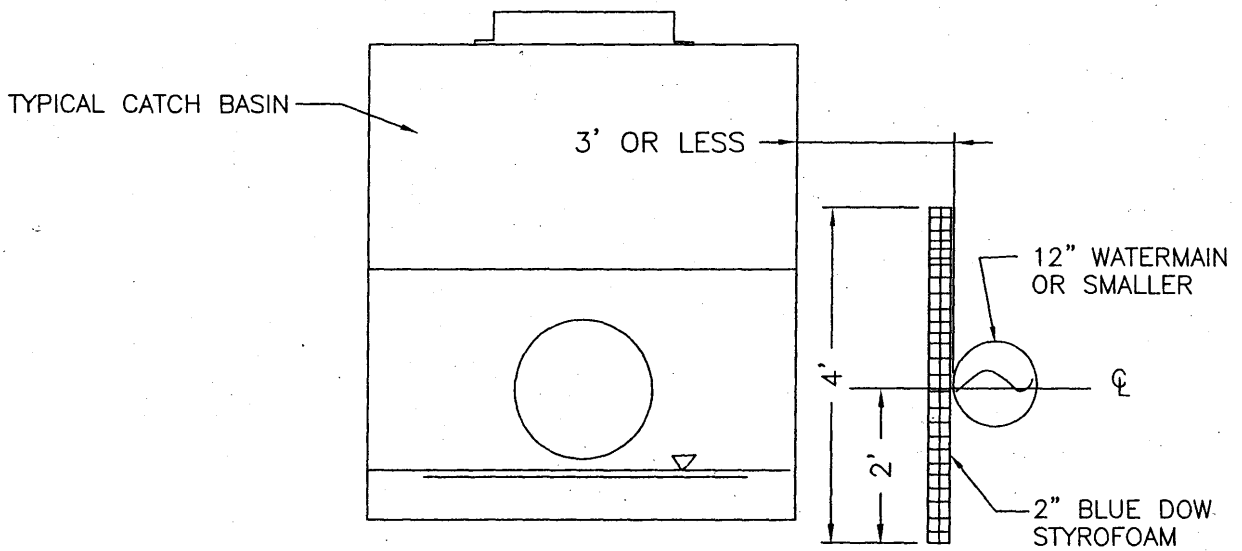


NOTES

1. THE GREATER AUGUSTA UTILITY DISTRICT RESERVES THE RIGHT TO MODIFY INSULATION REQUIREMENTS AS NECESSARY BASED ON FIELD CONDITIONS, ETC.

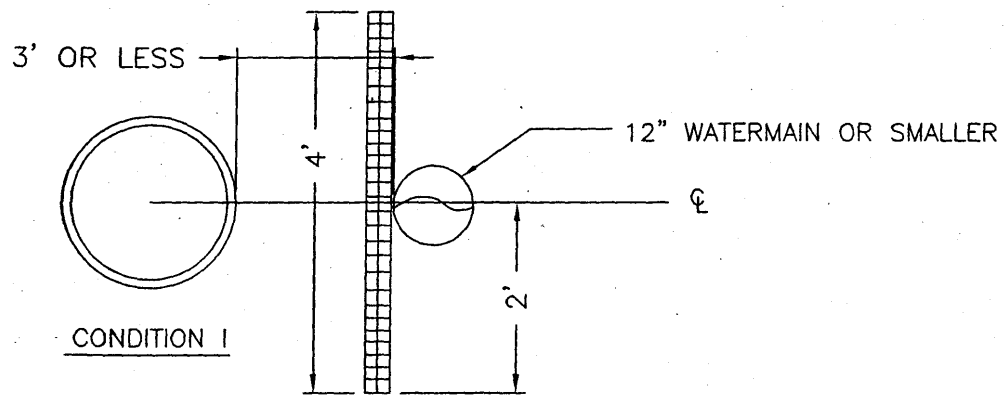
2. ALL BUTT JOINT SEAMS TO BE OVERLAPPED WITH 2' PIECE OF INSULATION CENTERED OVER SEAM.

PLAN VIEW

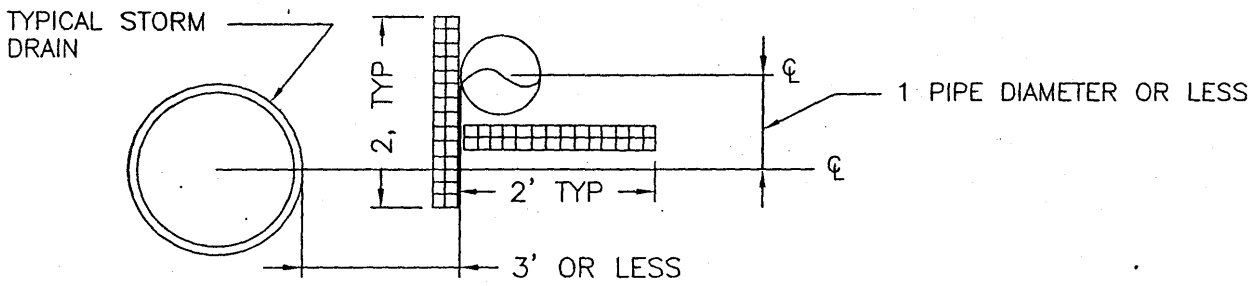


ELEVATION VIEW

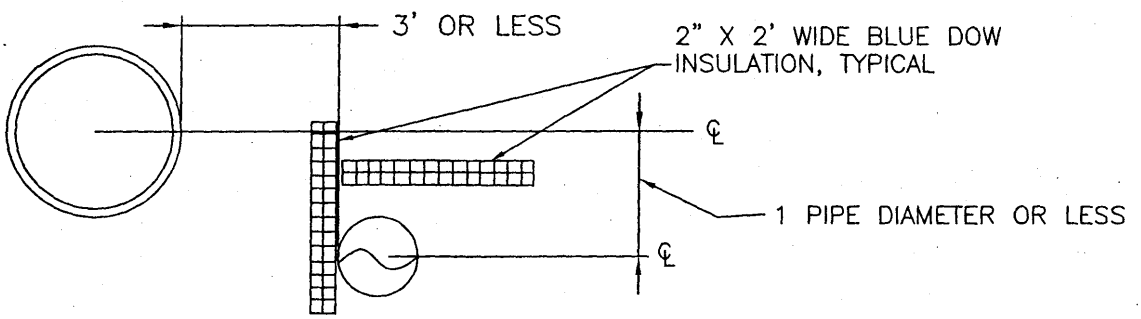
STORM DRAIN/WATER MAIN PARALLEL RUNS
ELEVATION VIEW
GREATER AUGUSTA UTILITY DISTRICT
REVISED JAN. 2008 NTS



CONDITION I



CONDITION II



CONDITION III

NOTES:

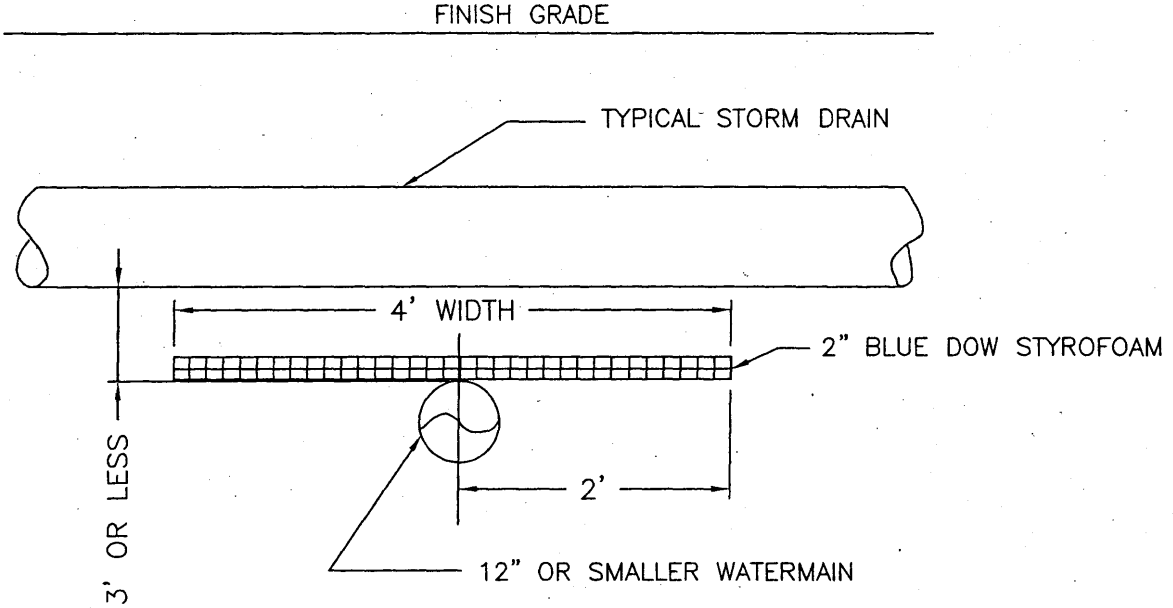
1. THE GREATER AUGUSTA UTILITY DISTRICT RESERVERS THE RIGHT TO MODIFY INSULATION REQUIREMENTS AS NECESSARY BASED ON FIELD CONDITIONS, ETC.

2. INSULATION TO BE RUN HORIZONTALLY AS LONG AS CONDITIONS I, II, OR III ABOVE EXIST. ALL BUTT JOINT SEAMS TO BE OVERLAPPED W/2' PIECE OF INSULATION CENTERED OVER SEAM.

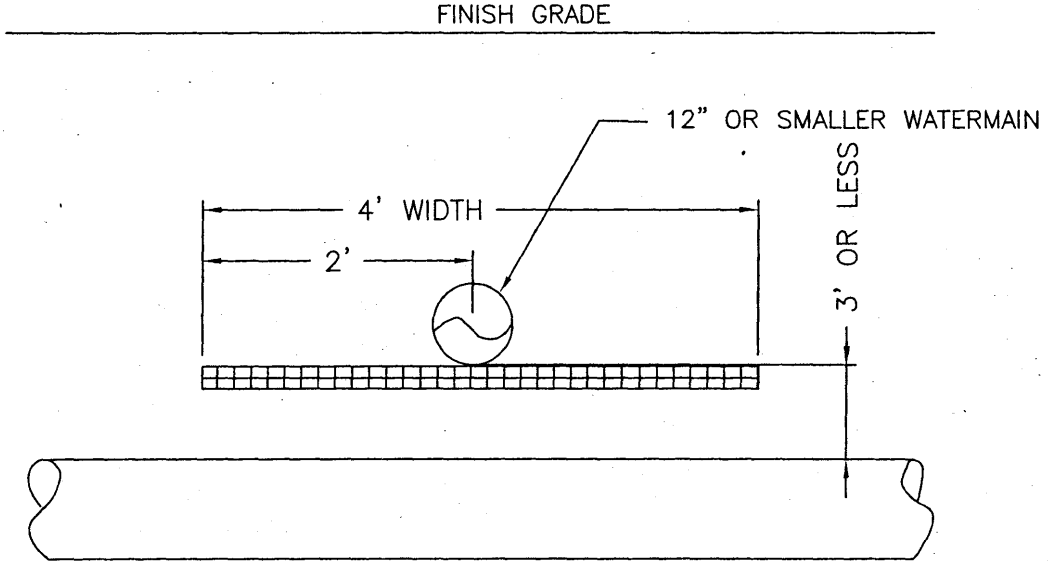
STORM DRAIN/WATER MAIN INTERSECTING RUNS ELEVATION VIEW

GREATER AUGUSTA UTILITY DISTRICT

REVISED JAN. 2008 NTS



CONDITION I



CONDITION II

NOTES:

1. THE GREATER AUGUSTA UTILITY DISTRICT RESERVES THE RIGHT TO MODIFY INSULATION REQUIREMENTS AS NECESSARY BASED ON FIELD CONDITIONS, ETC.

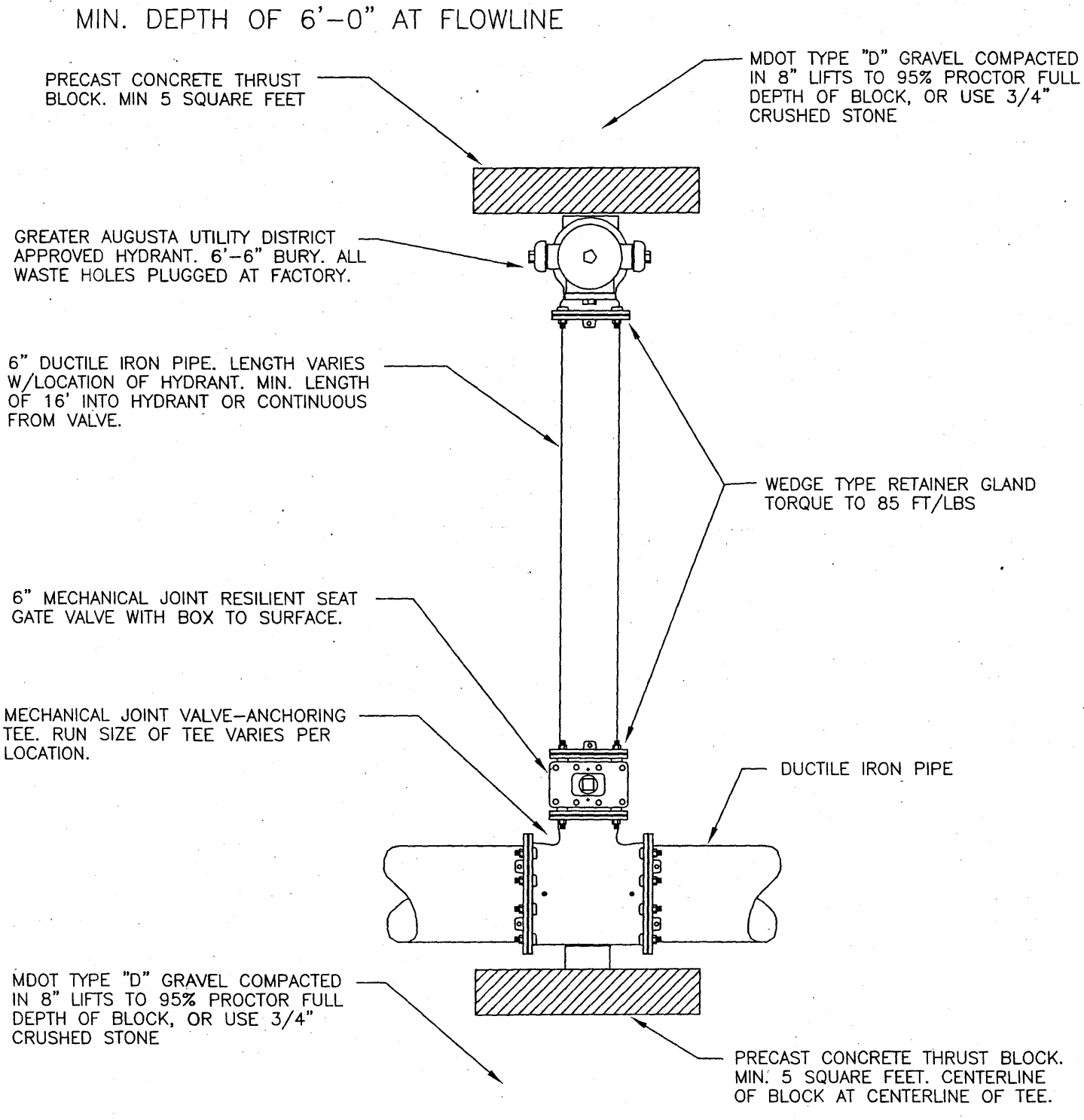
2. THE LENGTH OR WIDTH OF INSULATION SHALL EXTEND 1 STORM DRAIN PIPE DIAMETER BEYOND THE EDGE OF STORM DRAIN PIPE IN EACH DIRECTION OR A MINIMUM OF 2' BEYOND THE CENTERLINE OF STORM DRAIN PIPE, WHICHEVER IS GREATER.

3. ALL BUTT JOINT SEAMS TO BE OVERLAPPED WITH A 2' PIECE OF INSULATION CENTERED OVER SEAM.

TYPICAL HYDRANT INSTALLATION

GREATER AUGUSTA UTILITY DISTRICT

REVISED JAN. 2008 NTS

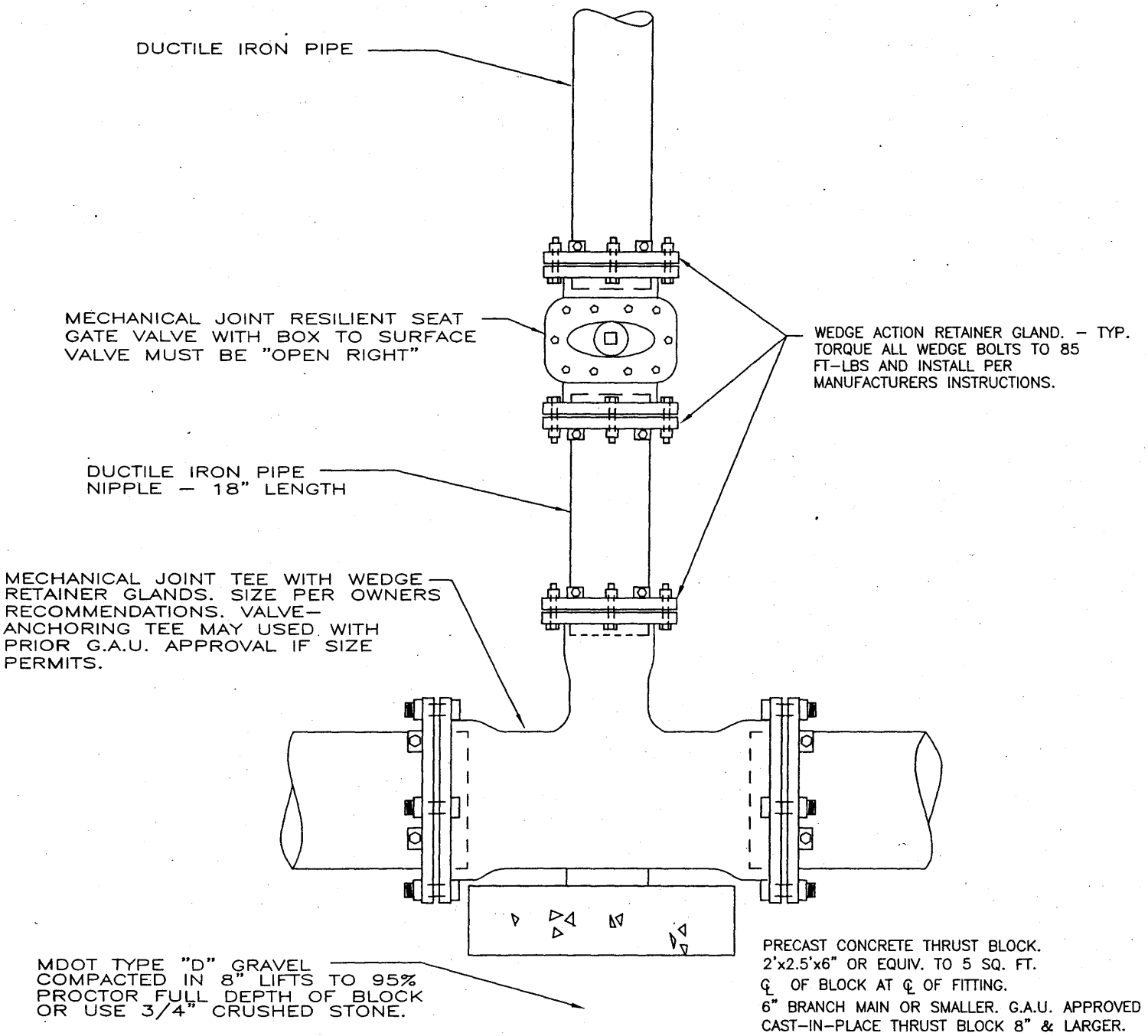


TYPICAL TEE DETAIL

GREATER AUGUSTA UTILITY DISTRICT

REVISED JAN. 2008 **NTS**

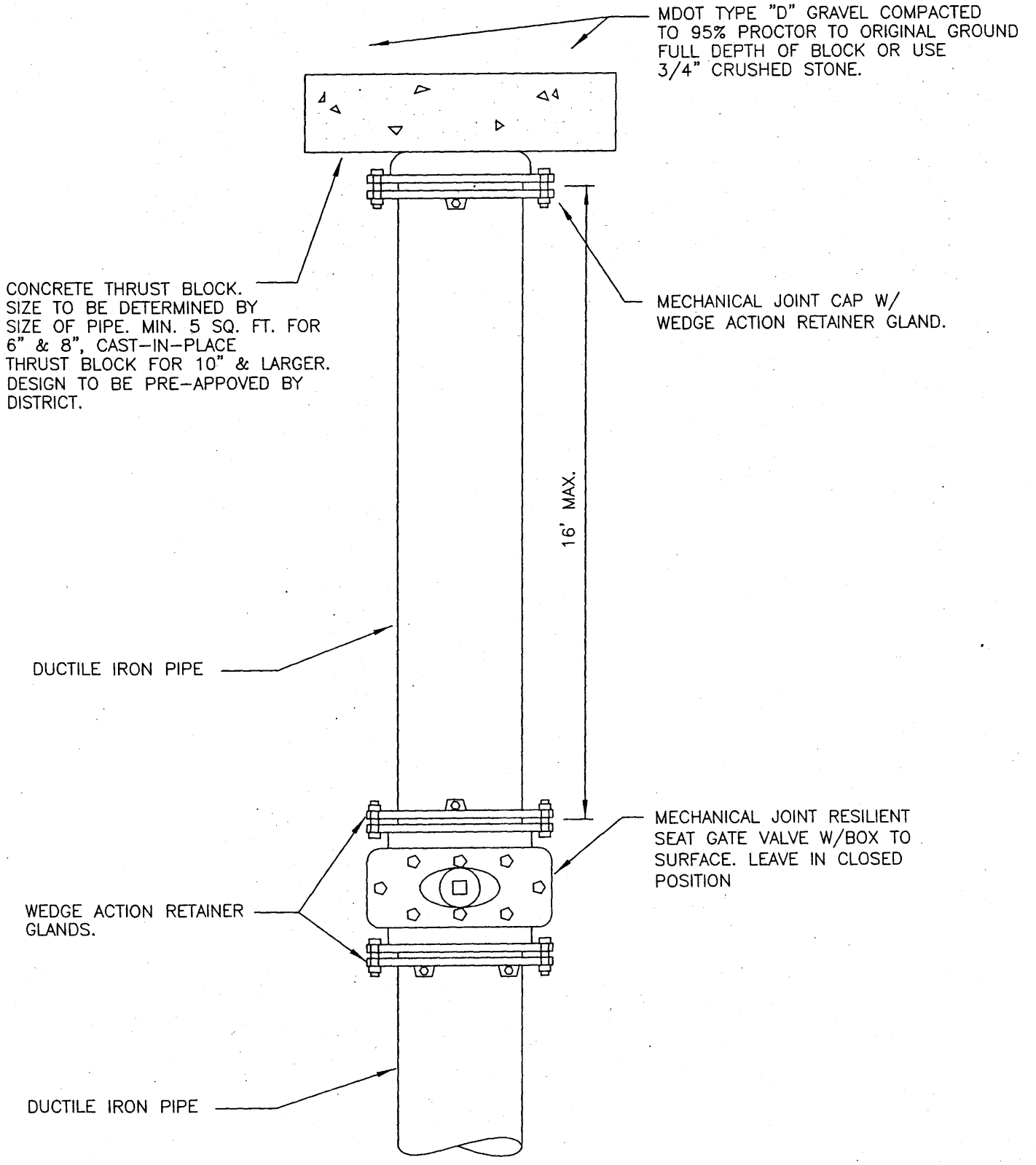
ALL PIPE SHOULD HAVE A MINIMUM DEPTH OF 5.5' TO TOP OF PIPE FROM FINISH GRADE



TYPICAL END OF MAIN DETAIL

GREATER AUGUSTA UTILITY DISTRICT

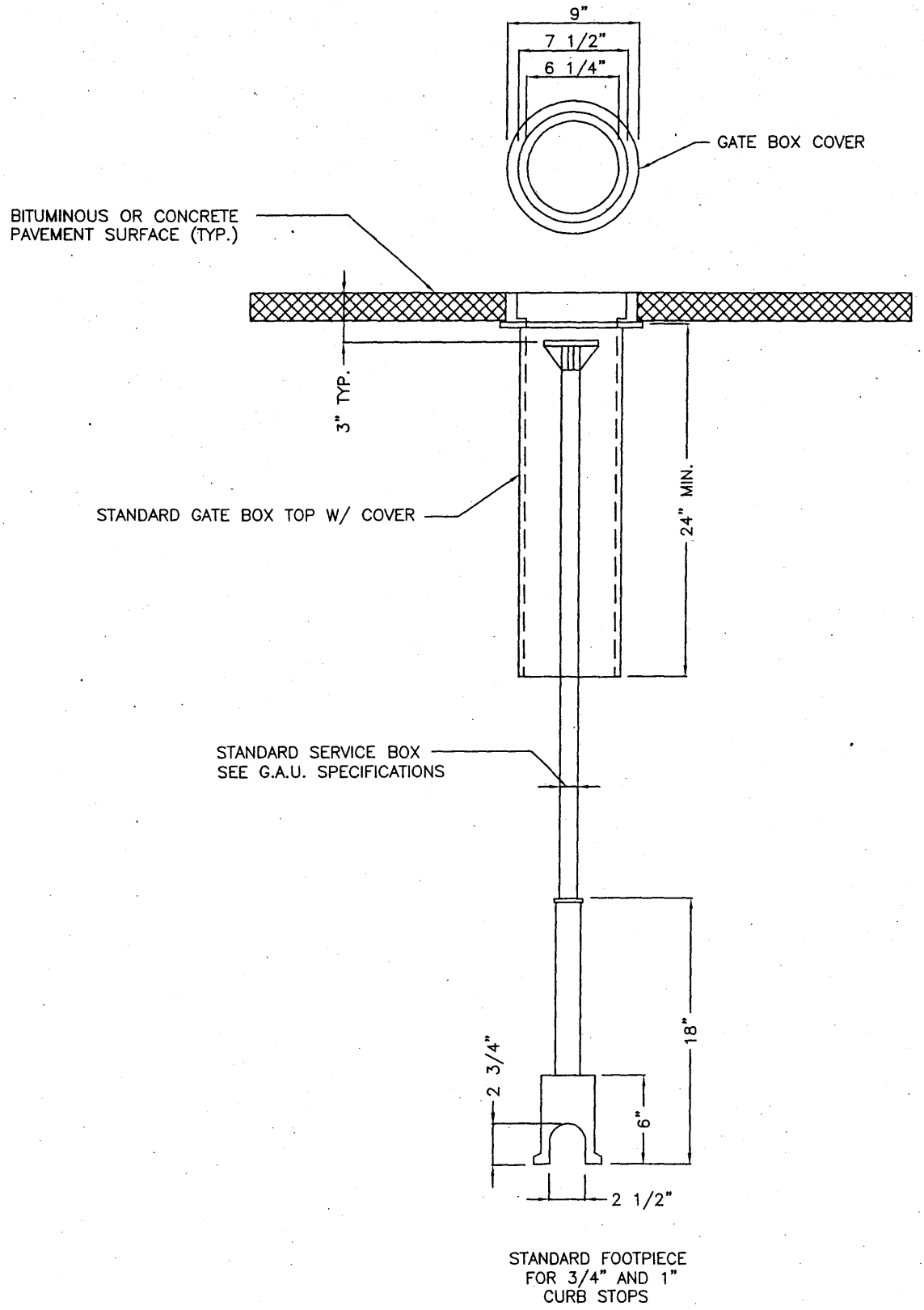
REVISED JAN. 2008 NTS



TYPICAL SERVICE BOX DETAIL IN PAVED AREAS

GREATER AUGUSTA UTILITY DISTRICT

REVISED JAN. 2008 NTS

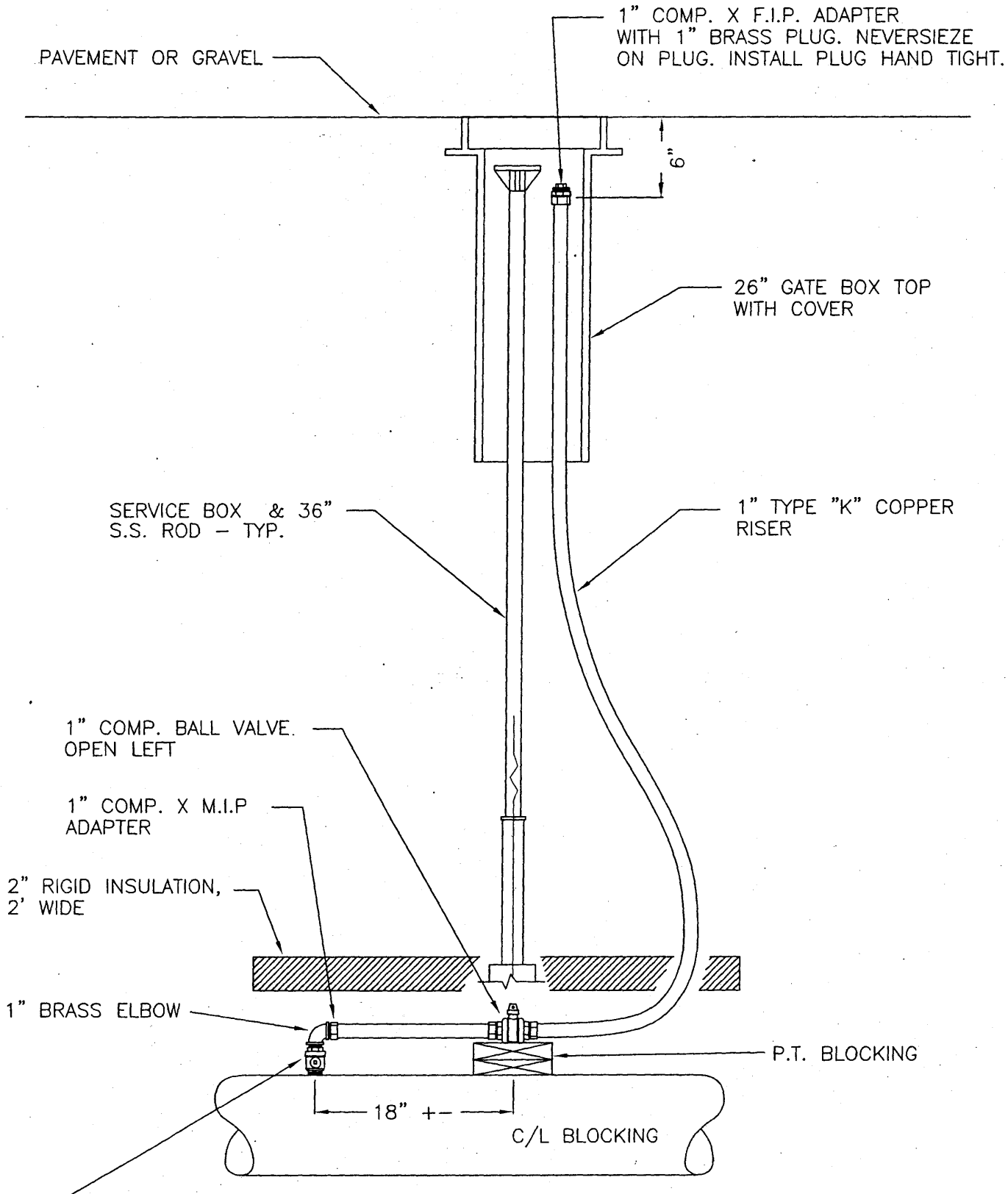


STANDARD FOOTPIECE
FOR 3/4" AND 1"
CURB STOPS

TYPICAL AIR RELEASE DETAIL

GREATER AUGUSTA UTILITY DISTRICT

REVISED JAN. 2008 NTS

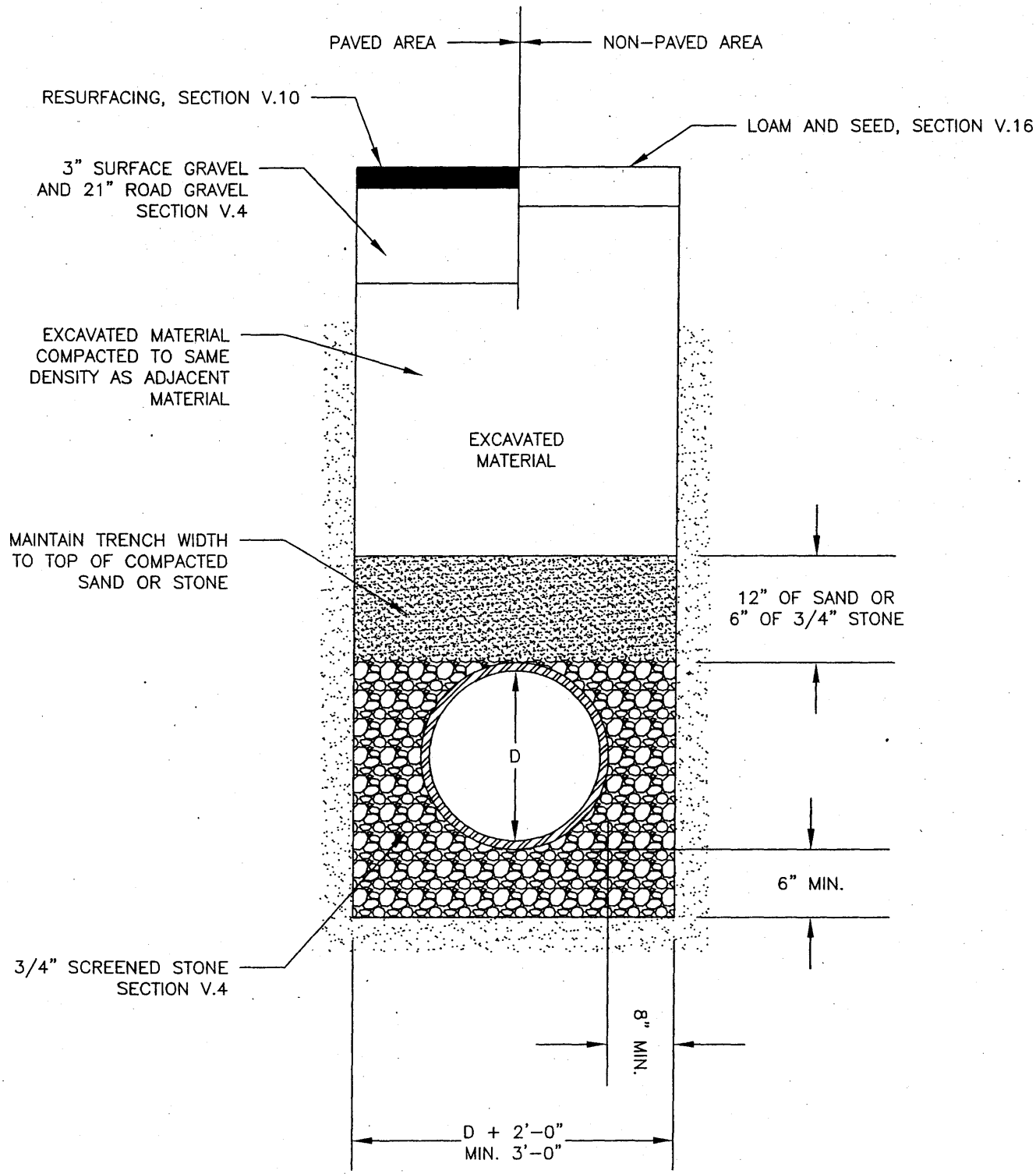


* TAPS MADE ON PIPE OTHER THAN D.I. OR C.I. MUST INCORPORATE A SERVICE SADDLE APPROVED BY THE DISTRICT.

TYPICAL TRENCH DETAIL - SEWER

GREATER AUGUSTA UTILITY DISTRICT

REVISED JAN. 2008 **NTS**

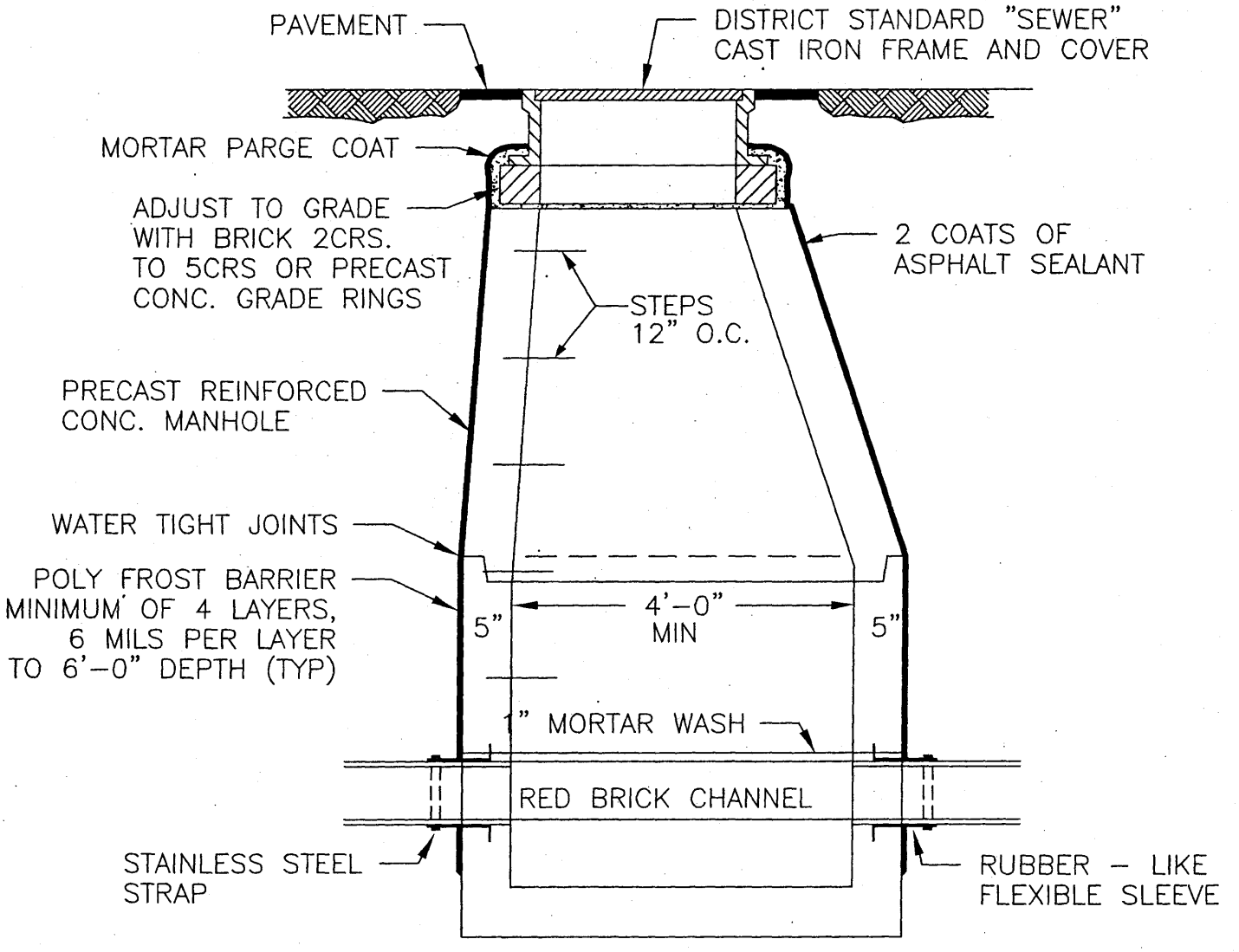


STANDARD PRECAST MANHOLE

GREATER AUGUSTA UTILITY DISTRICT

REVISED JAN. 2008 **NTS**

SECTION V.7



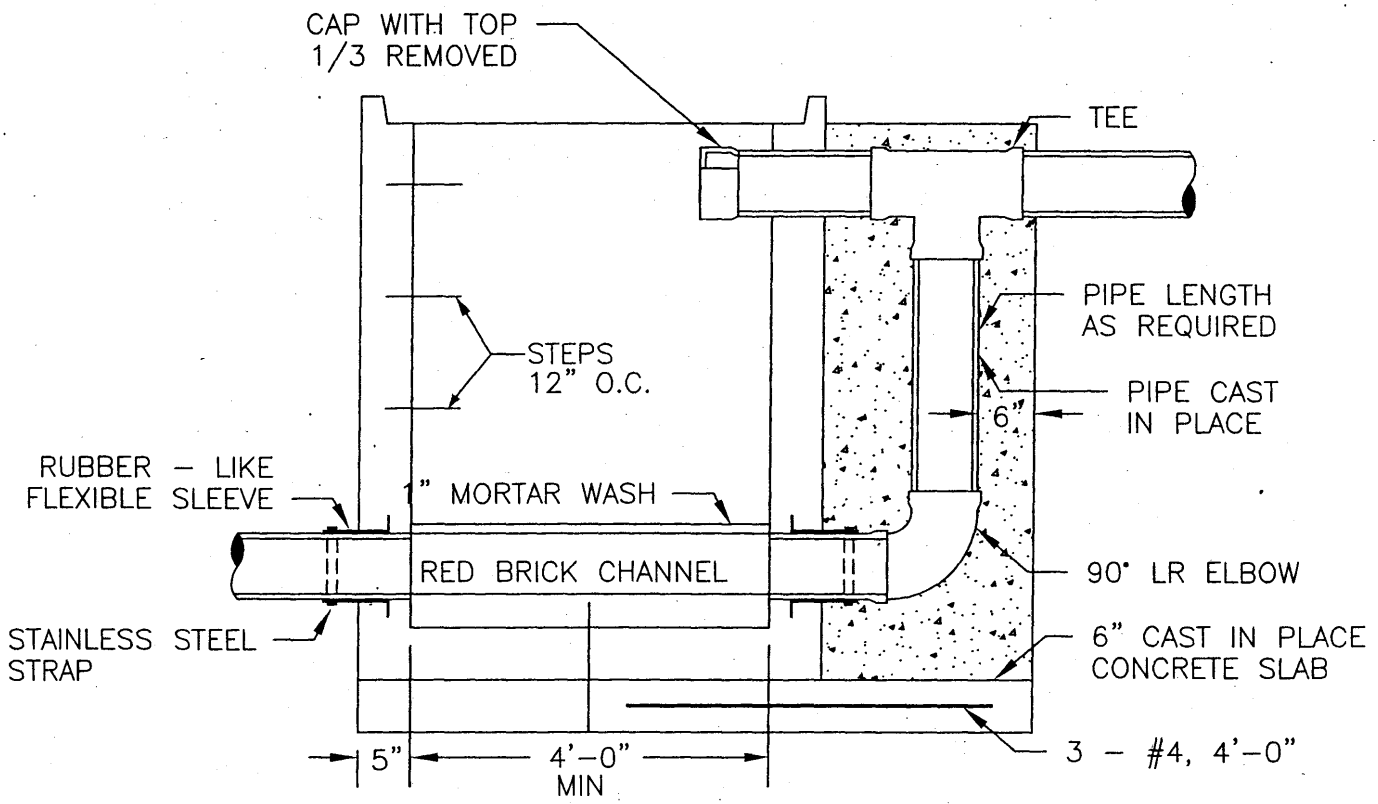
STANDARD PRECAST DROP MANHOLE

GREATER AUGUSTA UTILITY DISTRICT

REVISED JAN. 2008 **NTS**

SECTION V.7

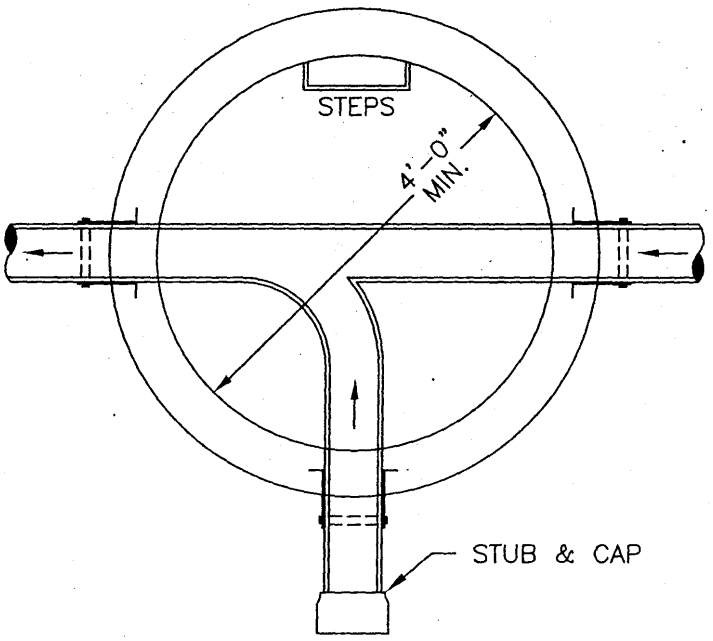
FOR SUPERSTRUCTURE SEE STANDARD MANHOLE



STANDARD INVERT & BRICK CHANNEL

GREATER AUGUSTA UTILITY DISTRICT

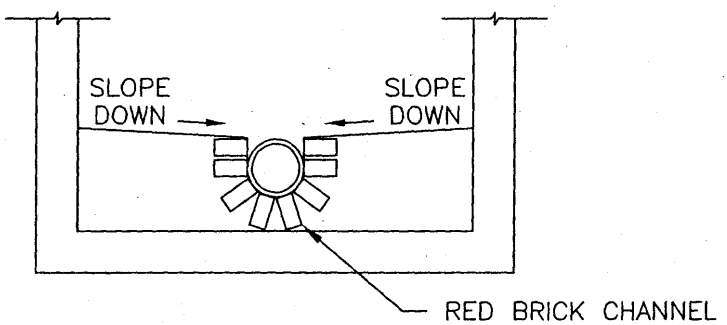
REVISED JAN. 2008 NTS



MANHOLE AND INVERT

NOT TO SCALE

SECTION V.7



BRICK CHANNEL

NOT TO SCALE

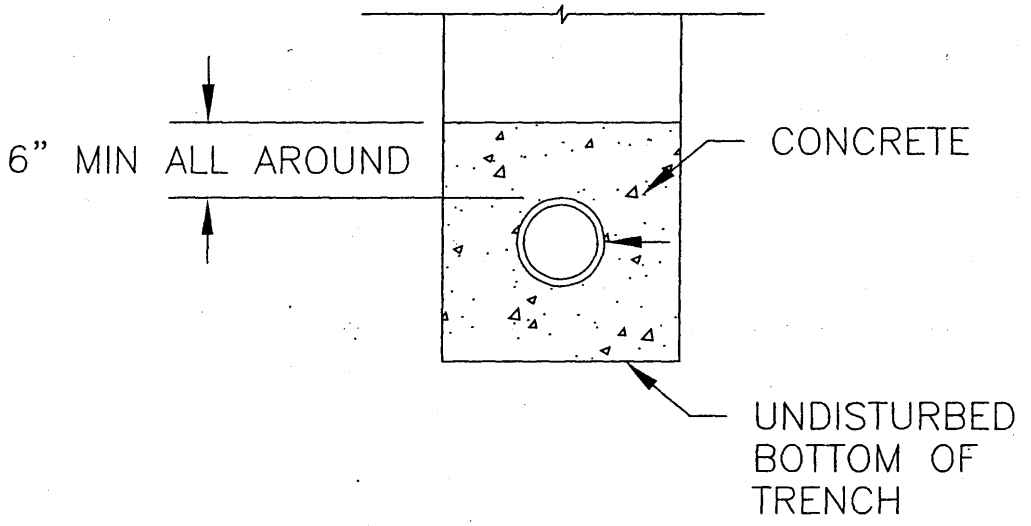
SECTION V.7

CONCRETE ENCASEMENT

GREATER AUGUSTA UTILITY DISTRICT

REVISED JAN. 2008 **NTS**

SECTION V.12

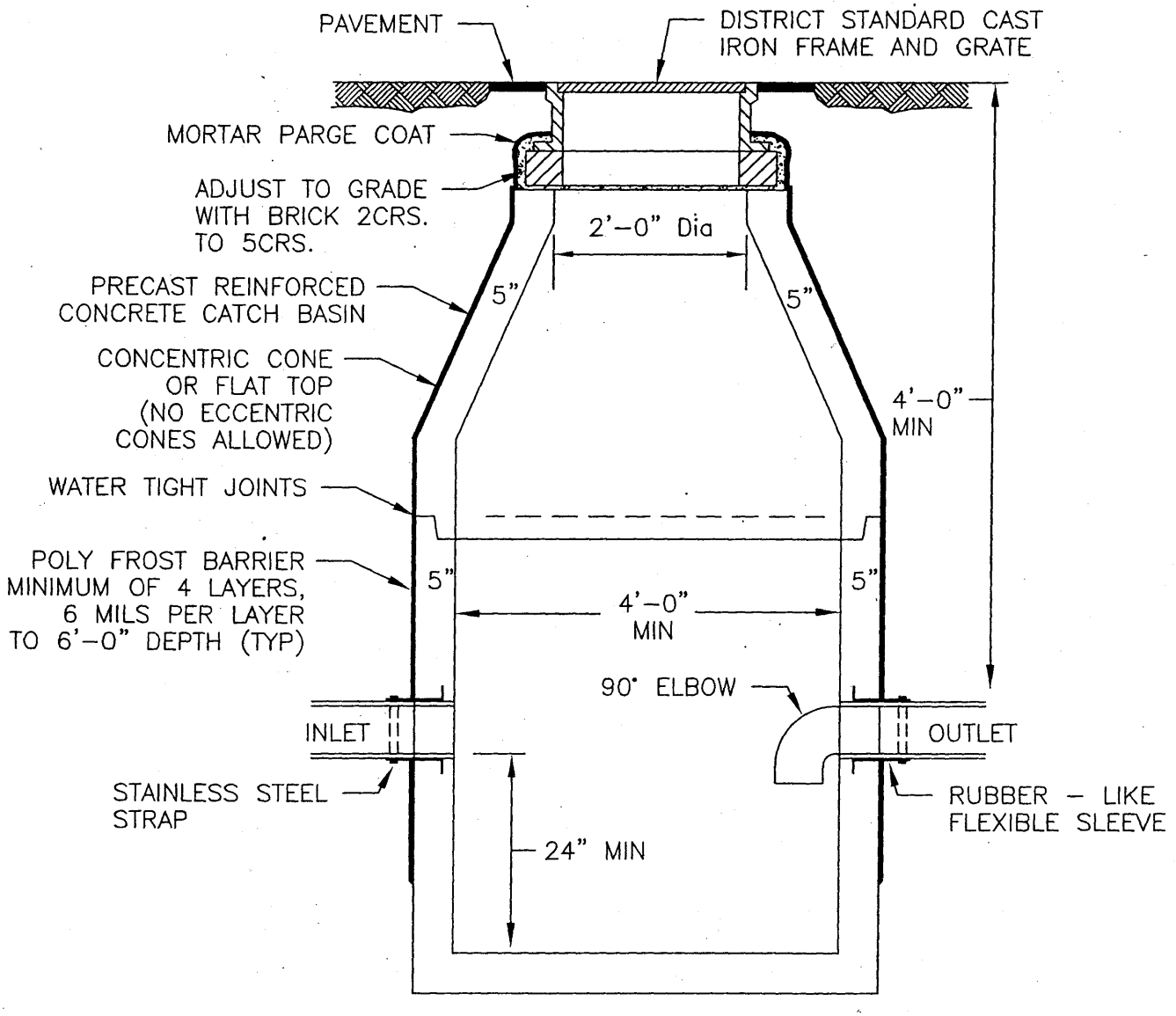


PRECAST CATCH BASIN

GREATER AUGUSTA UTILITY DISTRICT

REVISED JAN. 2008 **NTS**

SECTION V.8

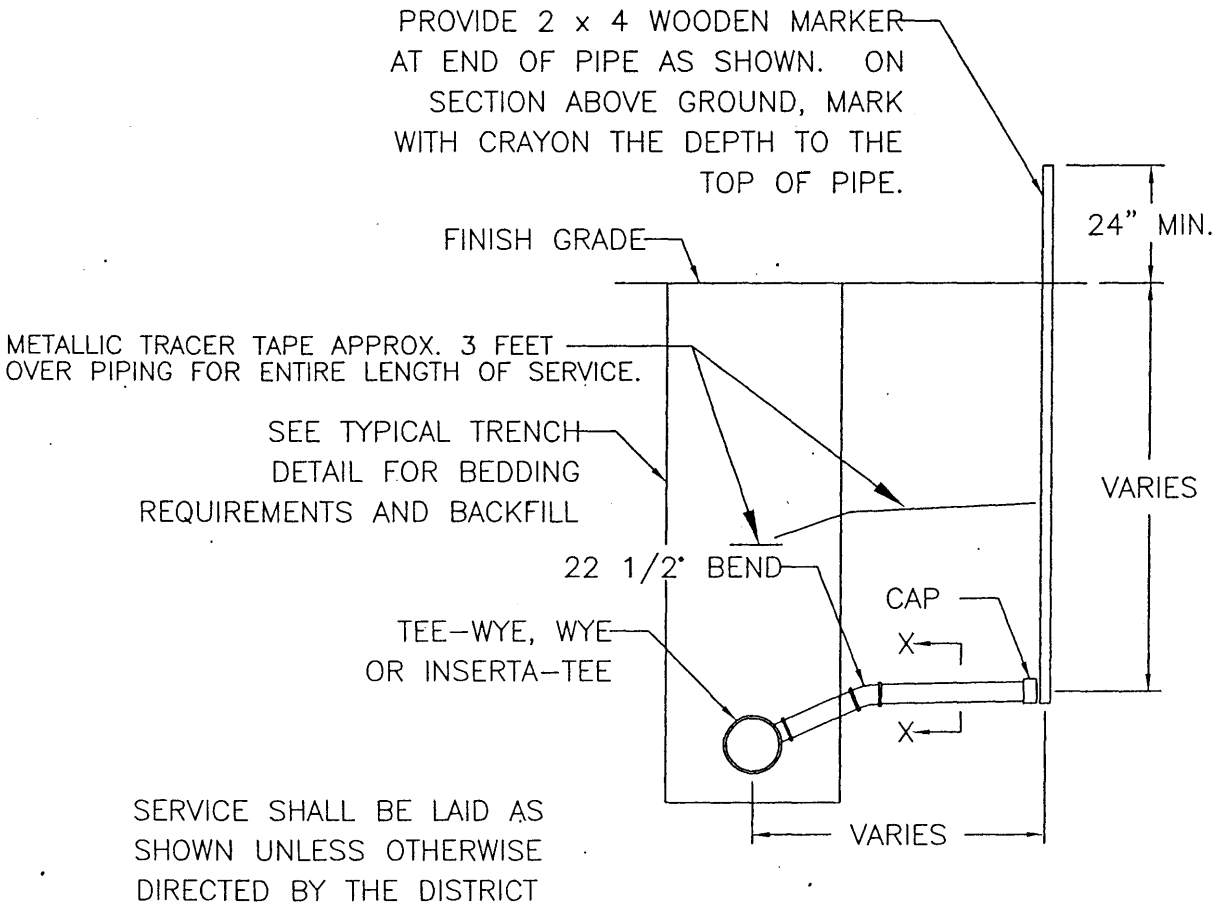


NEW SEWER CONNECTION

GREATER AUGUSTA UTILITY DISTRICT

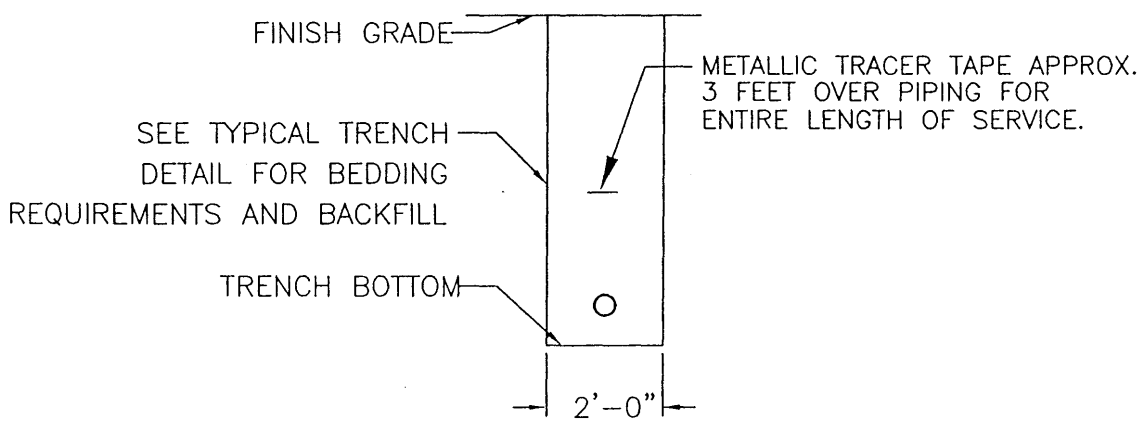
REVISED JAN. 2008 **NTS**

SECTION V.9



SEWER CONNECTION

SCALE: NONE



SECTION X-X

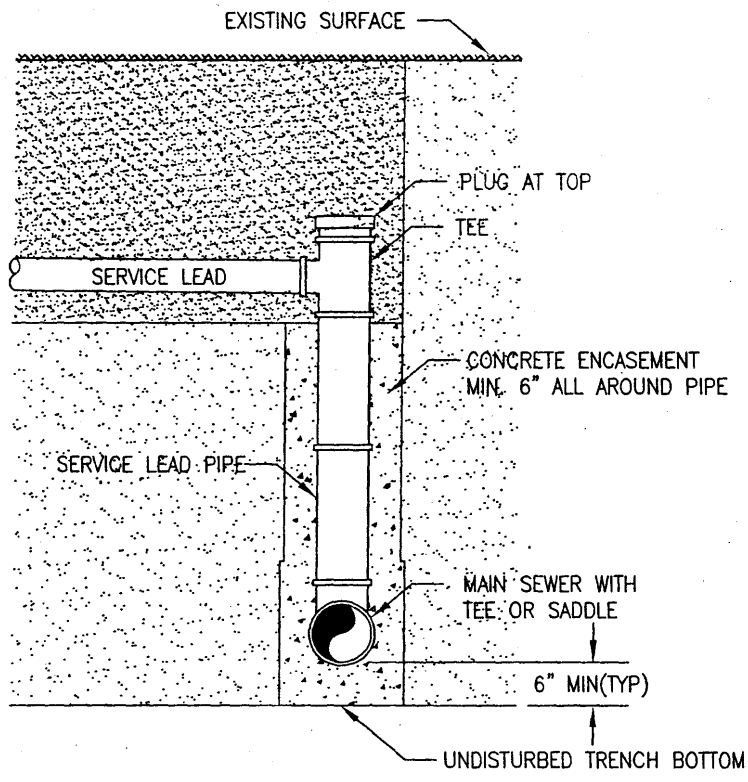
SCALE: NONE

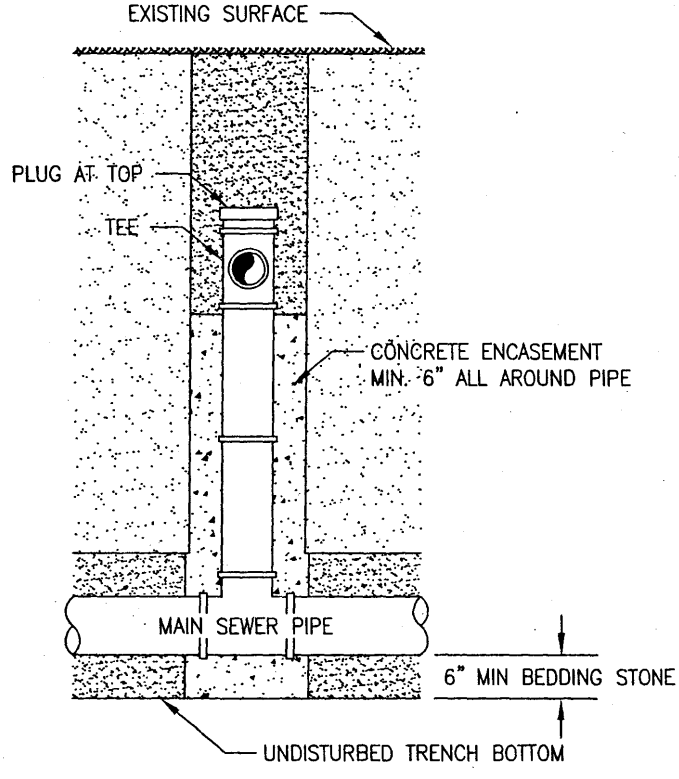
NEW SEWER CONNECTION - CHIMNEYS

GREATER AUGUSTA UTILITY DISTRICT

REVISED JAN. 2008 **NTS**

SECTION V.9

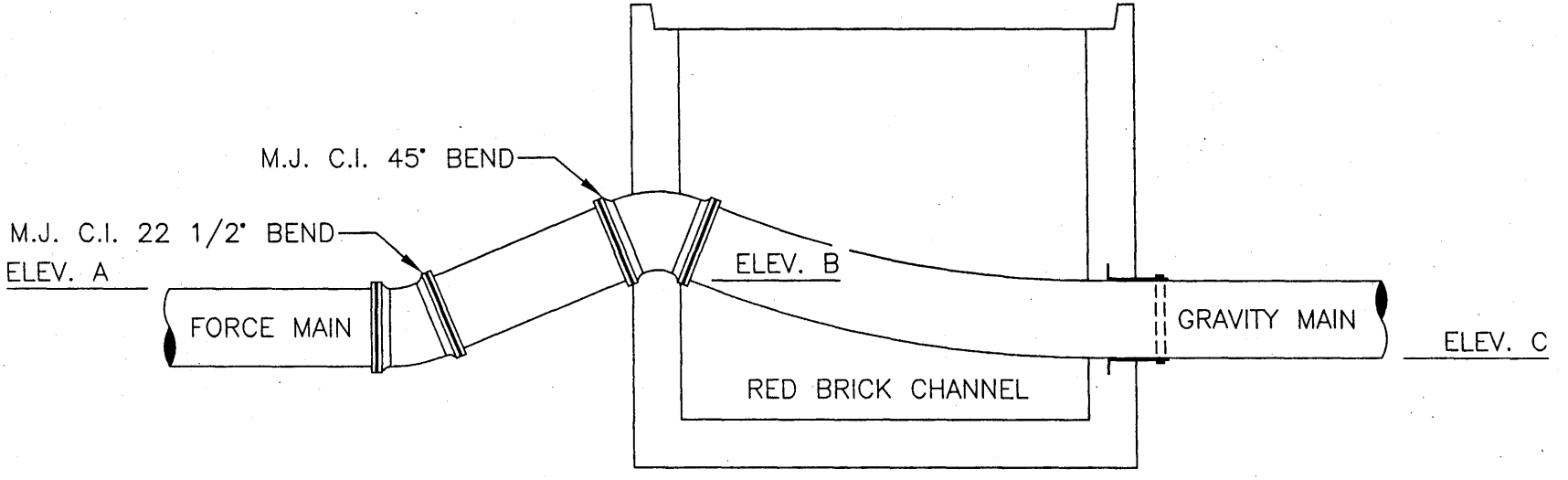




FORCE MAIN TERMINUS
GREATER AUGUSTA UTILITY DISTRICT
REVISED JAN. 2008 **NTS**

SECTION V.6

NOTE: ELEV. B TO BE 1" HIGHER THAN ELEV. A
ELEV. C TO BE A MIN. OF 8" BELOW ELEV. B

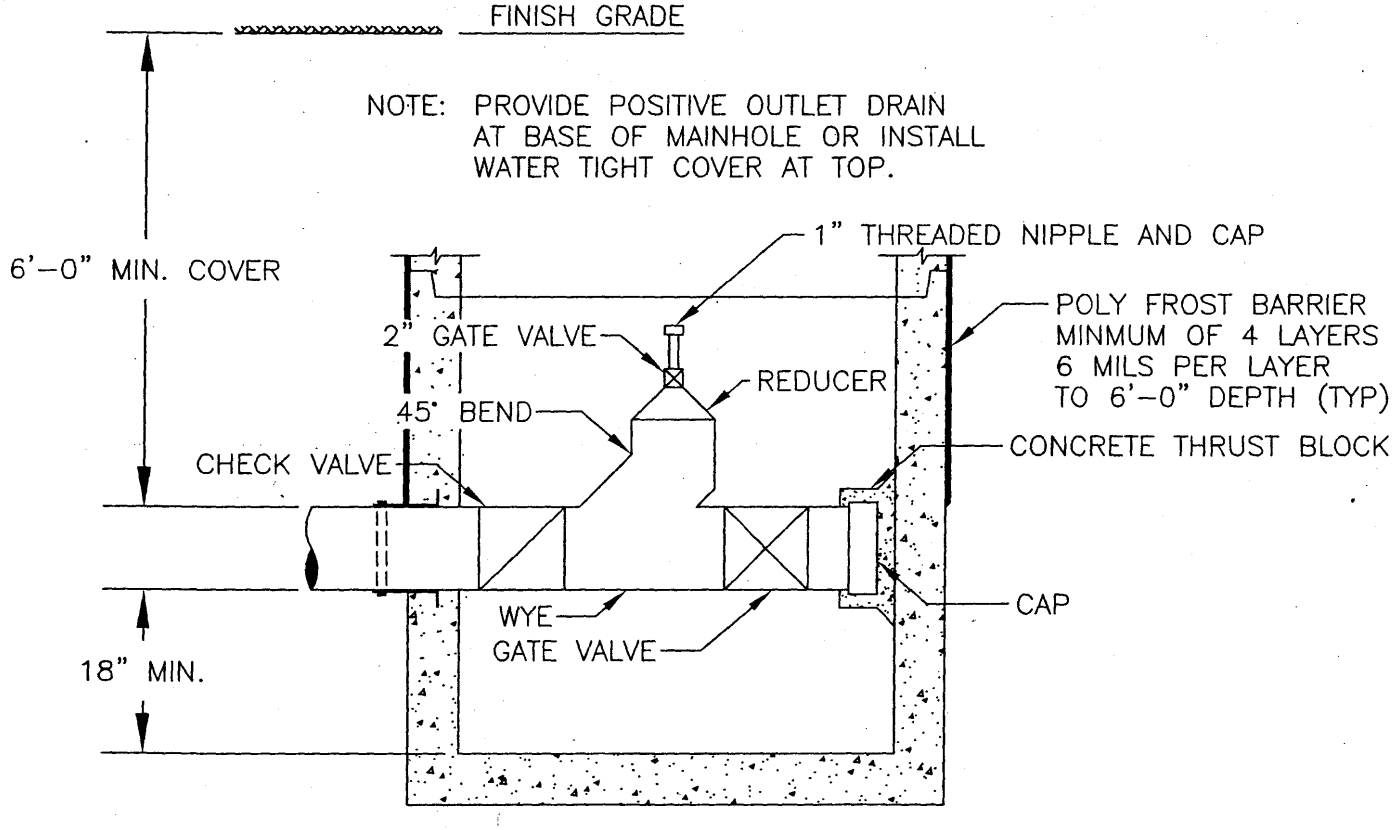


PRECAST CLEANOUT MANHOLE - 4' DIA.

GREATER AUGUSTA UTILITY DISTRICT

REVISED JAN. 2008 **NTS**

SECTION V.6

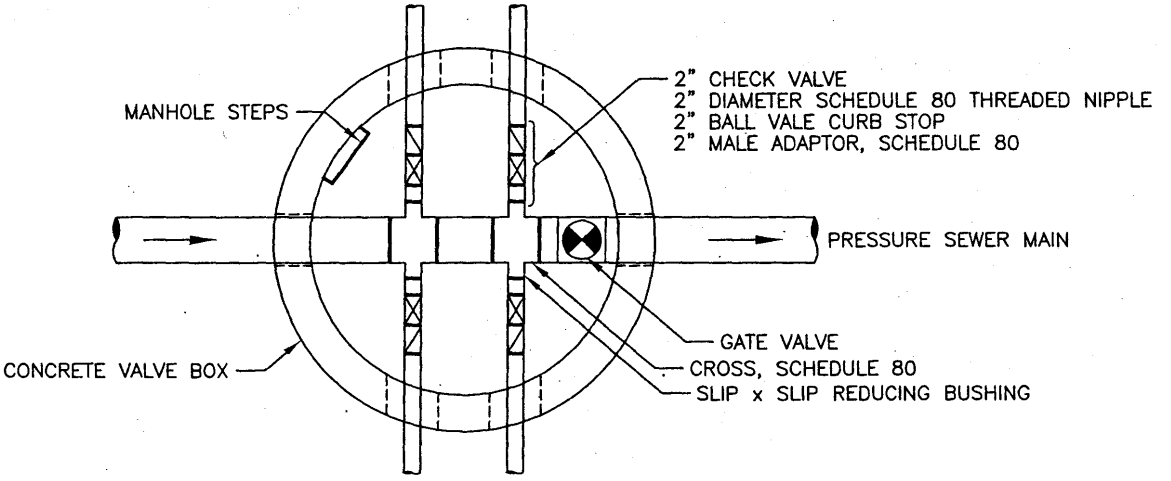


FORCE MAIN SERVICE VALVE BOX

GREATER AUGUSTA UTILITY DISTRICT

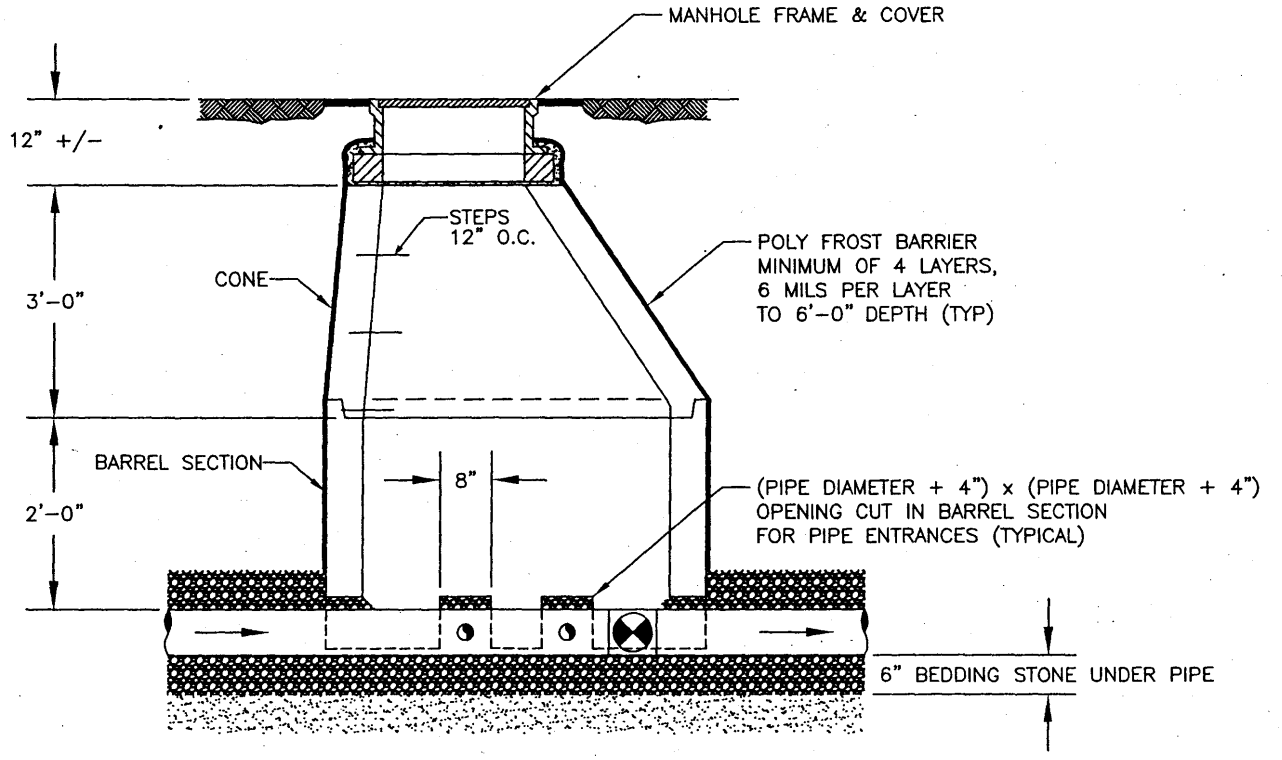
REVISED JAN. 2008 **NTS**

SECTION V.6

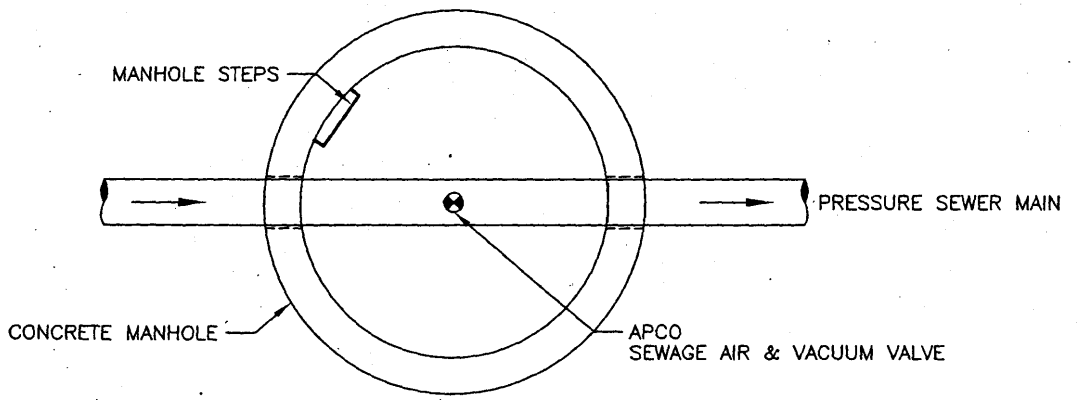


PLAN

NOT TO SCALE

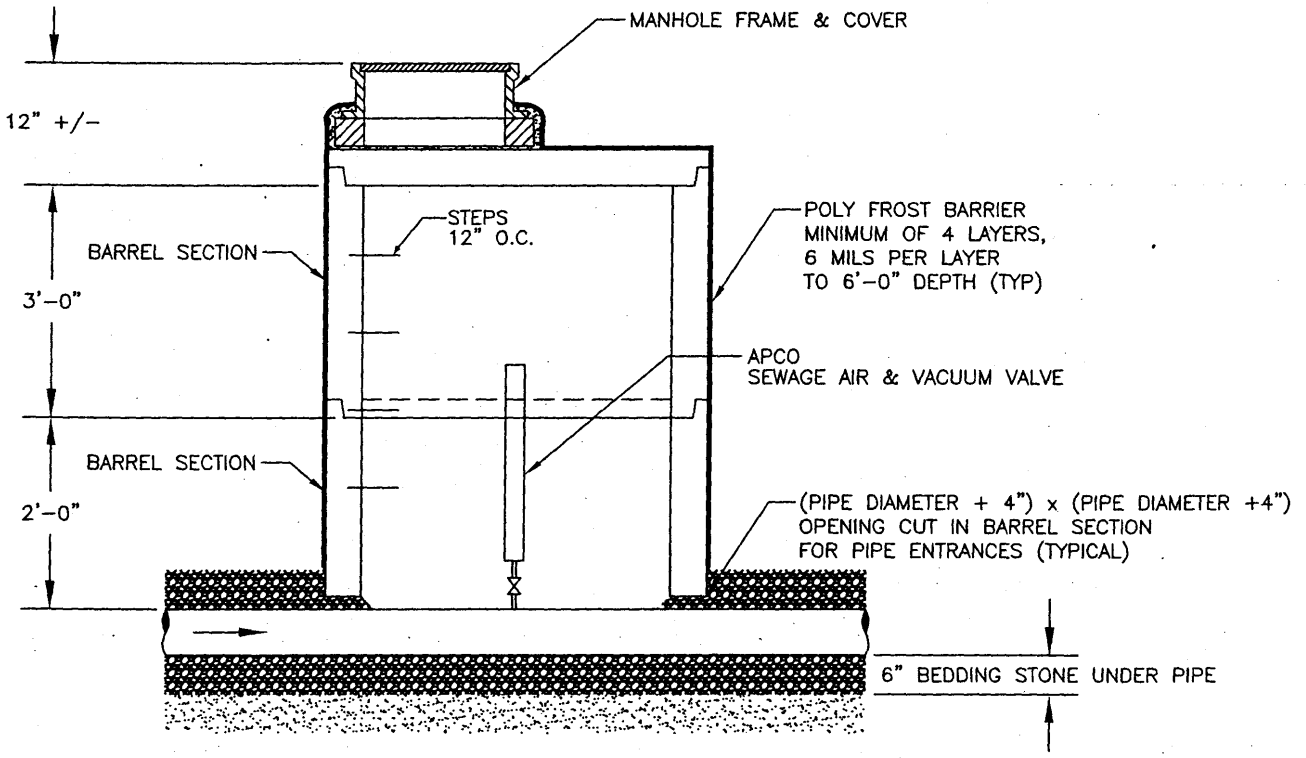


AIR RELEASE MANHOLE
GREATER AUGUSTA UTILITY DISTRICT
REVISED JAN. 2008 NTS



PLAN

NOT TO SCALE



SECTION 33 31 11

SITE SANITARY UTILITY SEWERAGE PIPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. State of Maine Department of Transportation, "Standard Specifications," Revision December 2002, and any revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1.3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.

2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.02 SECTION INCLUDES

A. Sanitary sewerage drainage piping, fittings, and accessories.

1.03 RELATED REQUIREMENTS

A. Section 31 23 16 - Excavation: Excavating of trenches.

B. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.

C. Section 31 23 23 - Fill: Bedding and backfilling.

D. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.

E. Section 33 05 13 - Manholes and Structures.

1.04 REFERENCE STANDARDS

A. Greater Augusta Utility District (GAUD) Water and Sewer Construction Specifications and Procedures, Latest Revision.

B. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2009.

C. ASTM A746 - Standard Specification for Ductile Iron Gravity Sewer Pipe; 2009.

D. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2012.

E. ASTM D 2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)

F. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; 2011.

G. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2011.

H. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2008.

I. ASTM F 1417 - Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air.

J. AWWA C111/A21.11 - American National Standard for Rubber Gasket Joints For Cast Iron and Ductile Iron Pressure Pipe and Fittings; 2007. (ANSI/AWWA C111/A21.11)

1.05 SUBMITTALS

A. Product Data: Provide data indicating pipe, pipe accessories.

B. Gravity and force main sewer testing results.

C. Project Record Documents:
1. Record location of pipe runs, connections, cleanouts, and invert elevations.
2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.06 REGULATORY REQUIREMENTS

A. Perform work in accordance with the Greater Augusta Utility District specifications and this specification, in the event of a conflict, the stricter requirement applies.

B. Maintain a minimum 5 foot separation between any private sewer piping and other utilities to facilitate maintenance and repairs.

PART 2 PRODUCTS

2.01 SEWER PIPE MATERIALS

A. Pipe shall be continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM classification.

B. Pipe joints shall be integrally molded bell ends in accordance with ASTM D 3034 Table 2, with factory supplied elastomeric gaskets and lubricant.

C. Polyvinyl Chloride Pressure Sewer less than 4" diameter: ASTM D 2241, ASTM D 1784, and ASTM D 1869. Strength requirement 200 psi SDR 21.

D. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

2.02 PIPE ACCESSORIES

A. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Sewer Service” in large letters. Minimum 8 gauge wire or approved equivalent.

2.03 BEDDING AND COVER MATERIALS

A. Pipe Bedding Material: As specified in Section 31 23 16.13.

B. Pipe Cover Material: As specified in Section 31 23 16.13.

PART 3 EXECUTION

3.01 TRENCHING

A. See Section 31 23 16.13 for additional requirements.

B. Hand trim excavation for accurate placement of pipe to elevations indicated.

C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.02 INSTALLATION - PIPE

A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
   1. Plastic Pipe: Also comply with ASTM D2321.

C. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

D. Connect to building sanitary sewer outlet.

E. Make all required connections to existing sewers. Carry out such work in accordance with local standards. Observe care to prevent debris from entering sewers. Check the invert elevations of existing sewers to which connections are to be made, and if appreciable difference from elevations noted on the drawings, or if they involve any difficulty in obtaining necessary drainage, notify the Engineer immediately so that appropriate corrective action may be taken.

F. Commence at the lowest point in the system and lay the pipe with the bell end upgrade. Test pipe for soundness and clean interior and joint surfaces before lowering the pipe into the trench. Lay pipe in straight lines and on uniform grades between points where changes in alignment or grade are shown. Bed the pipe barrel uniformly.

G. Comply fully with manufacturer's instructions for sewer pipe jointing, using sealing or lubricating compounds supplied by the manufacturer, and apply proper pressure to seal the spigot in the bell.

H. As soon as the joint material has set, pack fine earth carefully around the joints, and around and over the pipe. Carry this backfill operation to a depth of at least twelve inches above the top of the pipe. Care shall be used in tamping backfill under lower parts of the pipe to give proper support, especially in shallow trenches.

I. Flush all sanitary sewers, including building connections, with water in sufficient volume to obtain free flow through each line. Remove any obstructions and correct any defects discovered.

J. Install trace wire 6 inches above top of pipe; coordinate with Section 31 23 16.13.

K. Test all sewer piping in accordance with GAUD specifications prior to being activated. All test results shall be submitted to GAUD within 1 week of testing.

3.03 FIELD QUALITY CONTROL

A. Provide copies of test report to owner and servicing utility, documenting results and compliance with requirements in advance of requesting a certificate of occupancy.

B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

C. Pressure Test (Gravity Sewer): Test in accordance with ASTM F 1417.

D. Pressure Test Force Main: Use Hydrostatic test as follows:
   1. Fill section of pipe with water and expel all air.
   2. Pressurize to 1.5 times the normal operating pressure but not less than 60 psi.
   3. Measure leakage over a 2-hour test period.
   4. Acceptable leakage: less than 10 gallons per day per inch diameter per mile of pipe tested.

3.04 PROTECTION

A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION 33 31 11

SECTION 33 41 11

SITE STORM UTILITY DRAINAGE PIPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. State of Maine Department of Transportation, “Standard Specifications,” Revision December 2002, and any revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.

2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.02 SECTION INCLUDES

A. Storm drainage piping, fittings, and accessories.

B. Foundation drainage piping and accessories.

1.03 RELATED REQUIREMENTS

A. Section 31 23 16 - Excavation: Excavating of trenches.

B. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.

C. Section 31 23 23 - Fill: Bedding and backfilling.

D. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.

E. Section 33 05 13 - Manholes and Structures.

1.04 REFERENCE STANDARDS

A. AASHTO M252 - Standard Specification For Corrugated Polyethylene Pipe, 75 mm to 250mm; 2009.

B. AASHTO M254 - Standard Specification For Corrugated Polyethylene Pipe, 300 mm to 1,500mm; 2009.

C. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe; 2012a.

D. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets; 2012.

E. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2012.

F. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; 2011.

G. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2011.

H. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2008.

1.05 SUBMITTALS

A. Product Data: Provide data indicating pipe, pipe accessories.

B. Project Record Documents:
1. Record location of pipe runs, connections, catch basins, cleanouts, and invert elevations.
2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.06 PROJECT CONDITIONS

A. Coordinate the Work with termination of storm sewer connection outside building, trenching, connection to foundation drainage system.

PART 2 PRODUCTS

2.01 STORM DRAIN PIPE MATERIALS

A. Reinforced Concrete Pipe: ANSI/ASTM C76, IV, with modified tongue-and-groove compression gasket joints complying with ANSI/ASTM C443.

B. Reinforced Concrete Pipe Joint Device: ASTM C 443 rubber compression gasket joint.

C. Corrugated Polyethylene Pipe (PE): Pipe complying with AASHTO M294 and MP7, and ASTM D3550. Interior of pipes shall be smooth, and shall have an "n" value of not less than .010. Pipes shall be joined with gasketed bell and spigot joints complying with AASHTO M252 and M294. Gaskets shall comply with ASTM F477 and ASTM D1149. Provide minimum coverage per manufacturers specifications.
1. Acceptable Manufacturers of Corrugated Polyethylene Pipe: Hancor "Sure Lok", ADS N-12 Prolink, or equal.

D. Plastic Pipe: ASTM D3034, Type PSM, Poly(Vinyl Chloride) (PVC) material; inside nominal diameter of specified inches, bell and spigot style solvent sealed joint end.

E. Building foundation drain: 4" dia. SDR-35 perforated underdrain pipe.

2.02 PIPE ACCESSORIES

A. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

PART 3 EXECUTION

3.01 TRENCHING

A. See Section 31 23 16.13 for additional requirements.

B. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.02 INSTALLATION - PIPE

A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
   1. Plastic Pipe: Also comply with ASTM D2321.

C. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

D. Connect to building storm drainage system, foundation drainage system.

3.03 INSTALLATION - CATCH BASINS, TRENCH DRAINS AND CLEANOUTS

A. See Section 33 05 13 "Manholes and Structures"

3.04 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with requirements of local authorities having jurisdiction.

B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

3.05 PROTECTION

A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION 33 41 11

SECTION 33 46 00

SUBDRAINAGE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. State of Maine Department of Transportation, “Standard Specifications,” Revision December 2002, and any revisions thereto, apply to this Section. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, Section 10 1. 3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.

2. Any supplements to any of the above specifications and or standards issued prior to issuance of this Project Manual, apply to this section.

1.02 SECTION INCLUDES

A. Building Perimeter and Under-Slab Drainage Systems.

B. Filter aggregate and fabric and bedding.

1.03 RELATED REQUIREMENTS

A. Geotechnical Engineering Study (Soils Report) by S.W. Cole Engineering, Inc. dated November 7, 2013.

B. Section 31 23 16 - Excavation: Excavating for subdrainage system piping and surrounding filter aggregate.

C. Section 31 23 23 - Fill: Backfilling over filter aggregate, up to subgrade elevation.

1.04 REFERENCE STANDARDS

A. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2011.

1.05 SUBMITTALS

A. Product Data: Provide data on pipe drainage products, pipe accessories.

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

C. Project Record Documents: Record location of pipe runs, connections, cleanouts and principal invert elevations.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable code for materials and installation of the work of this section.

PART 2 PRODUCTS

2.01 PIPE MATERIALS

A. Polyvinyl Chloride Pipe: ASTM D2729; plain end, 4 inch inside diameter; with required fittings.

B. Use perforated pipe at subdrainage system; unperforated through sleeved walls.

2.02 AGGREGATE AND BEDDING

A. See Section 31 23 23 - Fill for Type C underdrain stone.

2.03 ACCESSORIES

A. Pipe Couplings: Solid plastic.

B. Geotextile Fabric: See Section 31 23 23 - Fill for non-woven geotextile.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavated base is ready to receive work and excavations, dimensions, and elevations are as indicated on layout Drawings.

3.02 PREPARATION

A. Hand trim excavations to required elevations. Correct over-excavation with Type C Underdrain stone.

B. Remove large stones or other hard matter that could damage drainage piping or impede consistent backfilling or compaction.

3.03 INSTALLATION

A. Install and join pipe and pipe fittings in accordance with pipe manufacturer's instructions.

B. Place 6 inches of Type C Underdrain Stone over non-woven geotextile.

C. Place pipe with perforations facing down. Mechanically join pipe ends.

D. Install pipe couplings.

E. Install Type C Underdrain Stone at sides, over joint covers and top of pipe. Provide top cover and sides a compacted thickness of 6 inches.

F. Wrap filter fabric over levelled top surface of aggregate cover prior to subsequent backfilling operations.

G. Place aggregate in maximum 4 inch lifts, consolidating each lift.

H. Refer to Section 31 23 23 for compaction requirements. Do not displace or damage pipe when compacting.

I. Connect to storm sewer system with unperforated pipe.

3.04 FIELD QUALITY CONTROL

A. Request inspection prior to and immediately after placing aggregate cover over pipe.

3.05 PROTECTION

A. Protect pipe and aggregate cover from damage or displacement until backfilling operation begins.

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END OF SECTION 33 46 00

October 29, 2013
Supersedes October 08, 2013

STANDARD DETAIL UPDATES

Standard Details and Standard Detail updates are available at:
http://www.maine.gov/mdot/contractor-consultant-information/ss_standard_details_updates.php

Detail #	Description	Revision Date
203(03)	Backslope Rounding	1/29/08
502(03)	Concrete Curb - Bituminous Wearing Surface	8/08/11
502(03)A	Concrete Curb - Concrete Wearing Surface	2/2/09
502(07)	Precast Concrete Deck Panels - Layout Plan	2/2/09
502(07)A	Precast Concrete Deck Panels - Layout Plan	2/2/09
502(08)	Precast Concrete Deck Panels - Panel Plan	2/2/09
502(09)	Precast Concrete Deck Panels - Blocking Detail	2/2/09
502(10)	Precast Concrete Deck Panels	2/2/09
502(11)	Precast Concrete Deck Panels	2/2/09
502(12)	Precast Concrete Deck Panels - Notes	10/28/09
502(12)A	Precast Concrete Deck Panels - Notes	2/2/09
504(15)	Diaphragms	5/19/11
504(21)	Tension Flange Connection for Diaphragm and Cross Frames	10-11-12
504(22)	Diaphragm & Crossframe Notes	10/11/12
504(23)	Hand-Hold Details	12/08/05
502(24)	Hand-Hold Details	10/11/12
507(04)	Steel Bridge Railing	2/05/03
507(04A)	Steel Bridge Railing	7/3/13
507(09)	Steel Bridge Railing	5/19/11
507(09)A	Steel Bridge Railing	5/19/11

526(06)	Permanent Concrete Barrier	2/2/09
526(08)	Permanent Concrete Barrier – Type IIIA	10/07/10
526(08)A	Permanent Concrete Barrier – Type IIIA	12/07/10
526(13)	Permanent Concrete Barrier – Type IIIB	2/2/09
526(14)	Permanent Concrete Barrier – Type IIIB	2/2/09
526(21)	Concrete Transition Barrier	2/2/09
526(29A)	Concrete Transition Barrier	5/1/13
526(29B)	Concrete Transition Barrier	5/1/13
526(29C)	Concrete Transition Barrier	5/1/13
526(33)	Concrete Transition Barrier	5/1/13
526(39)	Texas Classic Rail – Between Window	2/2/09
526(40)	Texas Classic Rail – Through Window	2/2/09
526(41)	Texas Classic Rail – Through Post	2/2/09
526(42)	Texas Classic Rail – Through Nose	2/2/09
535(01)	Precast Superstructure - Shear Key	10/12/06
535(02)	Precast Superstructure - Curb Key & Drip Notch	5/20/08
535(03)	Precast Superstructure - Shear Key	12/5/07
535(04)	Precast Superstructure - Shear Key	12/05/07
535(05)	Precast Superstructure - Post Tensioning	5/20/08
535(06)	Precast Superstructure - Sections	10/12/06
535(07)	Precast Superstructure - Precast Slab & Box	10/12/06
535(08)	Precast Superstructure - Sections	10/12/06
535(09)	Precast Superstructure - Sections	10/12/06
535(10)	Precast Superstructure - Sections	10/12/06
535(11)	Precast Superstructure - Sections	10/12/06

535(12)	Precast Superstructure - Sections	10/12/06
535(13)	Precast Superstructure - Sections	10/12/06
535(14)	Precast Superstructure - Stirrups	10/12/06
535(15)	Precast Superstructure - Plan	10/12/06
535(16)	Precast Superstructure - Reinforcing	10/12/06
535(17)	Precast Superstructure - Notes	12/05/07
604(01)	Catch Basins	11/16/05
604(05)	Type “A” & “B” Catch Basin Tops	11/16/05
604(06)	Type “C” Catch Basin Tops	11/16/05
604(07)	Manhole Top “D”	11/16/05
604(09)	Catch Basin Type “E”	11/16/05
604(18)	Utility Structures	11/29/13
606(02)	Multiple Mailbox Support	11/16/05
606(03)	Guardrail Standard Detail	9/19/12
606(07)	Reflectorized Beam Guardrail Delineator Details	11/16/05
606(20)	Guardrail - Type 3 - Single Rail - Bridge Mounted	2/2/09
606(21)	Guardrail - Type 3 - Single Rail - Bridge Mounted	2/2/09
606(22)	Guardrail - Type 3 - Single Rail - Bridge Mounted	2/2/09
606(23)	Guardrail - Type 3 - Single Rail - Bridge Mounted	2/2/09
609(03)	Curb Type 3	6/27/06
609(06)	Vertical Bridge Curb	2/12/09
609(07)	Curb Type 1	6/27/06
609(08)	Precast Concrete Transition Curb	2/2/09

610(02)	Stone Scour Protection	8/9/11
610(03)	Stone Scour Protection	5/19/11
610(04)	Stone Scour Protection	5/19/11
620(05)	Geotextile Placement for Protection of Slopes Adjacent to Stream & Tidal Areas	5/19/11
626(09)	Electrical Junction Box for Traffic Signals and Lighting	8/27/10
645(06)	H-Beam Posts – Highway Signing	7/21/04
645(09)	Installation of Type II Signs	7/21/04
801(01)	Drives on Sidewalk Sections	12/13/07
801(02)	Drives on Non-Sidewalk Sections	12/13/07

SUPPLEMENTAL SPECIFICATION

(Corrections, Additions, & Revisions to Standard Specifications - Revision of December 2002)

SECTION 101
CONTRACT INTERPRETATION

101.2 Definitions

Closeout Documentation Replace the sentence "A letter stating the amount….. DBE goals." with "DBE Goal Attainment Verification Form"

Add "Environmental Information Hazardous waste assessments, dredge material test results, boring logs, geophysical studies, and other records and reports of the environmental conditions. For a related provision, see Section 104.3.14 - Interpretation and Interpolation."

Add "Fabrication Engineer The Department's representative responsible for Quality Assurance of pre-fabricated products that are produced off-site."

Geotechnical Information Replace with the following: "Boring logs, soil reports, geotechnical design reports, ground penetrating radar evaluations, seismic refraction studies, and other records of subsurface conditions. For a related provision, see Section 104.3.14 - Interpretation and Interpolation."

SECTION 102
DELIVERY OF BIDS

102.7.1 Location and Time Add the following sentence "As a minimum, the Bidder will submit a Bid Package consisting of the Notice to Contractors, the completed Acknowledgement of Bid Amendments form, the completed Schedule of Items, 2 copies of the completed Agreement, Offer, & Award form, a Bid Bond or Bid Guarantee, and any other Certifications or Bid Requirements listed in the Bid Book."

102.11.1 Non-curable Bid Defects Replace E. with "E. The unit price and bid amount is not provided or a lump sum price is not provided or is illegible as determined by the Department."

SECTION 103
AWARD AND CONTRACTING

103.3.1 Notice and Information Gathering Change the first paragraph to read as follows: "After Bid Opening and as a condition for Award of a Contract, the Department may require an Apparent Successful Bidder to demonstrate to the Department's satisfaction that the Bidder is responsible and qualified to perform the Work."

SECTION 104
GENERAL RIGHTS AND RESPONSIBILITIES

104.3.14 Interpretation and Interpolation In the first sentence, change "…and Geotechnical Information." to "…Environmental Information, and Geotechnical Information."

SECTION 105
GENERAL SCOPE OF WORK

Delete the entire Section 105.6 and replace with the following:

105.6.1 Department Provided Services The Department will provide the Contractor with the description and coordinates of vertical and horizontal control points, set by the Department, within the Project Limits, for full construction Projects and other Projects where survey control is necessary. For Projects of 1,500 feet in length, or less: The Department will provide three points. For Projects between 1,500 and 5,000 feet in length: The Department will provide one set of two points at each end of the Project. For Projects in excess of 5,000 feet in length, the Department will provide one set of two points at each end of the Project, plus one additional set of two points for each mile of Project length. For non-full construction Projects and other Projects where survey control is not necessary, the Department will not set any control points and, therefore, will not provide description and coordinates of any control points. Upon request of the Contractor, the Department will provide the Department's survey data management software and Survey Manual to the Contractor, or its survey Subcontractor, for the exclusive use on the Department's Projects.

105.6.2 Contractor Provided Services Utilizing the survey information and points provided by the Department, described in Subsection 105.6.1, Department Provided Services, the Contractor shall provide all additional survey layout necessary to complete the Work. This may include, but not be limited to, reestablishing all points provided by the Department, establishing additional control points, running axis lines, providing layout and maintenance of all other lines, grades, or points, and survey quality control to ensure conformance with the Contract. The Contractor is also responsible for providing construction centerline, or close reference points, for all Utility Facilities relocations and adjustments as necessary to complete the Work. When the Work is to connect with existing Structures, the Contractor shall verify all dimensions before proceeding with the Work. The Contractor shall employ or retain competent engineering and/or surveying personnel to fulfill these responsibilities.

The Contractor must notify the Department of any errors or inconsistencies regarding the data and layout provided by the Department as provided by Section 104.3.3 - Duty to Notify Department If Ambiguities Discovered.

105.6.2.1 Survey Quality Control The Contractor is responsible for all construction survey quality control. Construction survey quality control is generally defined as, first, performing initial field survey layout of the Work and, second, performing an independent check of the initial layout using independent survey data to assure the accuracy of the initial layout; additional iterations of checks may be required if significant discrepancies are discovered in this process. Construction survey layout quality control also requires written documentation of the layout process such that the process can be followed and repeated, if necessary, by an independent survey crew.

105.6.3 Survey Quality Assurance It is the Department's prerogative to perform construction survey quality assurance. Construction survey quality assurance may, or may not, be performed by the Department. Construction survey quality assurance is generally defined as an independent check of the construction survey quality control. The construction survey

quality assurance process may involve physically checking the Contractor's construction survey layout using independent survey data, or may simply involve reviewing the construction survey quality control written documentation. If the Department elects to physically check the Contractor's survey layout, the Contractor's designated surveyor may be required to be present. The Department will provide a minimum notice of 48 hours to the Contractor, whenever possible, if the Contractor's designated surveyor's presence is required. Any errors discovered through the quality assurance process shall be corrected by the Contractor, at no additional cost to the Department.

105.6.4 Boundary Markers The Contractor shall preserve and protect from damage all monuments or other points that mark the boundaries of the Right-of-Way or abutting parcels that are outside the area that must be disturbed to perform the Work. The Contractor indemnifies and holds harmless the Department from all claims to reestablish the former location of all such monuments or points including claims arising from 14 MRSA § 7554-A. For a related provision, see Section 104.3.11 - Responsibility for Property of Others.

SECTION 106
QUALITY

106.4.3 Testing Change the first sentence in paragraph three from "…maintain records of all inspections and tests." to "…maintain original documentation of all inspections, tests, and calculations used to generate reports."

106.6 Acceptance Add the following to paragraph 1 of A: "This includes Sections 401 - Hot Mix Asphalt, 402 - Pavement Smoothness, and 502 - Structural Concrete - Method A - Air Content."

Add the following to the beginning of paragraph 3 of A: "For pay factors based on Quality Level Analysis, and"

106.7.1 Standard Deviation Method Add the following to F: "Note: In cases where the mean of the values is equal to either the USL or the LSL, then the PWL will be 50 regardless of the computed value of s."

Add the following to H: "Method C Hot Mix Asphalt: PF = [55 + (Quality Level *0.5)] * 0.01"

SECTION 107
TIME

107.3.1 General Add the following: "If a Holiday occurs on a Sunday, the following Monday shall be considered a Holiday. Sunday or Holiday work must be approved by the Department, except that the Contractor may work on Martin Luther King Day, President's Day, Patriot's Day, the Friday after Thanksgiving, and Columbus Day without the Department's approval."

107.7.2 Schedule of Liquidated Damages Replace the table of Liquidated Damages as follows:

From More Than	Up to and Including	Amount of Liquidated Damages per Calendar Day
$0	$100,000	$225

$100,000	$250,000	$350
$250,000	$500,000	$475
$500,000	$1,000,000	$675
$1,000,000	$2,000,000	$900
$2,000,000	$4,000,000	$1,000
$4,000,000	and more	$2,100

SECTION 108
PAYMENT

Remove Section 108.4 and replace with the following:

"108.4 Payment for Materials Obtained and Stored Acting upon a request from the Contractor and accompanied by bills or receipted bills, the Department will pay for all or part of the value of acceptable, non-perishable Materials that are to be incorporated in the Work, including Materials that are to be incorporated into the Work, not delivered on the Work site, and stored at places acceptable to the Department. Examples of such Materials include steel piles, stone masonry, curbing, timber and lumber, metal Culverts, stone and sand, gravel, and other Materials. The Department will not make payment on living or perishable Materials until acceptably planted in their final locations.

If payment for Materials is made to the Contractor based on bills, only, then the Contractor must provide receipted bills to the Department for these Materials within 14 days of the date the Contractor receives payment for the Materials. Failure of the Contractor to provide receipted bills for these Materials within 14 days of the dated the Contractor receives payment will result in the paid amount being withheld from the subsequent progress payment, or payments, until such time the receipted bills are received by the Department.

Materials paid for by the Department are the property of the Department, but the risk of loss shall remain with the Contractor. Payment for Materials does not constitute Acceptance of the Material. If Materials for which the Department has paid are later found to be unacceptable, then the Department may withhold amounts reflecting such unacceptable Materials from payments otherwise due the Contractor.

In the event of Default, the Department may use or cause to be used all paid-for Materials in any manner that is in the best interest of the Department."

SECTION 109
CHANGES

109.1.1 Changes Permitted Add the following to the end of the paragraph: "There will be no adjustment to Contract Time due to an increase or decrease in quantities, compared to those estimated, except as addressed through Contract Modification(s)."

109.1.2 Substantial Changes to Major Items Add the following to the end of the paragraph: "Contract Time adjustments may be made for substantial changes to Major Items when the change affects the Critical Path, as determined by the Department"

109.4.4 Investigation / Adjustment Third sentence, delete the words "subsections (A) - (E)"

109.5.1 Definitions - Types of Delays

B. Compensable Delay Replace (1) with the following; "a weather related Uncontrollable Event of such an unusually severe nature that a Federal Emergency Disaster is declared. The Contractor will only be entitled to an Equitable Adjustment if the Project falls within the geographic boundaries prescribed under the disaster declaration."

109.7.2 Basis of Payment Replace with the following: "Adjustments will be established by mutual Agreement based upon Unit or Lump Sum Prices. These agreed Unit or Lump Sum prices will be full compensation and no additions or mark-ups are allowed. If Agreement cannot be reached, the Contractor shall accept payment on a Force Account basis as provided in Section 109.7.5 - Force Account Work, as full and complete compensation for all Work relating to the Equitable Adjustment."

109.7.3 Compensable Items Delete this Section entirely.

109.7.4 Non-Compensable Items Replace with the following: "The Contractor is not entitled to compensation or reimbursement for any of the following items:

A. Total profit or home office overhead in excess of 15%,
B. ……."

109.7.5 Force Account Work

C. Equipment
Paragraph 2, delete sentence 1 which starts; "Equipment leased…."

Paragraph 6, change sentence 2 from "The Contractor may furnish…" to read "If requested by the Department, the Contractor will produce cost data to assist the Department in the establishment of such rental rate, including all records that are relevant to the Actual Costs including rental Receipts, acquisition costs, financing documents, lease Agreements, and maintenance and operational cost records."
Add the following paragraph; "Equipment leased by the Contractor for Force Account Work and actually used on the Project will be paid for at the actual invoice amount plus 10% markup for administrative costs."

Add the following section;

"F. Subcontractor Work When accomplishing Force Account Work that utilizes Subcontractors, the Contractor will be allowed a maximum markup of 5% for profit and overhead on the Subcontractor's portion of the Force Account Work. If the Department does not accept the Subcontractor quote, then the Subcontractor work will be subject to the Force Account provisions with a 5% markup for profit & overhead.."

SECTION 110
INDEMNIFICATION, BONDING, AND INSURANCE

Delete the entire Section 110.2.3 and replace with the following:

110.2.3 Bonding for Landscape Establishment Period The Contractor shall provide a signed, valid, and enforceable Performance, Warranty, or Maintenance Bond complying with the Contract, to the Department at Final Acceptance.

The bond shall be in the full amount for all Pay Items for work pursuant to Sec 621, Landscape, payable to the "Treasurer - State of Maine," and on the Department's forms, on exact copies thereof, or on forms that do not contain any significant variations from the Department's forms as solely determined by the Department.

The Contractor shall pay all premiums and take all other actions necessary to keep said bond in effect for the duration of the Landscape Establishment Period described in Special Provision 621.0036 - Establishment Period. If the Surety becomes financially insolvent, ceases to be licensed or approved to do business in the State of Maine, or stops operating in the United States, the Contractor shall file new bonds complying with this Section within 10 Days of the date the Contractor is notified or becomes aware of such change.

All Bonds shall be procured from a company organized and operating in the United States, licensed or approved to do business in the State of Maine by the State of Maine Department of Business Regulation, Bureau of Insurance, and listed on the latest Federal Department of the Treasury listing for "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies."

By issuing a bond, the Surety agrees to be bound by all terms of the Contract, including those related to payment, time for performance, quality, warranties, and the Department's self-help remedy provided in Section 112.1 - Default to the same extent as if all terms of the Contract are contained in the bond(s).

Regarding claims related to any obligations covered by the bond, the Surety shall provide, within 60 Days of Receipt of written notice thereof, full payment of the entire claim or written notice of all bases upon which it is denying or contesting payment. Failure of the Surety to provide such notice within the 60-day period constitutes the Surety's waiver of any right to deny or contest payment and the Surety's acknowledgment that the claim is valid and undisputed.

110 - Indemnification, Bonding and Insurance
Add the following to the end of Section 110, Indemnification, Bonding and Insurance:

Nothing in these Standard Specifications constitutes a waiver of any defense, immunity or limitation of liability that may be available to the Department, or its officers, agents or employees under the Maine Tort Claims Act (Title 14 M.R.S.A. 8101 et seq.), and shall not constitute a waiver of other privileges or immunities that may be available to the Department.

SECTION 202
REMOVING STRUCTURES AND OBSTRUCTIONS

202.02 Removing Buildings Make the following change to the last sentence in the final paragraph, change "…Code of Maine Regulations 401." to "…Department of Environmental

Protection Maine Solid Waste Management Rules, 06-096 CMR Ch. 401, Landfill Siting, Design and Operation."

SECTION 203
EXCAVATION AND EMBANKMENT

203.01 Description Under b. Rock Excavation; add the following sentence: "The use of perchlorate is not allowed in blasting operations."

Delete the entire Section 203.041 and replace with the following:
"203.041 Salvage of Existing Hot Mix Asphalt Pavement All existing hot mix asphalt pavement designated to be removed under this contract must be salvaged for utilization. Existing hot mix asphalt pavement material shall not be deposited in any waste area or be placed below subgrade in any embankment.

Methods of utilization may be any of the following:

1. Used as a replacement for untreated aggregate surface course on entrances provided the material contains no particles greater than 50 mm [2 in] in any dimension. Payment will be made under Pay Item 411.09, Untreated Aggregate Surface Course or 411.10, Untreated Aggregate Surface Course, Truck Measure. Material shall be placed, shaped, compacted and stabilized as directed by the Resident.

2. Used as the top 3" of gravel. Recycled Asphalt Pavement (RAP) shall be process to 1½" minus and blending will not be allowed. When this method is utilized, a surcharge will not be required

3. Stockpiled at commercial or approved sites for commercial or MaineDOT use.

4. Other approved methods proposed by the Contractor, and approved by the Resident which will assure proper use of the existing hot mix asphalt pavement.

The cost of salvaging hot mix asphalt material will be included for payment under the applicable pay item, with no additional allowances made, which will be full compensation for removing, temporarily stockpiling, and rehandling, if necessary, and utilizing the material in entrances or other approved uses, or stockpiling at an approved site as described above. The material will also be measured and paid for under the applicable Pay Item if it is reused for aggregate in entrances, or other approved uses."

SECTION 502
STRUCTURAL CONCRETE

502.05 Composition and Proportioning; TABLE #1; NOTE #2; third sentence; Change "…alcohol based saline sealer…" to "alcohol based silane sealer…". Add NOTE #6 to Class S Concrete.

502.0502 Quality Assurance Method A - Rejection by Resident Change the first sentence to read: "For an individual sublot with test results failing to meet the criteria in Table #1, or if the calculated pay factor for Air Content is less than 0.80……"

502.0503 Quality Assurance Method B - Rejection by Resident Change the first sentence to read: "For material represented by a verification test with test results failing to meet the criteria in Table #1, the Department will……"

502.0505 Resolution of Disputed Acceptance Test Results Combine the second and third sentence to read: "Circumstances may arise, however, where the Department may ……"

502.10 Forms and False work

D. Removal of Forms and False work 1., First paragraph; first, second, and third sentence; replace "forms" with "forms and false work"

502.11 Placing Concrete

G. Concrete Wearing Surface and Structural Slabs on Precast Superstructures Last paragraph; third sentence; replace "The temperature of the concrete shall not exceed 24° C [75° F} at the time of placement." with "The temperature of the concrete shall not exceed 24° C [75° F} at the time the concrete is placed in its final position."

502.15 Curing Concrete First paragraph; replace the first sentence with the following; "All concrete surfaces shall be kept wet with clean, fresh water for a curing period of at least 7 days after concrete placing, with the exception of vertical surfaces as provided for in Section 502.10 (D) - Removal of Forms and False work."

Second paragraph; delete the first two sentences.
Third paragraph; delete the entire paragraph which starts "When the ambient temperature…."
Fourth paragraph; delete "approved" to now read "…continuously wet for the entire curing period…"

Fifth paragraph; second sentence; change "…as soon as it is possible to do so without damaging the concrete surface." to "…as soon as possible."

Seventh paragraph; first sentence; change "…until the end of the curing period." to "…until the end of the curing period, except as provided for in Section 502.10(D) - Removal of Forms and False work."

502.19 Basis of Payment First paragraph, second sentence; add "pier nose armor" to the list of items included in the contract price for concrete.

SECTION 503
REINFORCING STEEL

503.06 Placing and Fastening Change the second paragraph, first sentence from: "All tack welding shall be done in accordance with Section 504, Structural Steel." to "All tack welding shall be done in accordance with AWS D1.4 Structural Welding Code - Reinforcing Steel."

SECTION 504
STRUCTURAL STEEL

504.09 Facilities for Inspection Add the follow as the last paragraph: "Failure to comply with the above requirements will be consider to be a denial to allow access to work by the Contractor. The Department will reject any work done when access for inspection is denied."

504.18 Plates for Fabricated Members Change the second paragraph, first sentence from: "…ASTM A 898/A 898 M…" to "…ASTM A 898/A 898 M or ASTM A 435/A 435 M as applicable and…"

504.31 Shop Assembly Add the following as the last sentence: "The minimum assembly length shall include bearing centerlines of at least two substructure units."

504.64 Non Destructive Testing-Ancillary Bridge Products and Support Structures Change the third paragraph, first sentence from "One hundred percent…" to "Twenty five percent…"

SECTION 535
PRECAST, PRESTRESSED CONCRETE SUPERSTRUCTURE

535.02 Materials Change "Steel Strand for Concrete Reinforcement" to "Steel Strand." Add the following to the beginning of the third paragraph; "Concrete shall be Class P conforming to the requirements in this section. 28 day compressive strength shall be as stated on the plans. Coarse aggregate…."

535.05 Inspection Facilities Add the follow as the last paragraph: "If the above requirements are not met, the Contractor shall be considered to be in violation of Standard Specification 104.2.5 – Right to Inspect Work. All work occurring during a violation of this specification will be rejected."

535.26 Lateral Post-Tensioning Replace the first paragraph; "A final tension…" with "Overstressing strands for setting losses cannot be accomplished for chuck to chuck lengths of 7.6 m [25 ft] and less. In such instances, refer to the Plans for all materials and methods. Otherwise, post-tensioning shall be in accordance with PCI standards and shall provide the anchorage force noted in the Plans. The applied jacking force shall be no less than 100% of the design jacking force."

SECTION 603
PIPE CULVERTS AND STORM DRAINS

603.0311 Corrugated Polyethylene Pipe for Option III Replace the Minimum Mandrel Diameter Table with the following:

Nominal Size US Customary (in)	Minimum Mandrel Diameter (in)	Nominal Size Metric (mm)	Minimum Mandrel Diameter (mm)
12	11.23	300	280.73
15	14.04	375	350.91
18	16.84	450	421.09
24	22.46	600	561.45
30	28.07	750	701.81

36	33.69	900	842.18
42	39.30	1050	982.54
48	44.92	1200	1122.90

SECTION 604
MANHOLES, INLETS, AND CATCH BASINS

604.02 Materials Add the following:

"Tops and Traps	712.07
Corrugated Metal Units	712.08
Catch Basin and Manhole Steps	712.09"

SECTION 605
UNDERDRAINS

605.05 Underdrain Outlets Make the following change:

In the first paragraph, second sentence, delete the words "metal pipe".

SECTION 606
GUARDRAIL

606.02 Materials Delete the entire paragraph which reads "The sole patented supplier of multiple mailbox…." and replace with "Acceptable multiple mailbox assemblies shall be listed on the Department's Approved Products List and shall be NCHRP 350 tested and approved."
Delete the entire paragraph which reads "Retroreflective beam guardrail delineators…." and replace with "Reflectorized sheeting for Guardrail Delineators shall meet the requirements of Section 719.01 - Reflective Sheeting. Delineators shall be fabricated from high-impact, ultraviolet and weather resistant thermoplastic.

606.09 Basis of Payment First paragraph; delete the second and third sentence in their entirety and replace with "Butterfly-type guardrail reflectorized delineators shall be mounted on all W-beam guardrail at an interval of every 10 posts [62.5 ft] on tangents sections and every 5 posts [31.25 ft] on curved sections as directed by the Resident. On divided highways, the delineators shall be yellow on the left hand side and silver/white on the right hand side. On two-way roadways, the delineators shall be silver/white on the right hand side. All delineators shall have retroreflective sheeting applied to only the traffic facing side. Reflectorized guardrail delineators will not be paid for directly, but will be considered incidental to the guardrail items."

SECTION 609
CURB

609.04 Bituminous Curb f., Delete the requirement "Color Natural (White)"

SECTION 610

STONE FILL, RIPRAP, STONE BLANKET, AND STONE DITCH PROTECTION

Add the following paragraph to Section 610.02:
"Materials shall meet the requirements of the following Sections of Special Provision 703:

Stone Fill	703.25
Plain and Hand Laid Riprap	703.26
Stone Blanket	703.27
Heavy Riprap	703.28
Definitions	703.32"

Add the following paragraph to Section 610.032.a.
"Stone fill and stone blanket shall be placed on the slope in a well-knit, compact and uniform layer. The surface stones shall be chinked with smaller stone from the same source."

Add the following paragraph to Section 610.032.b:
"Riprap shall be placed on the slope in a well-knit, compact and uniform layer. The surface stones shall be chinked with smaller stone from the same source."

Add the following to Section 610.032: "Section 610.032.d. The grading of riprap, stone fill, stone blanket and stone ditch protection shall be determined by the Resident by visual inspection of the load before it is dumped into place, or, if ordered by the Resident, by dumping individual loads on a flat surface and sorting and measuring the individual rocks contained in the load. A separate, reference pile of stone with the required gradation will be placed by the Contractor at a convenient location where the Resident can see and judge by eye the suitability of the rock being placed during the duration of the project. The Resident reserves the right to reject stone at the job site or stockpile, and in place. Stone rejected at the job site or in place shall be removed from the site at no additional cost to the Department."

SECTION 615
LOAM

615.02 Materials Make the following change:

Organic Content	Percent by Volume
Humus	"5% - 10%", as determined by Ignition Test

SECTION 618
SEEDING

618.01 Description Change the first sentence to read as follows: "This work shall consist of furnishing and applying seed ….." Also remove ",and cellulose fiber mulch" from 618.01(a).
618.03 Rates of Application In 618.03(a), remove the last sentence and replace with the following: "These rates shall apply to Seeding Method 2, 3, and Crown Vetch."

In 618.03(c) "1.8 kg [4 lb]/unit." to "1.95 kg [4 lb]/unit."

618.09 Construction Method In 618.09(a) 1, sentence two, replace "100 mm [4 in]" with "25 mm [1 in] (Method 1 areas) and 50 mm [2 in] (Method 2 areas)"

618.15 Temporary Seeding Change the Pay Unit from Unit to Kg [lb].

SECTION 620
GEOTEXTILES

620.03 Placement Section (c)

Title: Replace "Non-woven" in title with "Erosion Control".
First Paragraph: Replace first word "Non-woven" with "Woven monofilament".
Second Paragraph: Replace second word "Non-woven" with "Erosion Control".

620.07 Shipment, Storage, Protection and Repair of Fabric Section (a)

Replace the second sentence with the following: "Damaged geotextiles, as identified by the Resident, shall be repaired immediately."

620.09 Basis of Payment

Pay Item 620.58: Replace "Non-woven" with "Erosion Control"
Pay Item 620.59: Replace "Non-woven" with "Erosion Control"

SECTION 621
LANDSCAPING

621.0036 Establishment Period In paragraph 4 and 5, change "time of Final Acceptance" to "end of the period of establishment". In Paragraph 7, change "Final Acceptance date" to ""end of the period of establishment" and change "date of Final Acceptance" to "end of the period of establishment".

SECTION 626
HIGHWAY SIGNING

626.034 Concrete Foundations Add to the following to the end of the second paragraph: "Pre-cast and cast-in-place foundations shall be warranteed against leaning and corrosion for two years after the project is completed. If the lean is greater than 2 degrees from normal or the foundation is spalling within the first two years, the Contractor shall replace the foundation at no extra cost."

SECTION 627
PAVEMENT MARKINGS

627.10 Basis of Payment Add to the following to the end of the third paragraph: "If allowed by Special Provision, the Contractor may utilize Temporary Bi-Directional Yellow and White(As required) Delineators as temporary pavement marking lines and paid for at the contract lump sum price. Such payment will include as many applications as required and removal."

SECTION 637
DUST CONTROL

637.06 Basis of Payment Add the following after the second sentence of the third paragraph: "Failure by the Contractor to follow Standard Specification or Special Provision - Section 637 and/or the Contractor's own Soil Erosion and Pollution Control Plan concerning Dust Control and/or the Contractor's own Traffic Control Plan concerning Dust Control and/or visible evidence of excessive dust problems, as determined by the Resident, will result in a reduction in payment, computed by reducing the Lump Sum Total by 5% per occurrence per day. The Department's Resident or any other representative of the Department reserves the right to suspend the work at any time and request a meeting to discuss violations and remedies. The Department shall not be held responsible for any delay in the work due to any suspension under this item. Additional penalties may also be assessed in accordance with Special Provision 652 - Work Zone Traffic Control and Standard Specification 656 - Temporary Soil Erosion and Water Pollution Control."

SECTION 639
ENGINEERING FACILITIES

639.04 Field Offices Change the forth to last paragraph from: "The Contractor shall provide a fully functional desktop copier…" to "….desktop copier/scanner…"

Description Change "Floor Area" to "Floor Area (Outside Dimension)". Change Type B floor area from "15 (160)" to "20 (217)".

639.09 Telephone Paragraph 1 is amended as follows:
"The contractor shall provide **two** telephone lines and two telephones,…."

Add- "In addition the contractor will supply one computer broadband connection, modem lease and router. The router shall have wireless access and be 802.11n or 802.11g capable and wireless. The type of connection supplied will be contingent upon the availability of services (i.e. DSL or Cable Broadband). It shall be the contractor's option to provide dynamic or static IP addresses through the service. **The selected service will have a minimum downstream connection of 1.5 Mbps and 384 Kbps upstream.** The contractor shall be responsible for the installation charges and all reinstallation charges following suspended periods. Monthly service and maintenance charges shall be billed by the Internet Service Provider (ISP) directly to the contractor."

SECTION 652
MAINTENANCE OF TRAFFIC

652.2.3 Flashing Arrow Board Delete the existing 5 paragraphs and replace with the following: Flashing Arrow Panels (FAP) must be of a type that has been submitted to AASHTO's National Transportation Product Evaluation Program (NTPEP) for evaluation and placed on the Maine Department of Transportations' Approved Products List of Portable Changeable Message Signs & Flashing Arrow Panels.

FAP units shall meet requirements of the current Manual on Uniform Traffic Control Devices

(MUTCD) for Type "C" panels as described in Section 6F.56 - Temporary Traffic Control Devices. An FAP shall have matrix of a minimum of 15 low-glare, sealed beam, Par 46 elements capable of either flashing or sequential displays as well as the various operating modes as described in the MUTCD, Chapter 6-F. If an FAP consisting of a bulb matrix is used, each element should be recess-mounted or equipped with an upper hood of not less than 180 degrees. The color presented by the elements shall be yellow.

FAP elements shall be capable of at least a 50 percent dimming from full brilliance. Full brilliance should be used for daytime operation and the dimmed mode shall be used for nighttime operation. FAP shall be at least 2.4 M x 1.2 M [96" x 48"] and finished in non-reflective black. The FAP shall be interpretable for a distance not less than 1.6 km [1 mile].

Operating modes shall include, flashing arrow, sequential arrow, sequential chevron, flashing double arrow, and flashing caution. In the three arrow signals, the second light from the arrow point shall not operate.

The minimum element on-time shall be 50 percent for the flashing mode, with equal intervals of 25 percent for each sequential phase. The flashing rate shall be not less than 25 nor more than 40 flashes per minute. All on-board circuitry shall be solid state.

Primary power source shall be 12 volt solar with a battery back-up to provide continuous operation when failure of the primary power source occurs, up to 30 days with fully charged batteries. Batteries must be capable of being charged from an onboard 110 volt AC power source and the unit shall be equipped with a cable for this purpose.

Controller and battery compartments shall be enclosed in lockable, weather-tight boxes.
The FAP shall be mounted on a pneumatic-tired trailer or other suitable support for hauling to various locations, as directed. The minimum mounting height of an arrow panel should be 2.1 M [7 feet] from the roadway to the bottom of the panel.

The face of the trailer shall be delineated on a permanent basis by affixing retro-reflective material, known as conspicuity material, in a continuous line as seen by oncoming drivers.

A portable changeable message sign may be used to simulate an arrow panel display."

652.2.4 Other Devices Delete the last paragraph and add the following:
"652.2.5 Portable Changeable Message Sign Trailer mounted Portable Changeable Message Signs (PCMS) must be of a type that has been submitted to AASHTO's National Transportation Product Evaluation Program (NTPEP) for evaluation and placed on the Maine Department of Transportations' Approved Products List of Portable Changeable Message Signs & Flashing Arrow Panels. The PCMS unit shall meet or exceed the current specifications of the Manual on Uniform Traffic Control Devices (MUTCD), 6F.55.

The front face of the sign should be covered with a low-glare protective material. The color of the LED elements shall be amber on a black background. The PCMS should be visible from a distance of 0.8 km [0.5 mile] day and night and have a minimum 15º viewing angle. Characters must be legible from a distance of at least 200 M [650 feet].

The message panel should have adjustable display rates (minimum of 3 seconds per phase), so that the entire message can be read at least twice at the posted speed, the off-peak 85th-percentile speed prior to work starting, or the anticipated operating speed. Each message shall consist of either one or two phases. A phase shall consist of up to eight characters per line. The unit must be capable of displaying at least three lines of text with eight characters per line. Each character shall be 457 mm [18"] high. Each character module shall use at least a five wide and seven high pixel matrix. The text of the messages shall not scroll or travel horizontally or vertically across the face of the sign.

Units shall automatically adjust their brightness under varying light conditions to maintain legibility.

The control system shall include a display screen upon which messages can be reviewed before being displayed on the message sign. The control system shall be capable of maintaining memory when power is unavailable. Message must be changeable with either a notebook computer or an on-board keypad. The controller shall have the capability to store a minimum of 200 user-defined and 200 pre-programmed messages. Controller and battery compartments shall be enclosed in lockable, weather-tight boxes.

PCMS units shall have the capability of being made programmable by means of wireless communications. PCMS units shall also be fully capable of having an on-board radar system installed if required for a particular application.

PCMS' primary power source shall be solar with a battery back-up to provide continuous operation when failure of the primary power source occurs. Batteries must be capable of being charged from a 110 volt AC power source. The unit must also be capable of being operated solely from a 110 volt AC power source and be equipped with a cable for this purpose.

The PCMS shall be mounted on a trailer in such a way that the bottom of the message sign panel shall be a minimum of 2.1 M [7 ft] above the roadway in urban areas and 1.5 M [5 ft] above the roadway in rural areas when it is in the operating mode. PCMS trailers should be of a heavy duty type with a 51 mm [2"] ball hitch and a minimum of four leveling jacks (at each corner). The sign shall be capable of being rotated 360° relative to the trailer. The face of the trailer shall be delineated on a permanent basis by affixing retro-reflective material, known as conspicuity material, in a continuous line as seen by oncoming drivers."

652.3.3 Submittal of Traffic Control Plan In item e. change "A list of all certified flaggers…" to "A list of all the Contractor's certified flaggers…"

Change a. in the list of requirements to: "a. The name, telephone number, and other contact numbers (cellular phone, pager, if any) of the Contractor's Traffic Control Supervisor (the person with overall responsibility for following the TCP), who has received Work Zone Traffic Control Training commensurate with the level of responsibility shown in the requirements of the Contract, and who is empowered to immediately resolve any work zone traffic control deficiencies or issues. Provide documentation that the Traffic Control Supervisor has completed a Work Zone Traffic Control Training Course (AGC, ATSSA, or other industry-recognized training), and a Supervisory refresher training every 5 years thereafter. Submit the course name, training entity, and date of training.

Traffic Control Training Course curriculum must be based on the standards and guidelines of the MUTCD and must include, at a minimum, the following:

1. Parts of Temporary Traffic Control Zone
2. Appropriate use and spacing of signs
3. Use and spacing of channelizing devices
4. Flagging basics
5. Typical examples and applications

The Traffic Control Supervisor, or designee directly overseeing physical installation, adjustment, and dismantling of work zone traffic control, will ensure all personnel performing those activities are trained to execute the work in a safe and proper manner, in accordance with their level of decision-making and responsibility."

Add the follow to the list of requirements: "k. The plan for unexpected nighttime work along with a list of emergency nighttime equipment available on-site."

In the last paragraph add the following as the second sentence: "The Department will review and provide comments to the Contractor within 14 days of receipt of the TCP." Add the following as the last sentence: "The creation and modification of the TCP will be considered incidental to the related 652 items."

652.3.5 Installation of Traffic Control Devices In the first paragraph, first sentence; change "Signs shall be erected…" to "Portable signs shall be erected.." In the third sentence; change "Signs must be erected so that the sign face…" to "Post-mounted signs must also be erected so that the sign face…"

652.4 Flaggers Replace the first paragraph with the following; "The Contractor shall furnish flaggers as required by the TCP or as otherwise specified by the Resident. All flaggers must have successfully completed a flagger test approved by the Department and administered by a Department-approved Flagger-Certifier who is employing that flagger. All flaggers must carry an official certification card with them while flagging that has been issued by their employer. Flaggers shall wear safety apparel meeting ANSI 107-2004 Class 2 risk exposure that clearly identifies the wearer as a person, and is visible at a minimum distance of 300 m [1000 ft], and shall wear a hardhat with 360° retro-reflectivity. For nighttime conditions, Class 3 apparel, meeting ANSI 107-2004, shall be worn along with a hardhat with 360° retro-reflectivity. Retro-reflective or flashing SLOW/STOP paddles shall be used, and the flagger station shall be illuminated to assure visibility in accordance with 652.6.2."

Second paragraph, first sentence; change "…have sufficient distance to stop before entering the workspace." to "…have sufficient distance to stop at the intended stopping point." Third sentence; change "At a spot obstruction…" to "At a spot obstruction with adequate sight distance,…"

Fourth paragraph, delete and replace with "Flaggers shall be provided as a minimum, a 10 minute break, every 2 hours and a 30 minute or longer lunch period away from the work station. Flaggers may only receive 1 unpaid break per day; all other breaks must be paid. Sufficient certified flaggers shall be available onsite to provide for continuous flagging operations during break periods. If the flaggers are receiving the appropriate breaks, breaker flagger(s) shall be paid starting 2 hours after the work begins and ending 2 hours before the work ends. A maximum of 1 breaker per 6 flaggers will be paid. (1 breaker flagger for 2 to 6 flaggers, 2 breaker flaggers for 7 to 12 flaggers, etc)"

Add the following:
"652.5.1 Rumble Strip Crossing When lane shifts or lane closures require traffic to cross a permanent longitudinal rumble strip for 7 calendar days or less, the Contractor shall install warning signs that read "RUMBLE STRIP CROSSING" with a supplemental Motorcycle Plaque, (W8-15P).

When lane shifts or lane closures require traffic to cross a permanent longitudinal rumble strip for more than 7 calendar days, the Contractor shall pave in the rumble strips in the area that traffic will cross, unless otherwise directed by the Resident. Rumble strips shall be replaced prior to the end of the project, when it is no longer necessary to cross them."

652.6 Nightwork Delete this section entirely and replace with the following:
"652.6.1 Daylight Work Times Unless otherwise described in the Contract, the Contractor is allowed to commence work and end work daily according to the Sunrise/Sunset Table at: http://www.sunrisesunset.com/usa/Maine.asp . If the Project town is not listed, the closest town on the list will be used as agreed at the Preconstruction Meeting. Any work conducted before sunrise or after sunset will be considered Night Work.

652.6.2 Night Work When Night Work occurs (either scheduled or unscheduled), the Contractor shall provide and maintain lighting on all equipment and at all work stations.

The lighting facilities shall be capable of providing light of sufficient intensity to permit good workmanship, safety and proper inspection at all times. The lighting shall be cut off and arranged on stanchions at a height that will provide perimeter lighting for each piece of equipment and will not interfere with traffic, including commercial vehicles, approaching the work site from either direction.

The Contractor shall have available portable floodlights for special areas.

The Contractor shall utilize padding, shielding or other insulation of mechanical and electrical equipment, if necessary, to minimize noise, and shall provide sufficient fuel, spare lamps, generators, etc. to maintain lighting of the work site.

The Contractor shall submit, as a subset of the Traffic Control Plan, a lighting plan at the Preconstruction Conference, showing the type and location of lights to be used for night work. The Resident may require modifications be made to the lighting set up in actual field conditions.

Prior to beginning any Night Work, the Contractor shall furnish a light meter for the Residents use that is capable of measuring the range of light levels from 5 to 20 foot-candles.

Horizontal illumination, for activities on the ground, shall be measured with the photometer parallel to the road surface. For purposes of roadway lighting, the photometer is placed on the pavement. Vertical illumination, for overhead activities, shall be measured with the photometer perpendicular to the road surface. Measurements shall be taken at the height and location of the overhead activity.

Night Work lighting requirements:

Mobile Operations: For mobile-type operations, each piece of equipment (paver, roller, milling machine, etc) will carry indirect (i.e. balloon type) lights capable of producing at least 10 foot-candles of lighting around the work area of the equipment.

Fixed Operations: For fixed-type operations (flaggers, curb, bridge, pipes, etc.), direct (i.e. tower) lighting will be utilized capable of illuminating the work area with at least 10 foot-candles of light.

Hybrid Operations: For hybrid-type operations (guardrail, sweeping, Inslope excavation, etc.), either direct or indirect lighting may be utilized. The chosen lights must be capable of producing at least 10 foot-candles of light around the work area of the equipment
Inspection Operations: Areas required to be inspected by the Department will require a minimum of 5 foot-candles of lighting. This may be accomplished through direct or indirect means.

All workers shall wear safety apparel labeled as meeting the ANSI 107-2004 standard performance for Class 3 risk exposure.

The Contractor shall apply 2- inch wide retro-reflective tape, with alternating red and white segments, to outline the front back and sides of construction vehicles and equipment, to define their shape and size to the extent practicable. Pickup trucks and personal vehicles are exempt from this requirement. The Contractor shall furnish approved signs reading "Construction Vehicle - Keep Back" to be used on trucks hauling to the project when such signs are deemed necessary by the Resident. The signs shall be a minimum of 30 inches by 60 inches, Black and Orange, ASTM D 4956 - Type VII, Type VIII, or Type IX (prismatic).

All vehicles used on the project, including pickup trucks and personal vehicles, shall be equipped with amber flashing lights, visible from both front and rear, or by means of single, approved type, revolving, flashing or strobe lights mounted so as to be visible 360º. The vehicle flashing system shall be in continuous operation while the vehicle is on any part of the project.

The Resident or any other representative of the Department reserves the right to suspend the work at any time and request a meeting to discuss violations and remedies. The Department shall not be held responsible for any delay in the work due to any suspension under this item. Failure to follow the approved Lighting Plan will result in a Traffic Control violation.

Payment for lighting, vehicle mounted signs and other costs accrued because of night work will not be made directly but will be considered incidental to the related contract items."

652.8.2 Other Items Replace the first paragraph with the following: "The accepted quantities of flagger hours will be paid for at the contract unit price per hour for each flagging station occupied excluding lunch breaks, and for each approved breaker flagger. Overtime hours, as reported on the certified payrolls, will be paid an additional 30% of the bid price for 652.38. The computation and additional payment for overtime hours will occur during the project

close-out process and will be paid as additional hours of 652.38 to the nearest ¼ hour. The contract unit price shall be full compensation for hiring, transporting, equipping, supervising, and the payment of flaggers and all overhead and incidentals necessary to complete the work." Replace the last paragraph with the following: "There will be no payment made under any 652 pay items after the expiration of the adjusted total contract time."

SECTION 653
POLYSTYRENE PLASTIC INSULATION

653.05 Placing Backfill In the second sentence; change "…shall be not less than 150 mm [6 in] loose measure." to "…shall be not less than 250 mm [10 in] loose measure." In the third sentence; change "…crawler type bulldozer of not more than 390 kg/m^2 [80 lb/ft^2] ground contact pressure…" to "…crawler type bulldozer of not more than 4875 kg/m^2 [2000 lb/ft^2] ground contact pressure…"

653.06 Compaction In the last sentence; change "…not more than 390 kg/m^2 [80 lb/ft^2] ground contact…" to "…not more than 4875 kg/m^2 [2000 lb/ft^2] ground contact…"

SECTION 656
TEMPORARY SOIL EROSION AND WATER POLLUTION CONTROL

656.5.1 If Pay Item 656.75 Provided Replace the second paragraph with the following: "Failure by the Contractor to follow Standard Specification or Special Provision - Section 656 and/or the Contractor's own Soil Erosion and Water Pollution Control Plan (SEWPCP) will result in a violation letter and a reduction in payment as shown in the schedule below. The Department's Resident or any other representative of The Department reserves the right to suspend the work at any time and request a meeting to discuss violations and remedies. The Department shall not be held responsible for any delay in the work due to any suspension under this item.

ORIGINAL CONTRACT AMOUNT

From	Up to and	Amount of Penalty Damages per Violation		
More Than	Including	1st	2nd	3rd & Subsequent
$0	$1,000,000	$250	$500	$1,250
$1,000,000	$2,000,000	$500	$1,000	$2,500
$2,000,000	$4,000,000	$1,000	$2,000	$5,000
$4,000,000	and more	$2,000	$4,000	$10,000"

SECTION 701
STRUCTURAL CONCRETE RELATED MATERIALS

701.10 Fly Ash - Chemical Requirements Change all references from "ASTM C311" to "ASTM C114".

SECTION 703
AGGREGATES

703.05 Aggregate for Sand Leveling Change the percent passing the 9.5 mm [3/8 in] sieve from "85 – 10" to "85 – 100"

703.06 Aggregate for Base and Subbase Delete the first paragraph: "The material shall have…" and replace with "The material shall have a minimum degradation value of 15 as determined by Washington State DOT Test Method T113, Method of Test for Determination of Degradation Value (January 2009 version), except that the reported degradation value will be the result of testing a single specimen from that portion of a sample that passes the 12.5 mm [½ in] sieve and is retained on the 2.00 mm [No. 10] sieve, minus any reclaimed asphalt pavement used."

703.07 Aggregates for HMA Pavements Delete the forth paragraph: "The composite blend shall have…" and replace with "The composite blend, minus any reclaimed asphalt pavement used, shall have a Micro-Deval value of 18.0 or less as determined by AASHTO T 327. In the event the material exceeds the Micro Deval limit, a Washington Degradation test shall be performed. The material shall be acceptable if it has a value of 30 or more as determined by Washington State DOT Test Method T 113, Method of Test for Determination of Degradation Value (January 2009 version) except that the reported degradation value will be the result of testing a single composite specimen from that portion of the sample that passes the 12.5mm [1/2 inch] sieve and is retained on the 2.00mm [No 10] sieve, minus any reclaimed asphalt pavement used."

703.09 HMA Mixture Composition The coarse and fine aggregate shall meet the requirements of Section 703.07. The several aggregate fractions for mixtures shall be sized, graded, and combined in such proportions that the resulting composite blends will meet the grading requirements of the following table.

AGGREGATE GRADATION CONTROL POINTS

SIEVE SIZE	Nominal Maximum Aggregate Size---Control Points (Percent Passing)				
	TYPE 25 mm	TYPE 19 mm	TYPE 12.5 mm	TYPE 9.5 mm	TYPE 4.75 mm
	PERCENT BY WEIGHT PASSING - COMBINED AGGREGATE				
37.5 mm	100				
25 mm	90-100	100			
19 mm	-90	90-100	100		
12.5 mm		-90	90-100	100	100
9.5 mm		-	-90	90-100	95-100
4.75 mm		-	-	-90	80-100
2.36 mm	19-45	23-49	28-58	32-67	40 - 80
1.18 mm		-	-	-	-
600 µm		-	-	-	-
300 µm		-	-	-	-
75 µm	1-7	2-8	2-10	2-10	2-10

Gradation Classification---- The combined aggregate gradation shall be classified as coarse-graded when it passes below the Primary Control Sieve (PCS) control point as defined in the following table. All other gradations shall be classified as fine-graded.

GRADATION CLASSIFICATION

PCS Control Point for Mixture Nominal Maximum Aggregate Size (% passing)				
Nominal Maximum Aggregate Size	TYPE 25 mm	TYPE 19 mm	TYPE 12.5 mm	TYPE 9.5 mm
Primary Control Sieve	4.75 mm	4.75 mm	2.36 mm	2.36 mm
PCS Control Point (% passing)	40	47	39	47

If a Grading "D" mixture is allowed per Special Provision Section 403, it shall meet the following gradation and the aggregate requirements of Section 703.07.

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves
½ inch	100
⅜ inch	93-100
No. 4	60-80
No. 8	46-65
No. 16	25-55
No. 30	16-40
No. 50	10-30
No. 100	6-22
No. 200	3.0-8.0

703.18 Common Borrow Replace the first paragraph with the following: "Common borrow shall consist of earth, suitable for embankment construction. It shall be free from frozen material, perishable rubbish, peat, and other unsuitable material including material currently or previously contaminated by chemical, radiological, or biological agents unless the material is from a DOT project and authorized by DEP for use."

703.22 Underdrain Backfill Material Change the first paragraph from "…for Underdrain Type B…" to "…for Underdrain Type B and C…"

Replace subsections 703.25 through 703.28 with the following:
"703.25 Stone Fill Stones for stone fill shall consist of hard, sound, durable rock that will not disintegrate by exposure to water or weather. Stone for stone fill shall be angular and rough. Rounded, subrounded, or long thin stones will not be allowed. Stone for stone fill may be obtained from quarries or by screening oversized rock from earth borrow pits. The maximum allowable length to thickness ratio will be 3:1. The minimum stone size (10 lbs) shall have an average dimension of 5 inches. The maximum stone size (500 lbs) shall have a maximum dimension of approximately 36 inches. Larger stones may be used if approved by the Resident. Fifty percent of the stones by volume shall have an average dimension of 12 inches (200 lbs).

703.26 Plain and Hand Laid Riprap Stone for riprap shall consist of hard, sound durable rock that will not disintegrate by exposure to water or weather. Stone for riprap shall be angular and rough. Rounded, subrounded or long thin stones will not be allowed. The maximum

allowable length to width ratio will be 3:1. Stone for riprap may be obtained from quarries or by screening oversized rock from earth borrow pits. The minimum stone size (10 lbs) shall have an average dimension of 5 inches. The maximum stone size (200 lbs) shall have an average dimension of approximately 12 inches. Larger stones may be used if approved by the Resident. Fifty percent of the stones by volume shall have an average dimension greater than 9 inches (50 lbs).

703.27 Stone Blanket Stones for stone blanket shall consist of sound durable rock that will not disintegrate by exposure to water or weather. Stone for stone blanket shall be angular and rough. Rounded or subrounded stones will not be allowed. Stones may be obtained from quarries or by screening oversized rock from earth borrow pits. The minimum stone size (300 lbs) shall have minimum dimension of 14 inches, and the maximum stone size (3000 lbs) shall have a maximum dimension of approximately 66 inches. Fifty percent of the stones by volume shall have average dimension greater than 24 inches (1000 lbs).

703.28 Heavy Riprap Stone for heavy riprap shall consist of hard, sound, durable rock that will not disintegrate by exposure to water or weather. Stone for heavy riprap shall be angular and rough. Rounded, subrounded, or thin, flat stones will not be allowed. The maximum allowable length to width ratio will be 3:1. Stone for heavy riprap may be obtained from quarries or by screening oversized rock from earth borrow pits. The minimum stone size (500 lbs) shall have minimum dimension of 15 inches, and at least fifty percent of the stones by volume shall have an average dimension greater than 24 inches (1000 lbs)."

Add the following paragraph:
"703.32 Definitions (ASTM D 2488, Table 1).
Angular: Particles have sharp edges and relatively plane sides with unpolished surfaces
Subrounded: Particles have nearly plane sides but have well-rounded corners and edges
Rounded: Particles have smoothly curved sides and no edges"

SECTION 706
NON-METALLIC PIPE

706.06 Corrugated Polyethylene Pipe for Underdrain, Option I and Option III Culvert Pipe Change the first sentence from "…300 mm diameters to 900 mm" to "…300 mm diameters to 1200 mm" Delete, in its' entirety, the last sentence which begins "This pipe and resins…" and replace with the following; "Manufacturers of corrugated polyethylene pipe must participate in, and maintain compliance with, AASHTO's National Transportation Product Evaluation Program (www.ntpep.org) which audits producers of plastic pipe. A certificate of compliance must be provided with each shipment."

SECTION 708
PAINTS AND PERSERVATIVES

708.03 Pavement Marking Paint Change the first sentence from "…AASHTO M248" to "…the Maine DOT Maintenance Fast-Dry Water-Based Traffic Paint on file at the Traffic Section in Augusta". Delete, in its' entirety, the last sentence.

SECTION 709
REINFORCING STEEL AND WELDED STEEL WIRE FABIC

709.03 Steel Strand Change the second paragraph from "…shall be 12mm [½ inch] AASHTO M203M/M203 (ASTM A416/A416M)…" to "…shall be 15.24 mm [0.600 inch] diameter AASHTO M203 (ASTM A416)…"

SECTION 710
FENCE AND GUARDRAIL

710.03 Chain Link Fabric Add the following sentence: "Chain Link fabric for PVC coated shall conform to the requirements of AASHTO M181, Type IV-Class B."

710.04 Metal Beam Rail Replace with the following: "Galvanized steel rail elements shall conform to the requirements of AASHTO M 180, Class A, Type II.

When corrosion resistant steel is specified, rail shall conform to AASHTO M 180, Class A, Type IV. Beams of corrosion resistant steel shall not be painted or galvanized. They shall be so handled and stored that the traffic face of these beams, used in a continuous run of guardrail, shall not show a distinctive color differential.

When metal beam rail is to be installed on a curve having a radius of curvature of 150 ft. or less, the beam sections shall be fabricated on an arc to the required radius and permanently stamped or embossed with the designated radius.

The engineer may take one piece of guardrail, a backup plate, and end or buffer section from each 200 pieces in a lot, or from each lot if less than 200 pieces are included therein for determination of compliance with specification requirements. If one piece fails to conform to the requirements of this specification, two other pieces shall be tested. If either of these pieces fails to conform to the requirements of this specification, the lot of material represented by these samples shall be rejected. A lot shall be considered that quantity of material offered for inspection at one time that bears the same heat and coating identification."

710.07 Guardrail Posts Section b. change "…AASHTO M183/M183M…" to "…AASHTO M 270M/M 270 Grade 250 (36)…"

SECTION 712
MISCELLANEOUS HIGHWAY MATERIALS

712.04 Stone Curbing and Edging Delete the existing and replace with the following: "Stone for curbing and edging shall be approved granite from acceptable sources. The stone shall be hard and durable, predominantly gray in color, free from seams that would be likely to impair its structural integrity, and of a smooth splitting character. Natural grain size and color variations characteristic of the source deposit will be permitted. Such natural variations may include bands or clusters of mineral crystallization provided they do not impair the structural integrity of the curb stone. The Contractor shall submit for approval the name of the quarry that is the proposed source of the granite for curb materials along with full scale color photos of the granite. Such submission shall be made sufficiently in advance of ordering so that the Resident may have an opportunity to judge the stone, both as to quality and appearance. Samples of curbing shall be submitted for approval only when requested by the Resident. The dimensions, shape, and other details shall be as shown on the plans."

712.06 Precast Concrete Units In the first paragraph, change "…ASTM C478M…" to "…AASHTO M199…" Delete the second paragraph and replace with the following; "Approved structural fibers may be used as a replacement of 6 x 6 #10 gauge welded wire fabric when used at an approved dosage rate for the construction of manhole and catch basin units. The material used shall be one of the products listed on the Maine Department of Transportation's Approved Product List of Structural Fiber Reinforcement." Delete the fifth paragraph and replace with the following; "The concrete mix design shall be approved by the Department. Concrete shall contain 6% air content, plus or minus 1½% tolerance when tested according to AASHTO T152. All concrete shall develop a minimum compressive strength of 28 MPa [4000 psi] in 28 days when tested according to AASHTO T22. The absorption of a specimen, when tested according to AASHTO T280, Test Method "A", shall not exceed nine percent of the dry mass."

Add the following:
"712.07 Tops, and Traps These metal units shall conform to the plan dimensions and to the following specification requirements for the designated materials.

Gray iron or ductile iron castings shall conform to the requirements of AASHTO M306 unless otherwise designated."

712.08 Corrugated Metal Units The units shall conform to plan dimensions and the metal to AASHTO M36/M36M. Bituminous coating, when specified, shall conform to AASHTO M190 Type A.

712.09 Catch Basin and Manhole Steps Steps for catch basins and for manholes shall conform to ASTM C478M [ASTM C478], Section 13 for either of the following material:

(a) Aluminum steps-ASTM B221M, [ASTM B211] Alloy 6061-T6 or 6005-T5.

(b) Reinforced plastic steps Steel reinforcing bar with injection molded plastic coating copolymer polypropylene. Polypropylene shall conform to ASTM D 4101.

712.23 Flashing Lights Flashing Lights shall be power operated or battery operated as specified.

(a) Power operated flashing lights shall consist of housing, adapters, lamps, sockets, reflectors, lens, hoods and other necessary equipment designed to give clearly visible signal indications within an angle of at least 45 degrees and from 3 to 90 m [10 to 300 ft] under all light and atmospheric conditions.

Two circuit flasher controllers with a two-circuit filter capable of providing alternate flashing operations at the rate of not less than 50 nor more than 60 flashes per minute shall be provided.

The lamps shall be 650 lumens, 120 volt traffic signal lamps with sockets constructed to properly focus and hold the lamp firmly in position.
The housing shall have a rotatable sun visor not less than 175 mm [7 in] in length designed to shield the lens.

Reflectors shall be of such design that light from a properly focused lamp will reflect the light rays parallel. Reflectors shall have a maximum diameter at the point of contact with the lens of approximately 200 mm [8 in].

The lens shall consist of a round one-piece convex amber material which, when mounted, shall have a visible diameter of approximately 200 mm [8 in]. They shall distribute light and not diffuse it. The distribution of the light shall be asymmetrical in a downward direction. The light distribution of the lens shall not be uniform, but shall consist of a small high intensity portion with narrow distribution for long distance throw and a larger low intensity portion with wide distribution for short distance throw. Lenses shall be marked to indicate the top and bottom of the lens.

(b) Battery operated flashing lights shall be self- illuminated by an electric lamp behind the lens. These lights shall also be externally illuminated by reflex-reflective elements built into the lens to enable it to be seen by reflex-reflection of the light from the headlights of oncoming traffic. The batteries must be entirely enclosed in a case. A locking device must secure the case. The light shall have a flash rate of not less than 50 nor more than 60 flashes per minute from minus 30 °C [minus 20 °F] to plus 65 °C [plus 150 °F]. The light shall have an on time of not less than 10 percent of the flash cycle. The light beam projected upon a surface perpendicular to the axis of the light beam shall produce a lighted rectangular projection whose minimum horizontal dimension shall be 5 degrees each side of the horizontal axis. The effective intensity shall not have an initial value greater than 15.0 candelas or drop below 4.0 candelas during the first 336 hours of continuous flashing. The illuminated lens shall appear to be uniformly bright over its entire illuminated surface when viewed from any point within an angle of 9 degrees each side of the vertical axis and 5 degrees each side of the horizontal axis. The lens shall not be less than 175 mm [7 in] in diameter including a reflex-reflector ring of 13 mm [½ in] minimum width around the periphery. The lens shall be yellow in color and have a minimum relative luminous transmittance of 0.440 with a luminance of 2854° Kelvin. The lens shall be one-piece construction. The lens material shall be plastic and meet the luminous transmission requirements of this specification. The case containing the batteries and circuitry shall be constructed of a material capable of withstanding abuse equal to or greater than 1.21 mm thick steel [No. 18 U.S. Standard Gage Steel]. The housing and the lens frame, if of metal shall be properly cleaned, degreased and pretreated to promote adhesion. It shall be given one or more coats of enamel which, when dry shall completely obscure the metal. The enamel coating shall be of such quality that when the coated case is struck a light blow with a sharp tool, the paint will not chip or crack and if scratched with a knife will not powder. The case shall be so constructed and closed as to exclude moisture that would affect the proper operation of light. The case shall have a weep hole to allow the escape of moisture from condensation. Photoelectric controls, if provided, shall keep the light operating whenever the ambient light falls below 215 lx [20 foot candles]. Each light shall be plainly marked as to the manufacturer's name and model number.

If required by the Resident, certification as to conformance to these specifications shall be furnished based on results of tests made by an independent testing laboratory. All lights are subject to random inspection and testing. All necessary random samples shall

be provided to the Resident upon request without cost to the Department. All such samples shall be returned to the Contractor upon completion of the tests.

712.32 Copper Tubing Copper tubing and fittings shall conform to the requirements of ASTM B88M Type A [ASTM B88, Type K] or better.

712.33 Non-metallic Pipe, Flexible Non-metallic pipe and pipe fittings shall be acceptable flexible pipe manufactured from virgin polyethylene polymer suitable for transmitting liquids intended for human or animal consumption.

712.34 Non-metallic Pipe, Rigid Non-metallic pipe shall be Schedule 40 polyvinylchloride (PVC) that meets the requirement of ASTM D1785. Fittings shall be of the same material.

712.341 Metallic Pipe Metallic pipe shall be ANSI, Standard B36.10, Schedule 40 steel pipe conforming to the requirements of ASTM A53 Types E or S, Grade B. End plates shall be steel conforming to ASTM A36/A36M.

Both the sleeve and end plates shall be hot dip galvanized. Pipe sleeve splices shall be welded splices with full penetration weld before galvanizing.

712.35 Epoxy Resin Epoxy resin for grouting or sealing shall consist of a mineral filled thixotropic, flexible epoxy resin having a pot life of approximately one hour at 10°C [50°F]. The grout shall be an approved product suitable for cementing steel dowels into the preformed holes of curb inlets and adjacent curbing. The sealant shall be an approved product, light gray in color and suitable for coating the surface.

712.36 Bituminous Curb The asphalt cement for bituminous curb shall be of the grade required for the wearing course, or shall be Viscosity Grade AC-20 meeting the current requirements of Subsection 702.01 Asphalt Cement. The aggregate shall conform to the requirements of Subsection 703.07. The coarse aggregate portion retained on the 2.36 mm [No. 8] sieve may be either crushed rock or crushed gravel.

The mineral constituents of the bituminous mixture shall be sized and graded and combined in a composite blend that will produce a stable durable curbing with an acceptable texture.

Bituminous material for curb shall meet the requirements of Section 403 - Hot Bituminous Pavement.

712.37 Precast Concrete Slab Portland cement concrete for precast slabs shall meet the requirements of Section 502 - Structural Concrete, Class A.

The slabs shall be precast to the dimension shown on the plans and cross section and in accordance with the Standard Detail plans for Concrete Sidewalk Slab. The surface shall be finished with a float finish in accordance with Subsection 502.14(c). Lift devices of sufficient strength to hold the slab while suspended from cables shall be cast into the top or back of the slab.

712.38 Stone Slab Stone slabs shall be of granite from an acceptable source, hard, durable, predominantly gray in color, free from seams which impair the structural integrity and be of smooth splitting character. Natural color variations characteristic of the deposit will be permitted. Exposed surfaces shall be free from drill holes or indications of drill holes. The granite slabs in any one section of backslope must be all the same finish.

The granite slabs shall be scabble dressed or sawed to an approximately true plane having no projections or depressions over 13 mm [½ in] under a 600 mm [2 ft] straightedge or over 25 mm [1 in] under a 1200 mm [4 ft] straightedge. The arris at the intersection of the top surface and exposed front face shall be pitched so that the arris line is uniform throughout the length of the installed slabs. The sides shall be square to the exposed face unless the slabs are to be set on a radius or other special condition which requires that the joints be cut to fit, but in any case shall be so finished that when the stones are placed side by side no space more than 20 mm [3/4 in] shall show in the joint for the full exposed height.

Liftpin holes in all sides will be allowed except on the exposed face.

SECTION 717
ROADSIDE IMPROVEMENT MATERIAL

717.03 C. Method #3 - Roadside Mixture #3 Change the seed proportions to the following:

Crown Vetch	25%
Perennial Lupine	25%
Red Clover	12.5%
Annual Rye	37.5%

717.05 Mulch Binder Change the third sentence to read as follows:

"Paper fiber mulch may be used as a binder at the rate of 2.3 kg/unit [5 lb/unit]."

SECTION 720
STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES, AND TRAFFIC SIGNALS

720.08 U-Channel Posts Change the first sentence from "…, U-Channel posts…" to "…, Rib Back U-Channel posts…"

SECTION 722
GEOTEXTILES

722.01 Stabilization/Reinforcement Geotextile Add the following to note #3; "The strengths specified in the columns labeled"<50%" and "≥ 50%" refer to the elongation at which the geotextile material was tested. For example; if a fabric is tested at 15% elongation then it must meet or exceed the minimum strength shown in the "<50%" column. Submittals must include the percent elongation at which the material was tested."

722.02 Drainage Geotextile Add the following to note #3; “The strengths specified in the columns labeled”<50%” and “≥ 50%” refer to the elongation at which the geotextile material was tested. For example; if a fabric is tested at 15% elongation then it must meet or exceed the minimum strength shown in the “<50%” column. Submittals must include the percent elongation at which the material was tested.”

722.01 Erosion Control Geotextile Add the following note to Elongation in the Mechanical Property Table; “The strengths specified in the columns labeled”<50%” and “≥ 50%” refer to the elongation at which the geotextile material was tested. For example; if a fabric is tested at 15% elongation then it must meet or exceed the minimum strength shown in the “<50%” column. Submittals must include the percent elongation at which the material was tested.”

STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION
17 STATE HOUSE STATION AUGUSTA, MAINE 04333-0017

DEPARTMENT ORDER

IN THE MATTER OF

MAINE DEPARTMENT OF TRANSPORTATION	) SITE LOCATION OF DEVELOPMENT ACT
Augusta, Kennebec County	) GENERAL PERMIT
FLEET SERVICE CENTER	) NATURAL RESOURCES PROTECTION ACT
L-26076-TG-A-N (approval)	) FRESHWATER WETLANDS
L-26076-TP-B-N (approval)	) WATER QUALITY CERTIFICATION
	) FINDINGS OF FACT AND ORDER

In consideration of the Notice of Intent, dated September 6, 2013, with supportive data and other related materials on file for coverage under the General Permit for the Maine Department of Transportation, issued by the Department on February 19, 2013, and pursuant to the provisions of 38 M.R.S.A. Sections 480-A et seq. and Section 401 of the Federal Water Pollution Control Act, the Department of Environmental Protection has considered the application of the MAINE DEPARTMENT OF TRANSPORTATION with the supportive data, agency review comments, and other related materials on file and FINDS THE FOLLOWING FACTS:

1. PROJECT DESCRIPTION:

A. History of Project: In Department Order #L-17197-25-A-N, dated April 7, 1992, the Department approved existing development and the proposed expansion of commercial development on Lot 5/6 of a municipally approved 43-acre industrial park referred to as J & D Business and Industrial Park, which included the construction of Industrial Drive. The existing development on Lot 5/6 of the commercial subdivision included a 59,310-square foot warehouse/distribution center and a 64,743-square foot storage area for the parking of trucks and moving vans. The proposed expansion included an 85,500-square foot addition, 80,000 square feet of additional outside truck and van storage area, a 10,000-gallon above-ground diesel fuel tank, and a stormwater detention basin. In Department Order #L-17197-25-B-B, dated January 18, 2008, the Department approved after-the-fact the division of Lot 5/6 into Lots 5 and 6, as well as additional expansion. The additional expansion included four separate storage buildings, totaling 61,000 square feet in size and a 73,425-square foot paved access area on Lot 6 and a stormwater management basin on Lot 5.

In Department Order #L-17197-25-C-T, dated November 15, 2013, the Department approved the transfer of #L-17197-25-B-B as it pertains to Lot 6, to the applicant. The proposed project will be located on Lot 6 as well as on an adjacent parcel known as the Ruby lot.

B. Summary: The applicant proposes to develop eight to nine acres of a 50-acre parcel in order to relocate and consolidate the State of Maine fleet services. The development includes a total of 201 parking spaces, a small fueling area, a 250-foot by 350-foot auction yard area with cement pad, which includes a 15-foot by 40-foot covered area for palleted items, a fifty-foot by 125-foot area for cold storage, a 50-foot by 165-

foot building to house MDOT fleet operations, a 75-foot by 165-foot heated coatings building, a 150-foot by 150-foot building for central services, equipment laydown space, a 16,000-square foot area for tractor-trailer size deliveries and maneuvers, and two wet ponds for stormwater control. The proposed project will fill 57,172 square feet of forested freshwater wetlands. Construction details are shown on a set of plans, with a latest revision date of October 17, 2013, and prepared by Gorrill-Palmer Consulting Engineers, Inc. The project site is located at 66 Industrial Drive in the City of Augusta.

C. Current Use of the Site: The proposed development is located on two adjoining lots which are depicted as Lot 208 on the City of Augusta Tax Map 5 (formerly Lot 6 on the aforementioned commercial subdivision plan) and Lot 26 on the City of Augusta Tax Map 79. Lot 26 is undeveloped; a portion of the lot on the east side of Bond Brook will be split off and sold to the property owners at 19 Meadow Brook Road. Lot 26 is described in a deed, dated September 12, 2013 and recorded on Page 17 in Book 11424 at the Kennebec County Registry of Deeds. Lot 208 is developed with a commercial building, parking spaces and other infrastructure, and is described in a quitclaim deed with covenant, dated September 12, 2013, and recorded on Page 262 in Book 11524 at the Kennebec County Registry of Deeds.

2. GENERAL PERMIT CONDITIONS

The applicant has indicated that it intends to comply with the terms and condition of the General Permit for the Maine Department of Transportation. The applicant is authorized to construct the facility in accordance with the applicant's Notice of Intent, accepted for processing on September 6, 2013, and in accordance with the terms and conditions of the General Permit for the Maine Department of Transportation issued on February 19, 2013.

If constructed and operated in accordance with the General Permit for the Maine Department of Transportation, the project will not adversely affect the natural environment, will be built on suitable soil types, will meet the standards for erosion control and stormwater management, will not pose an unreasonable risk of discharge to a significant ground water aquifer, will not unreasonably cause or increase the flooding of the area or adjacent properties, nor create an unreasonable flood hazard to any structure, and any blasting, if it occurs, will be conducted in accordance with the standards of 38 M.R.S.A § 490-Z(14). In addition, the applicant has made adequate provision for utilities and the development will not have an unreasonable adverse effect on existing or proposed utilities in the municipality or areas served by those services.

3. EXISTING SCENIC, AESTHETIC, RECREATIONAL OR NAVIGATIONAL USES:

In accordance with Chapter 315, Assessing and Mitigating Impacts to Scenic and Aesthetic Uses, the applicant submitted a copy of the Department's Visual Evaluation Field Survey Checklist as Appendix A to the application along with a description of the property and the proposed project. The applicant also submitted several photographs of the proposed project site including an aerial photograph of the project site. Department staff visited the project site on September 16, 2013.

The proposed project is located in and adjacent to forested freshwater wetlands, which are not a scenic resource visited by the general public, in part, for the use, observation, enjoyment and appreciation of its natural and cultural visual qualities.

The proposed project was evaluated using the Department's Visual Impact Assessment Matrix and was found to have an acceptable potential visual impact rating. Based on the information submitted in the application, the visual impact rating, and the site visit, the Department determined that the location and scale of the proposed activity is compatible with the existing visual quality and landscape characteristics found within the viewshed of the scenic resource in the project area.

The Department finds that the proposed activity will not unreasonably interfere with existing scenic, aesthetic, recreational or navigational uses of the protected natural resource.

4. SOIL EROSION:

The project will be performed in accordance with erosion control measures conforming to the 2008 edition of the *State of Maine Department of Transportation Standard Specifications for Highways and Bridges* and the *Department of Transportation's Best Management Practices for Erosion and Sediment Control*.

The Department finds that the activity will not cause unreasonable erosion of soil or sediment, nor unreasonably inhibit the natural transfer of soil from the terrestrial to the marine or freshwater environment.

5. HABITAT CONSIDERATIONS:

The project will impact freshwater forested wetlands that are dominated by balsam fir with a sensitive fern understory, and characterized by pit and mound topography. Two amphibian breeding areas exist within an old timber harvesting road. The amphibian breeding areas were surveyed by the applicant and found not to meet the significance criteria of the Natural Resources Protection Act. According to the applicant's wetlands functional assessment, wildlife habitat is a primary function of the onsite wetlands.

Two unnamed tributaries to Bond Brook also occur on the parcel. The first tributary is located more than 75 feet from the proposed development and originates in the vicinity of a stormwater management pond immediately to the west of the proposed auction yard and continues for approximately 400 feet before exiting the property at the western boundary. The second unnamed tributary flows across the entire parcel in a southwest direction and is also more than 75 feet away from the proposed development.

The Maine Department of Inland Fisheries and Wildlife (MDIFW) reviewed the proposed project and stated that there are no Essential or Significant Wildlife Habitats at the project site. MDIFW stated that it anticipates minimal impacts to wildlife and fisheries as a result of this project.

The Department finds that the activity will not unreasonably harm any significant wildlife habitat, freshwater wetland plant habitat, threatened or endangered plant habitat, aquatic

or adjacent upland habitat, travel corridor, freshwater, estuarine or marine fisheries or other aquatic life.

6. WATER QUALITY CONSIDERATIONS:

The Department does not anticipate that the proposed project will violate any state water quality law, including those governing the classification of the State's waters.

7. WETLANDS AND WATERBODIES PROTECTION RULES:

The applicant proposes to directly alter 57,172 square feet of forested freshwater wetlands, which includes two amphibian breeding areas, to construct the proposed project. The applicant does not propose to disturb soil within 75 feet of either unnamed tributary to Bond Brook.

The Wetland Protection Rules interpret and elaborate on the Natural Resources Protection Act (NRPA) criteria for obtaining a permit. The rules guide the Department in its determination of whether a project's impacts would be unreasonable. A proposed project would generally be found to be unreasonable if it would cause a loss in wetland area, functions and values and there is a practicable alternative to the project that would be less damaging to the environment. Each application for a NRPA permit that involves a freshwater wetland alteration must provide an analysis of alternatives in order to demonstrate that a practicable alternative does not exist.

A. Avoidance. No activity may be permitted if there is a practicable alternative to the project that would be less damaging to the environment. The applicant submitted an alternatives analysis for the proposed project. The purpose of the project is to relocate and combine, in one location, the heavy equipment and vehicle maintenance operations of the applicant and the Bureau of General Services to improve efficiency and cost effectiveness. The applicant expects to save approximately $1.4 million per year as a result of the consolidation. Currently, the State's fleet services are in multiple locations in the Augusta area where there is no room for expansion. Avoidance of all wetlands on the parcel is not possible as the wetlands and amphibian breeding areas are clustered at the only available access point into the parcel. Other sites that do not contain wetlands were considered, but the applicant determined that those sites are not practicable due to small lot size and/or the lack of proximity to the city proper. The applicant determined that the proposed project avoids wetland alteration to the greatest practicable extent while still meeting the project purpose.

B. Minimal Alteration. The amount of freshwater wetlands to be altered must be kept to the minimum amount necessary for meeting the overall purpose of the project. The applicant minimized impacts by locating the development away from wetlands where practicable. The applicant considered condensing the development in order to minimize impacts further, but this was not practicable due to the space requirements for buildings and parking areas that are necessary to meet operational needs. Originally, the applicant proposed to purchase an adjacent parcel to the west with plans for this development to be more westerly than the current proposal. However, the applicant decided not to buy the parcel after determining that the development would impact five additional vernal pools and additional forested freshwater wetlands. The project footprint was designed to avoid

and maintain a 75-foot setback from the two unnamed tributaries to Bond Brook. The applicant determined that the proposed project has the least amount of impact to the freshwater wetlands.

C. Compensation. The applicant submitted a functions and values assessment of the freshwater wetlands to be altered, dated September 2013. According to the assessment, the primary function of the wetland areas to be altered is wildlife habitat. Other wetlands on the parcel not affected by the project have the functions of groundwater discharge, base flow augmentation, flood flow alteration and nutrient/sediment/toxicant retention.

In accordance with Chapter 310 Section 5(C), the applicant proposes to compensate for lost wetland functions and values by preserving a 94-acre parcel off Cross Hill Road in Augusta, as shown on Figure 1 of the mitigation plan, dated September 5, 2013. The parcel, which is known as the Coitrone/Simmons compensation parcel, is located on the opposite side of the Kennebec River and the east side of the City of Augusta. The applicant entered into an agreement with State of Maine, Department of Defense, Military Bureau (DODMB) to provide funding jointly to the State of Maine Department of Inland Fisheries and Wildlife (MDIFW) for the purchase of the 94-acre parcel. DODMB also requested approval from the Department to alter freshwater wetlands. The review of that application is currently pending (Department #L-16144-T6-E-N/L-16144-26-D-A). The jointly funded purchase will provide compensation for both this project and one proposed by the DODMB by protecting the wetlands in perpetuity through a Memorandum of Interagency Agreement for Purchase between the applicant and the Department of Inland Fisheries and Wildlife, dated November 27, 2013, a copy of which was provided to the Department and found adequate.

The Coitrone/Simmons compensation parcel was purchased by MDIFW on December 11, 2013, and contains freshwater wetlands with the primary functions of groundwater recharge/discharge, production export and wildlife habitat. MDIFW stated that the parcel contains wetlands that are exceptional in regard to wildlife values. The total acreage of freshwater wetlands on the parcel is 14.38 acres (6.63 acres of forested wetlands and 7.75 acres of non-forested wetlands).

MDIFW is the owner of other lands adjacent to the Coitrone/Simmons compensation parcel, which are designated as the Alonzo H. Garcelon Wildlife Management Area. The Coitrone/Simmons compensation parcel will be combined with the Alonzo H. Garcelon Wildlife Management Area. MDOT and MDIFW have agreed that any unused mitigation credit remaining after satisfying the environmental obligations created by the proposed construction off Industrial Drive and the DODMB project shall belong to MDOT. MDIFW has agreed to manage the Coitrone/Simmons compensation parcel to ensure the perpetual protection of the premises from future development in accordance with its wildlife management plan for the Alonzo H. Garcelon Wildlife Management Area that includes forestry habitat management guidelines for vernal pools. The applicant submitted a copy of a Memorandum of Interagency Agreement between the MDOT and MDIFW and an addendum to the Wildlife Management Area (WMA) Plan for the Alonzo H. Garcelon WMA. Both of these documents describe the use of the compensation parcel. The applicant submitted a Memorandum of Interagency

Agreement that will protect the property in perpetuity in accordance with Chapter 310(6)(F).

The Department finds that the applicant has avoided and minimized freshwater wetland impacts to the greatest extent practicable, and that the proposed project represents the least environmentally damaging alternative that meets the overall purpose of the project, provided that prior to project construction, the applicant submits a copy of the recorded Memorandum of Interagency Agreement to the Department prior to construction.

8. OTHER CONSIDERATIONS:

The Department did not identify any other issues involving existing scenic, aesthetic, or navigational uses, soil erosion, habitat or fisheries, the natural transfer of soil, natural flow of water, water quality, or flooding.

BASED on the above findings of fact, and subject to the conditions listed below, the Department makes the following conclusions pursuant to 38 M.R.S.A. Sections 480-A et seq. and Section 401 of the Federal Water Pollution Control Act:

A. The proposed activity will not unreasonably interfere with existing scenic, aesthetic, recreational, or navigational uses.

B. The proposed activity will not cause unreasonable erosion of soil or sediment.

C. The proposed activity will not unreasonably inhibit the natural transfer of soil from the terrestrial to the marine or freshwater environment.

D. The proposed activity will not unreasonably harm any significant wildlife habitat, freshwater wetland plant habitat, threatened or endangered plant habitat, aquatic or adjacent upland habitat, travel corridor, freshwater, estuarine, or marine fisheries or other aquatic life, provided that prior to the start of construction the applicant submits a copy of the recorded Memorandum of Interagency Agreement to the Department for the Coitrone/Simmons compensation parcel ensuring that the parcel is protected in perpetuity.

E. The proposed activity will not unreasonably interfere with the natural flow of any surface or subsurface waters.

F. The proposed activity will not violate any state water quality law including those governing the classifications of the State's waters.

G. The proposed activity will not unreasonably cause or increase the flooding of the alteration area or adjacent properties.

H. The proposed activity is not on or adjacent to a sand dune.

I. The proposed activity is not on an outstanding river segment as noted in Title 38 M.R.S.A. Section 480-P.

THEREFORE, the Department APPROVES the above noted application of the MAINE DEPARTMENT OF TRANSPORTATION to develop an area for fleet services as described in Finding 1, SUBJECT TO THE ATTACHED CONDITIONS, and all applicable standards and regulations:

1. Standard Conditions of Approval, a copy attached.

2. The applicant shall take all necessary measures to ensure that its activities or those of its agents do not result in measurable erosion of soil on the site during the construction of the project covered by this approval.

3. Severability. The invalidity or unenforceability of any provision, or part thereof, of this License shall not affect the remainder of the provision or any other provisions. This License shall be construed and enforced in all respects as if such invalid or unenforceable provision or part thereof had been omitted.

4. Prior to the start of construction, the applicant shall submit a copy of the recorded Memorandum of Interagency Agreement between MDOT and MDIFW for the Coitrone/Simmons compensation parcel ensuring that the parcel is protected in perpetuity.

THIS APPROVAL DOES NOT CONSTITUTE OR SUBSTITUTE FOR ANY OTHER REQUIRED STATE, FEDERAL OR LOCAL APPROVALS NOR DOES IT VERIFY COMPLIANCE WITH ANY APPLICABLE SHORELAND ZONING ORDINANCES.

DONE AND DATED IN AUGUSTA, MAINE, THIS 29th DAY OF January, 2014.

DEPARTMENT OF ENVIRONMENTAL PROTECTION

Filed
JAN 29 2014
State of Maine
Board of Environmental Protection

BY: Michael Kuhns
For: Patricia W. Aho, Commissioner

PLEASE NOTE THE ATTACHED SHEET FOR GUIDANCE ON APPEAL PROCEDURES…

AL/L26076ANBN/ATS#76598, 76597

Natural Resources Protection Act (NRPA)
Standard Conditions

THE FOLLOWING STANDARD CONDITIONS SHALL APPLY TO ALL PERMITS GRANTED UNDER THE NATURAL RESOURCE PROTECTION ACT, TITLE 38, M.R.S.A. SECTION 480-A ET.SEQ. UNLESS OTHERWISE SPECIFICALLY STATED IN THE PERMIT.

A. Approval of Variations From Plans. The granting of this permit is dependent upon and limited to the proposals and plans contained in the application and supporting documents submitted and affirmed to by the applicant. Any variation from these plans, proposals, and supporting documents is subject to review and approval prior to implementation.

B. Compliance With All Applicable Laws. The applicant shall secure and comply with all applicable federal, state, and local licenses, permits, authorizations, conditions, agreements, and orders prior to or during construction and operation, as appropriate.

C. Erosion Control. The applicant shall take all necessary measures to ensure that his activities or those of his agents do not result in measurable erosion of soils on the site during the construction and operation of the project covered by this Approval.

D. Compliance With Conditions. Should the project be found, at any time, not to be in compliance with any of the Conditions of this Approval, or should the applicant construct or operate this development in any way other the specified in the Application or Supporting Documents, as modified by the Conditions of this Approval, then the terms of this Approval shall be considered to have been violated.

E. Time frame for approvals. If construction or operation of the activity is not begun within four years, this permit shall lapse and the applicant shall reapply to the Board for a new permit. The applicant may not begin construction or operation of the activity until a new permit is granted. Reapplications for permits may include information submitted in the initial application by reference. This approval, if construction is begun within the four-year time frame, is valid for seven years. If construction is not completed within the seven-year time frame, the applicant must reapply for, and receive, approval prior to continuing construction.

F. No Construction Equipment Below High Water. No construction equipment used in the undertaking of an approved activity is allowed below the mean high water line unless otherwise specified by this permit.

G. Permit Included In Contract Bids. A copy of this permit must be included in or attached to all contract bid specifications for the approved activity.

H. Permit Shown To Contractor. Work done by a contractor pursuant to this permit shall not begin before the contractor has been shown by the applicant a copy of this permit.

Revised (12/2011/DEP LW0428)

DEP INFORMATION SHEET

Appealing a Department Licensing Decision

Dated: March 2012 **Contact: (207) 287-2811**

SUMMARY

There are two methods available to an aggrieved person seeking to appeal a licensing decision made by the Department of Environmental Protection's ("DEP") Commissioner: (1) in an administrative process before the Board of Environmental Protection ("Board"); or (2) in a judicial process before Maine's Superior Court. An aggrieved person seeking review of a licensing decision over which the Board had original jurisdiction may seek judicial review in Maine's Superior Court.

A judicial appeal of final action by the Commissioner or the Board regarding an application for an expedited wind energy development (35-A M.R.S.A. § 3451(4)) or a general permit for an offshore wind energy demonstration project (38 M.R.S.A. § 480-HH(1)) or a general permit for a tidal energy demonstration project (38 M.R.S.A. § 636-A) must be taken to the Supreme Judicial Court sitting as the Law Court.

This INFORMATION SHEET, in conjunction with a review of the statutory and regulatory provisions referred to herein, can help a person to understand his or her rights and obligations in filing an administrative or judicial appeal.

I. ADMINISTRATIVE APPEALS TO THE BOARD

LEGAL REFERENCES

The laws concerning the DEP's *Organization and Powers*, 38 M.R.S.A. §§ 341-D(4) & 346, the *Maine Administrative Procedure Act*, 5 M.R.S.A. § 11001, and the DEP's *Rules Concerning the Processing of Applications and Other Administrative Matters* ("Chapter 2"), 06-096 CMR 2 (April 1, 2003).

HOW LONG YOU HAVE TO SUBMIT AN APPEAL TO THE BOARD

The Board must receive a written appeal within 30 days of the date on which the Commissioner's decision was filed with the Board. Appeals filed after 30 calendar days of the date on which the Commissioner's decision was filed with the Board will be rejected.

HOW TO SUBMIT AN APPEAL TO THE BOARD

Signed original appeal documents must be sent to: Chair, Board of Environmental Protection, c/o Department of Environmental Protection, 17 State House Station, Augusta, ME 04333-0017; faxes are acceptable for purposes of meeting the deadline when followed by the Board's receipt of mailed original documents within five (5) working days. Receipt on a particular day must be by 5:00 PM at DEP's offices in Augusta; materials received after 5:00 PM are not considered received until the following day. The person appealing a licensing decision must also send the DEP's Commissioner a copy of the appeal documents and if the person appealing is not the applicant in the license proceeding at issue the applicant must also be sent a copy of the appeal documents. All of the information listed in the next section must be submitted at the time the appeal is filed. Only the extraordinary circumstances described at the end of that section will justify evidence not in the DEP's record at the time of decision being added to the record for consideration by the Board as part of an appeal.

WHAT YOUR APPEAL PAPERWORK MUST CONTAIN

Appeal materials must contain the following information at the time submitted:

1. *Aggrieved Status.* The appeal must explain how the person filing the appeal has standing to maintain an appeal. This requires an explanation of how the person filing the appeal may suffer a particularized injury as a result of the Commissioner's decision.
2. *The findings, conclusions or conditions objected to or believed to be in error.* Specific references and facts regarding the appellant's issues with the decision must be provided in the notice of appeal.
3. *The basis of the objections or challenge.* If possible, specific regulations, statutes or other facts should be referenced. This may include citing omissions of relevant requirements, and errors believed to have been made in interpretations, conclusions, and relevant requirements.
4. *The remedy sought.* This can range from reversal of the Commissioner's decision on the license or permit to changes in specific permit conditions.
5. *All the matters to be contested.* The Board will limit its consideration to those arguments specifically raised in the written notice of appeal.
6. *Request for hearing.* The Board will hear presentations on appeals at its regularly scheduled meetings, unless a public hearing on the appeal is requested and granted. A request for public hearing on an appeal must be filed as part of the notice of appeal.
7. *New or additional evidence to be offered.* The Board may allow new or additional evidence, referred to as supplemental evidence, to be considered by the Board in an appeal only when the evidence is relevant and material and that the person seeking to add information to the record can show due diligence in bringing the evidence to the DEP's attention at the earliest possible time in the licensing process or that the evidence itself is newly discovered and could not have been presented earlier in the process. Specific requirements for additional evidence are found in Chapter 2.

OTHER CONSIDERATIONS IN APPEALING A DECISION TO THE BOARD

1. *Be familiar with all relevant material in the DEP record.* A license application file is public information, subject to any applicable statutory exceptions, made easily accessible by DEP. Upon request, the DEP will make the material available during normal working hours, provide space to review the file, and provide opportunity for photocopying materials. There is a charge for copies or copying services.
2. *Be familiar with the regulations and laws under which the application was processed, and the procedural rules governing your appeal.* DEP staff will provide this information on request and answer questions regarding applicable requirements.
3. *The filing of an appeal does not operate as a stay to any decision.* If a license has been granted and it has been appealed the license normally remains in effect pending the processing of the appeal. A license holder may proceed with a project pending the outcome of an appeal but the license holder runs the risk of the decision being reversed or modified as a result of the appeal.

WHAT TO EXPECT ONCE YOU FILE A TIMELY APPEAL WITH THE BOARD

The Board will formally acknowledge receipt of an appeal, including the name of the DEP project manager assigned to the specific appeal. The notice of appeal, any materials accepted by the Board Chair as supplementary evidence, and any materials submitted in response to the appeal will be sent to Board members with a recommendation from DEP staff. Persons filing appeals and interested persons are notified in advance of the date set for Board consideration of an appeal or request for public hearing. With or without holding a public hearing, the Board may affirm, amend, or reverse a Commissioner decision or remand the matter to the Commissioner for further proceedings. The Board will notify the appellant, a license holder, and interested persons of its decision.

II. JUDICIAL APPEALS

Maine law generally allows aggrieved persons to appeal final Commissioner or Board licensing decisions to Maine's Superior Court, see 38 M.R.S.A. § 346(1); 06-096 CMR 2; 5 M.R.S.A. § 11001; & M.R. Civ. P 80C. A party's appeal must be filed with the Superior Court within 30 days of receipt of notice of the Board's or the Commissioner's decision. For any other person, an appeal must be filed within 40 days of the date the decision was rendered. Failure to file a timely appeal will result in the Board's or the Commissioner's decision becoming final.

An appeal to court of a license decision regarding an expedited wind energy development, a general permit for an offshore wind energy demonstration project, or a general permit for a tidal energy demonstration project may only be taken directly to the Maine Supreme Judicial Court. See 38 M.R.S.A. § 346(4).

Maine's Administrative Procedure Act, DEP statutes governing a particular matter, and the Maine Rules of Civil Procedure must be consulted for the substantive and procedural details applicable to judicial appeals.

ADDITIONAL INFORMATION

If you have questions or need additional information on the appeal process, for administrative appeals contact the Board's Executive Analyst at (207) 287-2452 or for judicial appeals contact the court clerk's office in which your appeal will be filed.

Note: The DEP provides this INFORMATION SHEET for general guidance only; it is not intended for use as a legal reference. Maine law governs an appellant's rights.

DEPARTMENT OF THE ARMY
NEW ENGLAND DISTRICT, CORPS OF ENGINEERS
696 VIRGINIA ROAD
CONCORD, MASSACHUSETTS 01742-2751

REPLY TO
ATTENTION OF

MAINE GENERAL PERMIT (GP)
AUTHORIZATION LETTER AND SCREENING SUMMARY

OFFICE OF ENVIRONMENTAL SERVICES
MAINE DEPT. OF TRANSPORTATIONT
16 STATE HOUSE STATION
AUGUSTA, MAINE 04333

CORPS PERMIT # NAE-2013-01790
CORPS PGP ID# 13-309
STATE ID# L-26076-TG-B-N

DESCRIPTION OF WORK:
Fill approximately 57,172 s.f. (1.3 acres) of freshwater wetlands adjacent to unnamed tributaries to Bond Brook at Augusta, Maine in order to develop a consolidated fleet services facility. This work is shown on the attached plans entitled "RELOCATION OF MAINE DOT FLEET SERVICES, 66 INDUSTRIAL DRIVE, AUGUSTA, MAINE" in six sheets dated "OCTOBER 17, 2013".

DOT WIN: 20118.55

LAT/LONG COORDINATES : 44.3539633° N -69.8066452° W **USGS QUAD:** AUGUSTA, ME

I. CORPS DETERMINATION:
Based on our review of the information you provided, we have determined that your project will have only minimal individual and cumulative impacts on waters and wetlands of the United States. **Your work is therefore authorized by the U.S. Army Corps of Engineers under the enclosed Federal Permit, the Maine General Permit (GP).** Accordingly, we do not plan to take any further action on this project.

You must perform the activity authorized herein in compliance with all the terms and conditions of the GP [including any attached Additional Conditions and any conditions placed on the State 401 Water Quality Certification including any required mitigation]. Please review the enclosed GP carefully, including the GP conditions beginning on page 5, to familiarize yourself with its contents. You are responsible for complying with all of the GP requirements; therefore you should be certain that whoever does the work fully understands all of the conditions. You may wish to discuss the conditions of this authorization with your contractor to ensure the contractor can accomplish the work in a manner that conforms to all requirements.

If you change the plans or construction methods for work within our jurisdiction, please contact us immediately to discuss modification of this authorization. This office must approve any changes before you undertake them.

Condition 41 of the GP (page 18) provides one year for completion of work that has commenced or is under contract to commence prior to the expiration of the GP on October 12, 2015. You will need to apply for reauthorization for any work within Corps jurisdiction that is not completed by October 12, 2016.

This authorization presumes the work shown on your plans noted above is in waters of the U.S. Should you desire to appeal our jurisdiction, please submit a request for an approved jurisdictional determination in writing to the undersigned.

No work may be started unless and until all other required local, State and Federal licenses and permits have been obtained. **This includes but is not limited to a Flood Hazard Development Permit issued by the town if necessary.**

II. STATE ACTIONS: PENDING [X], ISSUED[ ], DENIED [ ] DATE:

APPLICATION TYPE: PBR:___, TIER 1:___, TIER 2:___, TIER 3: X , LURC: ___ DMR LEASE:: ___ NA: ___

III. FEDERAL ACTIONS:

JOINT PROCESSING MEETING: 9/12/13 LEVEL OF REVIEW: CATEGORY 1:___ CATEGORY 2: X

AUTHORITY (Based on a review of plans and/or State/Federal applications): SEC 10_____, 404__X__ 10/404_____, 103_____

EXCLUSIONS: The exclusionary criteria identified in the general permit do not apply to this project.

FEDERAL RESOURCE AGENCY OBJECTIONS: EPA NO, USF&WS NO, NMFS NO

If you have any questions on this matter, please contact my staff at 207-623-8367 at our Manchester, Maine Project Office. In order for us to better serve you, we would appreciate your completing our Customer Service Survey located at http://per2.nwp.usace.army.mil/survey.html

Jay L. Clement

JAY L. CLEMENT
SENIOR PROJECT MANAGER
MAINE PROJECT OFFICE

12-16-2013

FRANK J. DEL GIUDICE **DATE**
CHIEF, PERMITS & ENFORCEMENT BRANCH
REGULATORY DIVISION

US Army Corps
of Engineers ®
New England District

PLEASE NOTE THE FOLLOWING GENERAL CONDITIONS FOR DEPARTMENT OF THE ARMY GENERAL PERMIT NO. NAE-2013-01790

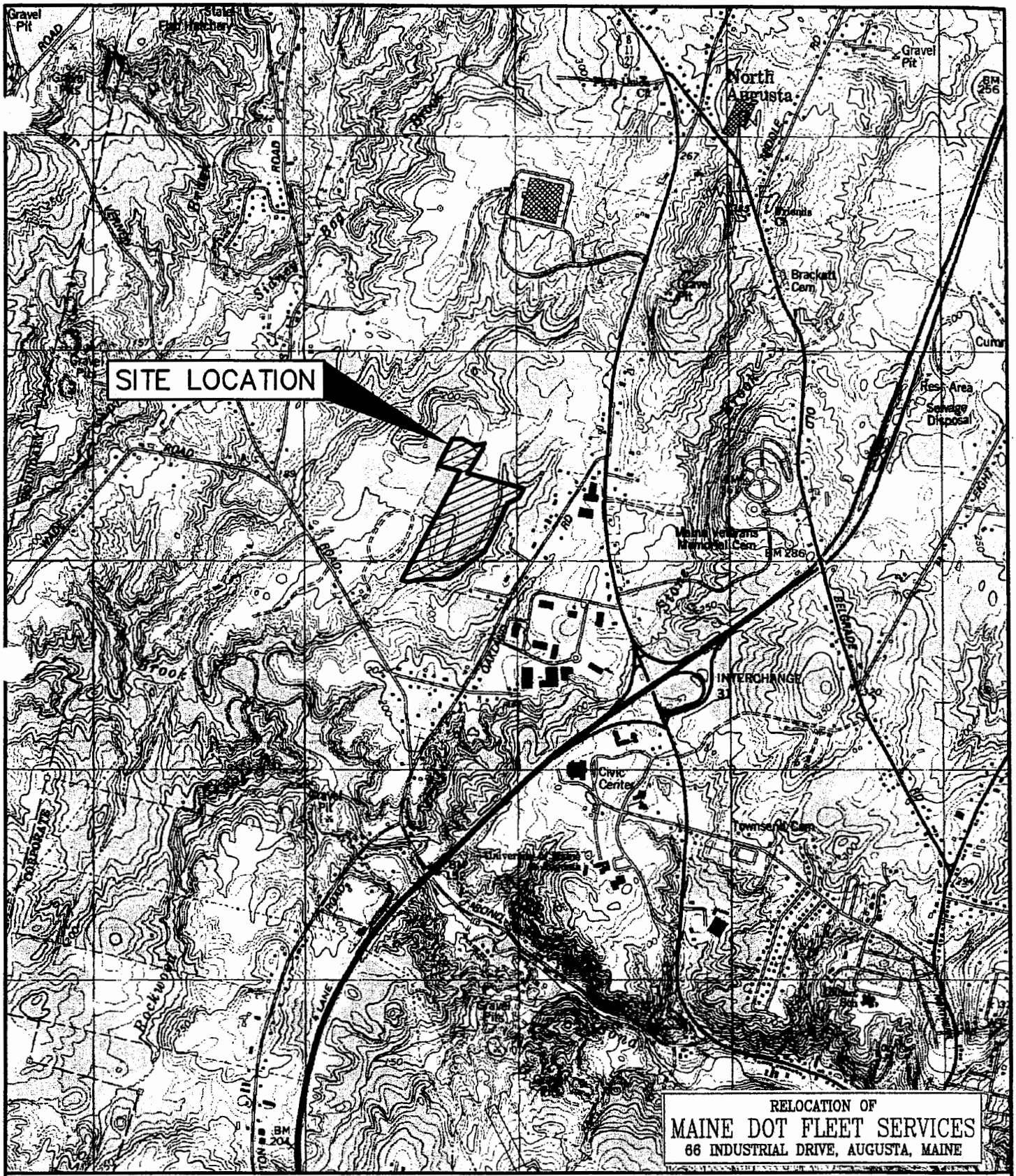
1. This authorization requires you to 1) notify us before beginning work so we may inspect the project, and 2) submit a Compliance Certification Form. You must complete and return the enclosed Work Start Notification Form(s) to this office at least two weeks before the anticipated starting date. You must complete and return the enclosed Compliance Certification Form within one month following the completion of the authorized work and any required mitigation (but not mitigation monitoring, which requires separate submittals).

2. The permittee shall assure that a copy of this permit is at the work site whenever work is being performed and that all personnel performing work at the site of the work authorized by this permit are fully aware of the terms and conditions of the permit. This permit, including its drawings and any appendices and other attachments, shall be made a part of any and all contracts and sub-contracts for work which affects areas of Corps of Engineers' jurisdiction at the site of the work authorized by this permit. This shall be done by including the entire permit in the specifications for the work. If the permit is issued after construction specifications but before receipt of bids or quotes, the entire permit shall be included as an addendum to the specifications. The term "entire permit" includes permit amendments. Although the permittee may assign various aspects of the work to different contractors or sub-contractors, all contractors and sub-contractors shall be obligated by contract to comply with all environmental protection provisions of the entire permit, and no contract or sub-contract shall require or allow unauthorized work in areas of Corps of Engineers jurisdiction.

3. Adequate sedimentation and erosion control devices, such as geotextile silt fences or other devices capable of filtering the fines involved, shall be installed and properly maintained to minimize impacts during construction. These devices must be removed upon completion of work and stabilization of disturbed areas. The sediment collected by these devices must also be removed and placed upland, in a manner that will prevent its later erosion and transport to a waterway or wetland.

4. All exposed soils resulting from the construction will be promptly seeded and mulched in order to achieve vegetative stabilization.

5. To address state and federal requirements for compensatory mitigation, the permittee shall preserve in perpetuity approximately 94 acres of mixed uplands, wetlands, and vernal pools off Cross Hill Road, adjacent to the Alanzo H. Garcelon Wildlife Management Area, at Augusta, Maine. This area is shown on the attached plan entitled "BOUNDARY SURVEY OF THE MOST SOUTHERLY LINE OF LAND TO BE PURCHASED FROM COITRONE/SIMMONS" in one sheet dated "11-05-2013". After purchase, the property shall be conveyed to the Maine Dept. of Inland Fisheries & Wildlife to be incorporated into the adjacent wildlife management area. The land title conveyance shall be forwarded to the Corps and the Maine DEP within 30 days of the acquisition closing. The site shall be acquired and conveyed within one year of the first impacts to regulated resources unless the Corps provides a written extension.



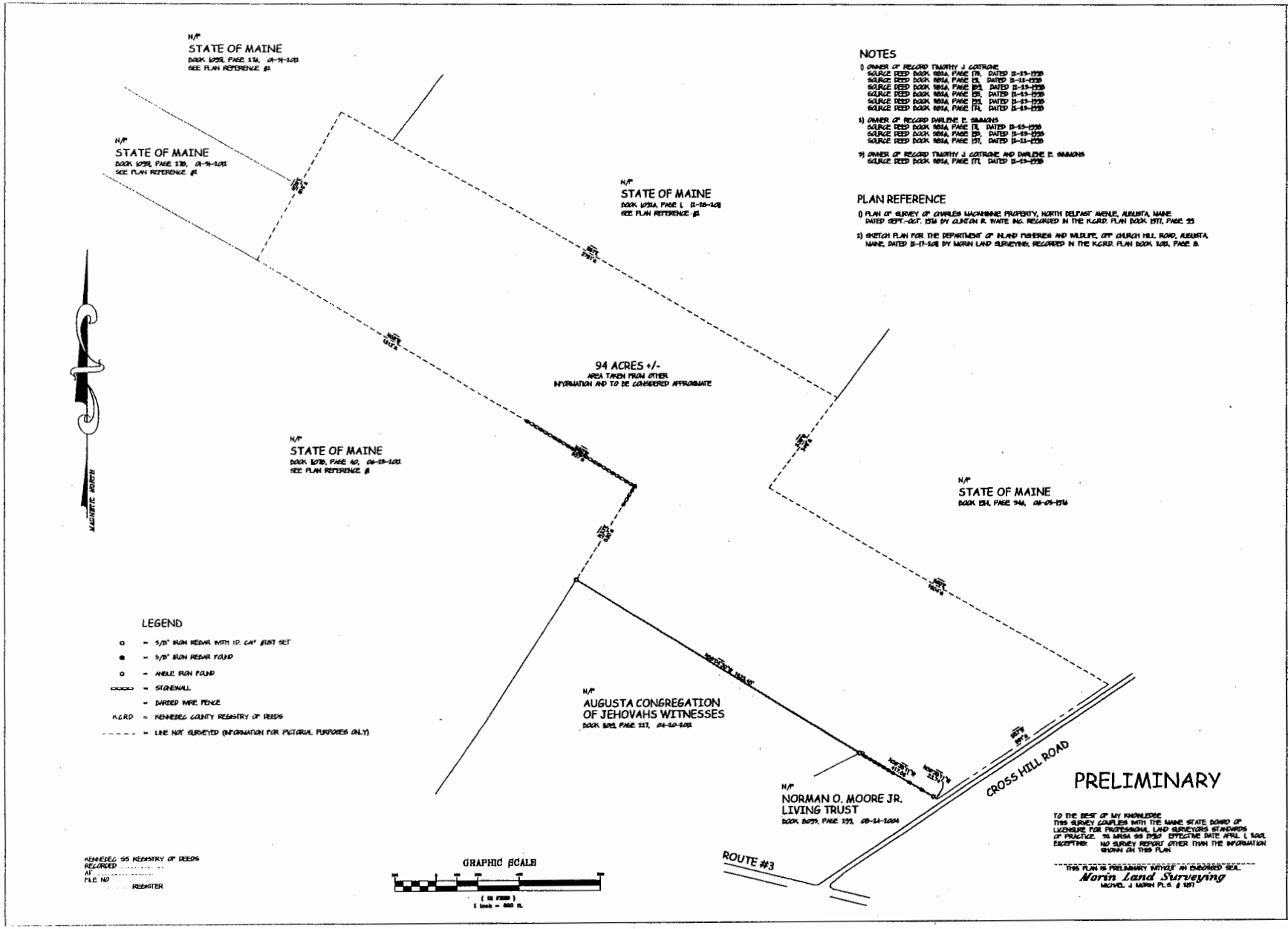
U.S.G.S. Location Map

Maine DOT BGS Fleet Services - Augusta, Maine

U.S.G.S. Augusta, Maine -7.5 Minute Series (Topographic)

Design: WCH	Date: SEPT 2013	Gorrill-Palmer Consulting Engineers, Inc.	Figure 1639
Draft: CG	Job No.: 2798	*Engineering Excellence since 1998*	
Checked: WCH	Scale: 1"=2000'±		
File Name: 2798-LOCATION.dwg			

PO Box 1237
15 Shaker Road
Gray, ME 04039
207-657-6910
FAX: 207-657-6912
E-Mail: mailbox@gorrillpalmer.com



NOTES

1) OWNER OF RECORD TIMOTHY J COSTRONE
SOURCE DEED BOOK 6851A, PAGE 178, DATED 11-13-2008
SOURCE DEED BOOK 6851A, PAGE 15, DATED 11-12-2008
SOURCE DEED BOOK 6851A, PAGE 182, DATED 11-13-2008
SOURCE DEED BOOK 6851A, PAGE 180, DATED 11-13-2008
SOURCE DEED BOOK 6851A, PAGE 172, DATED 11-13-2008
SOURCE DEED BOOK 6851A, PAGE 174, DATED 11-13-2008

2) OWNER OF RECORD DARLENE E. SIMMONS
SOURCE DEED BOOK 6851A, PAGE 171, DATED 11-13-2008
SOURCE DEED BOOK 6851A, PAGE 169, DATED 11-13-2008
SOURCE DEED BOOK 6851A, PAGE 167, DATED 11-13-2008

3) OWNER OF RECORD TIMOTHY J COSTRONE AND DARLENE E. SIMMONS
SOURCE DEED BOOK 6851A, PAGE 177, DATED 11-13-2008

PLAN REFERENCE

1) PLAN OF SURVEY OF CHARLES MACMANNIS PROPERTY, NORTH BELFAST AVENUE, AUGUSTA, MAINE DATED SEPT.-OCT. 1974 BY CLINTON R. WAITE INC. RECORDED IN THE K.C.R.D. PLAN BOOK 1977, PAGE 55

2) SKETCH PLAN FOR THE DEPARTMENT OF INLAND FISHERIES AND WILDLIFE, 270 CHURCH HILL ROAD, AUGUSTA, MAINE, DATED 11-17-2013 BY MORIN LAND SURVEYING, RECORDED IN THE K.C.R.D. PLAN BOOK 2013, PAGE 8.

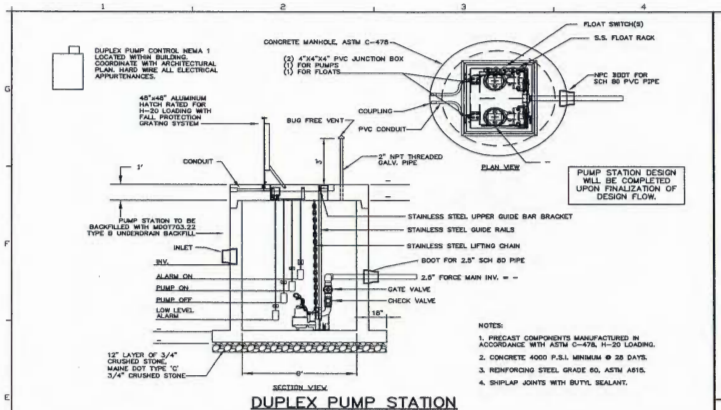
KENNEBEC SS REGISTRY OF DEEDS
RECORDED .....
AT .....
P.L.S. NO .....
REGISTER

PRELIMINARY

TO THE BEST OF MY KNOWLEDGE THIS SURVEY COMPLIES WITH THE MAINE STATE BOARD OF LICENSURE FOR PROFESSIONAL LAND SURVEYORS STANDARDS OF PRACTICE. 32 MRSA SS 13250 EFFECTIVE DATE APRIL 1, 2008.
EXCEPTIONS: NO SURVEY REPORT OTHER THAN THE INFORMATION SHOWN ON THIS PLAN.

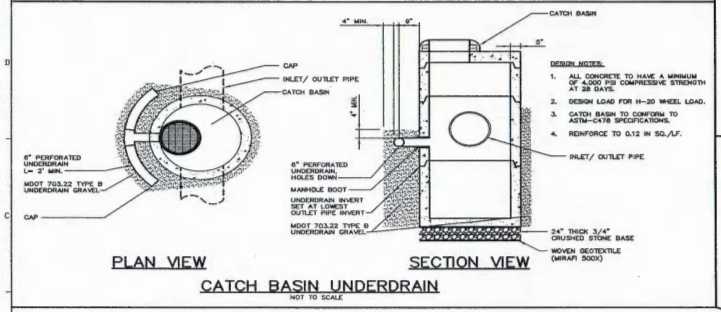
THIS PLAN IS PRELIMINARY WITHOUT AN EMBOSSED SEAL.
Morin Land Surveying
MICHAEL J. MORIN P.L.S. # 1217

PROJECT / LOCATION: DEPARTMENT OF INLAND FISHERIES AND WILDLIFE
270 LYONS ROAD SIDNEY, MAINE 04330
PROJECT LOCATION: CROSS HILL ROAD
TOWN: AUGUSTA COUNTY: KENNEBEC STATE: MAINE
PLS No. ALEXIOU
PLS BOOK No. 98
PLAN No. 438
BS
MORIN LAND SURVEYING
Augusta, Maine (207) 623-3443
SHEET TITLE: BOUNDARY SURVEY
OF THE EAST SOUTHERLY LINE OF LAND TO BE PURCHASED FROM COSTRONE / SIMMONS
SCALE: 1" = 200'
DATE: 11-05-2013
JOB
REVISED
DATE



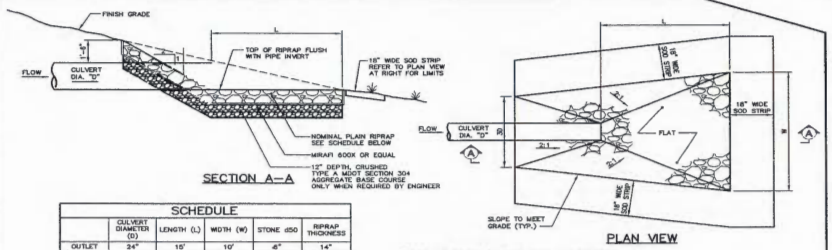
DUPLEX PUMP STATION
NOT TO SCALE

PUMP STATION	SHEET LOCATION		PUMP STATION SETTING DATA				PUMP CONTROL SETTING DATA				PUMP OPERATING CONDITIONS				
DESCRIPTION	UTILITY PLAN SHEET	PROFILE SHEET	TOP OF COVER SLAB	BOTTOM OF BASE SLAB	8" EFF. SEWER INVERT	& FORCE MAIN OUTLET	LOW LEVEL ALARM	PUMP OFF	PUMP ON	ALARM ON	NUMBER OF PUMPS	PUMP DISCHARGE	PUMP RATE	TOTAL DYNAMIC HEAD	PUMP H.P.
MAINE DOT/BGS FLEET SERVICES	--	--	--	--	--	--	--	--	--	--	2	3"	--	--	--



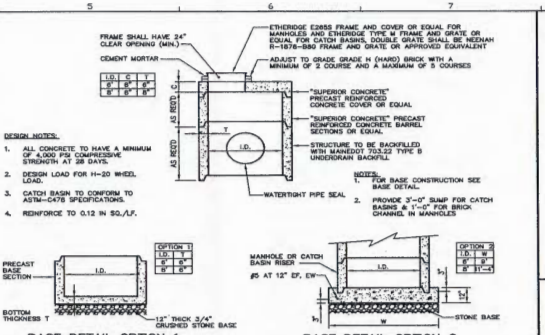
PLAN VIEW SECTION VIEW

CATCH BASIN UNDERDRAIN
NOT TO SCALE



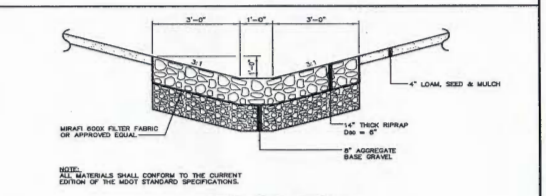
SCHEDULE					
	CULVERT DIAMETER (D)	LENGTH (L)	WIDTH (W)	STONE d50	RIPRAP THICKNESS
OUTLET	24"	15'	10'	6"	14"

CULVERT OUTLET APRON
NOT TO SCALE

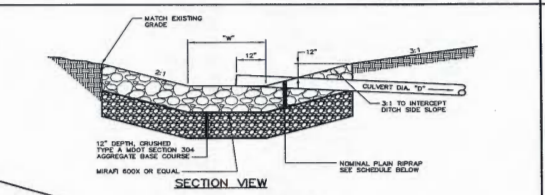


BASE DETAIL OPTION 1 BASE DETAIL OPTION 2

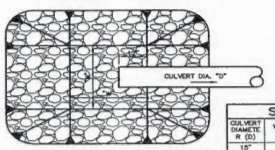
LARGE DIAMETER STORM DRAIN MANHOLE AND CATCH BASIN WITH FLAT TOP
NOT TO SCALE



RIP RAP SWALE
NOT TO SCALE



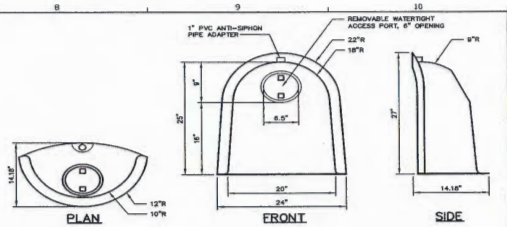
SECTION VIEW



PLAN VIEW

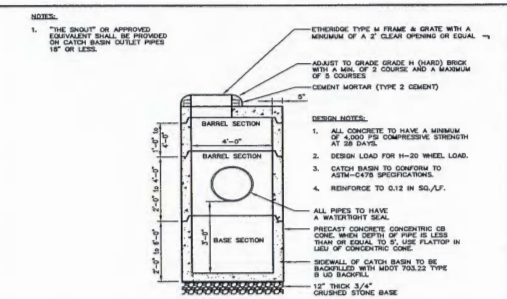
SCHEDULE			
CULVERT DIAMETER R (D)	WIDTH (W)	STONE d50	RIPRAP THICKNESS
15"	4'	6"	14"
18"	4'	8"	14"
24"	4'	8"	14"

CULVERT INLET APRON
NOT TO SCALE

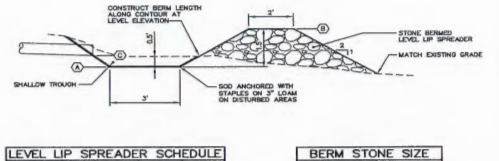


"THE SNOUT"
NOT TO SCALE

NOTE: FOR USE ON CATCH BASIN OUTLET 18" IN DIAMETER AND LESS



4'-0" PRECAST CATCH BASIN
NOT TO SCALE



LEVEL LIP SPREADER SCHEDULE		(A)	(B)	(C)
LEVEL LIP	BERM WIDTH	BOTTOM ELEVATION	TOP BERM ELEVATION	PIPE INVERT
1	15'	195	196.50	195.50

BERM STONE SIZE	
SIEVE DESIGNATION (US CUSTOMARY)	PERCENT BY WEIGHT PASSING
12 IN	100
6 IN	84-100
3 IN	68-83
1 IN	42-55
NO. 4	8-12

STONE BERM LEVEL LIP SPREADER
NOT TO SCALE

NOT FOR CONSTRUCTION
MAJOR DEVELOPMENT APPLICATION

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Structural Mechanical Electrical Commissioning
160 Veranda Street
Portland, Maine 04103
207.221.2266
207.221.2166
www.allied-eng.com
Allied Project No: 1306 / Cad File:

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

DATE	
FED PIN NO:	
PIN NO:	020116.00

WILLIAM C. HANSELL No. 8516 REGISTERED PROFESSIONAL ENGINEER 10/1/13

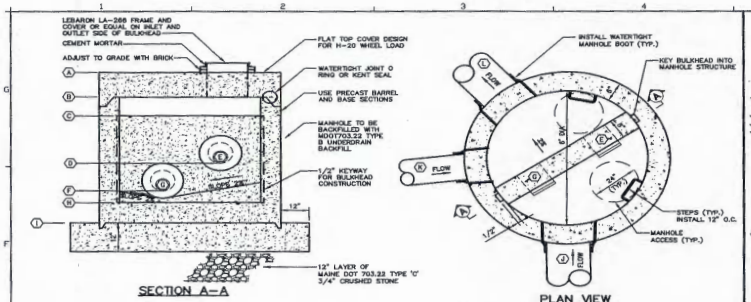
PROJECT INFORMATION		SIGNATURE
PROGRAM		-
PROJECT MANAGER		-
DESIGNER	ALLIED ENG., INC.	ABBR. LAN. NUMBER
CONSULTANT	GORRILL-PALMER	
PROJECT PRESIDENT		DATE OCTOBER 17, 2013
CONTRACTOR		-
PROJECT COMPLETION DATE		-

"RELOCATION OF . . . "
MAINE DOT FLEET SERVICES
66 INDUSTRIAL DRIVE, AUGUSTA, MAINE

DRAINAGE/UTILITY DETAILS

SHEET NUMBER
C502

1641



SECTION A–A

OUTLET CONTROL STRUCTURE 1 (OCS1)

SEE SCHEDULE A
NOT TO SCALE

PLAN VIEW

6' OUTLET CONTROL STRUCTURE 1 (OCS1)

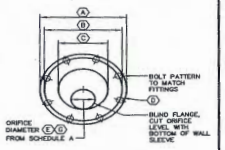
SEE SCHEDULE A
NOT TO SCALE

SCHEDULE A

	ITEM DESCRIPTION	DIMENSION/ ELEVATION OCS 1
A	TOP OF STRUCTURE	205.00
B	UNDERSIDE TOP SLAB	204.33
C	TOP CONCRETE BULKHEAD	203.63
D	ORIFICE INVERT	201.50
E	ORIFICE DIAMETER	8"
F	ORIFICE INVERT	200.35
G	ORIFICE DIAMETER	7.75"
H	MANHOLE INVERT	193.40
I	BOTTOM OF STRUCTURE	194.40
J	PIPE DIAMETER	24"
	INVERT IN	195.50
K	PIPE DIAMETER	8"
	INVERT IN	195.50
L	PIPE DIAMETER	24"
	INVERT OUT	193.40

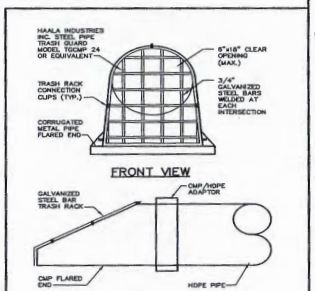
SCHEDULE B ORIFICE

	ITEM DESCRIPTION	DIMENSION /ELEVATION
		OCS 1
A	FLANGE O.D.	18"
B	BOLT CIRCLE	17"
C	NOMINAL PIPE DIAMETER	12"
D	BOLT HOLE DIAMETER	1"
E	ECCENTRIC ORIFICE DIAMETER	8"
G	ECCENTRIC ORIFICE DIAMETER	7.75"



ORIFICE DETAIL 1

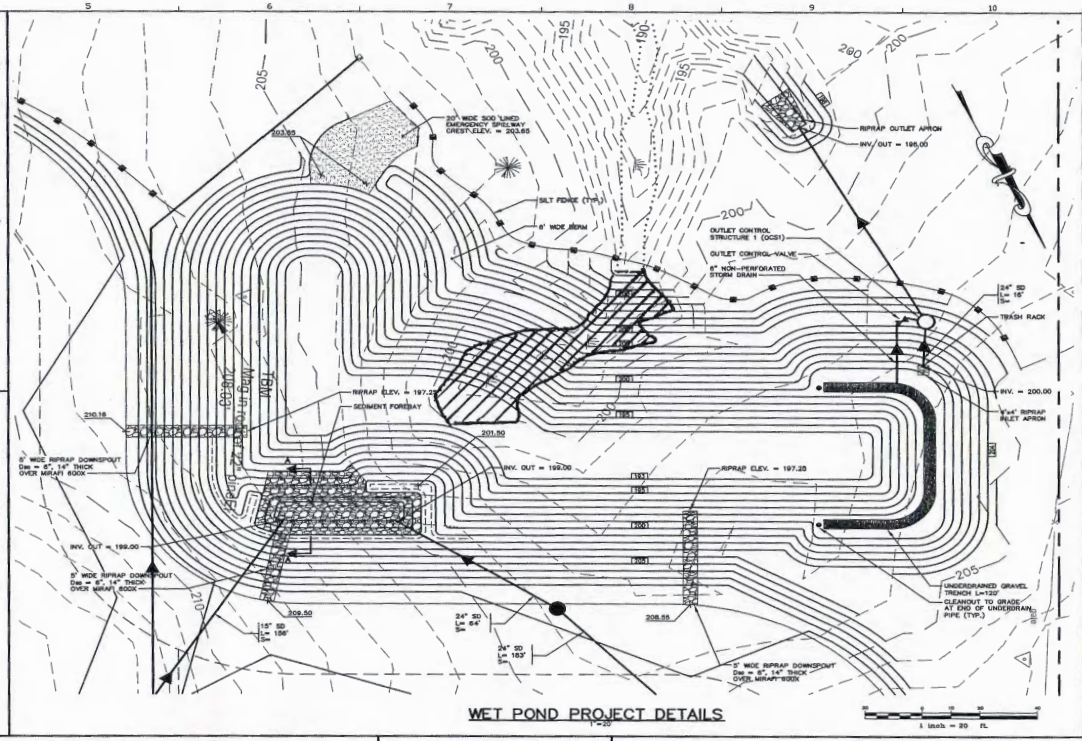
SEE SCHEDULE B
NOT TO SCALE



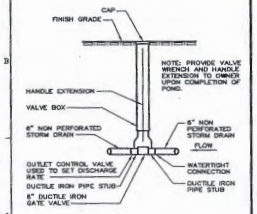
SIDE VIEW

TRASH RACK

NOT TO SCALE

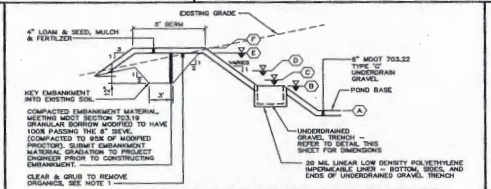


WET POND PROJECT DETAILS



OUTLET VALVE

NOT TO SCALE



NOTES:

1. EMBANKMENT FOOTPRINT SHALL BE CLEARED OF TRASH, DEBRIS AND ANY ROCKS GREATER THAN 6", BE FREE OF ROOTS AND STUMPS, AND BE GRADED TO BE NO STEEPER THAN 1H:1V, BE SCARIFIED PRIOR TO EMBANKMENT FILL PLACEMENT, AND BE INSPECTED AND APPROVED BY THE PROJECT ENGINEER BEFORE FILL PLACEMENT BEGINS.

SCHEDULE B EMBANKMENT SCHEDULE

ITEM DESCRIPTION	DIMENSION/ELEVATION
(A) POND BASE ELEVATION	193.00
(B) PERMANENT POOL ELEVATION	198.29
(C) PEAK ELEVATION – CHANNEL PROTECTION VOLUME	200.33
(D) PEAK ELEVATION – 2 YEAR STORM	201.47
(E) PEAK ELEVATION – 25 YEAR STORM	203.63
(F) TOP OF BERM	205.00

TYPICAL WET POND CROSS SECTION

NOT TO SCALE

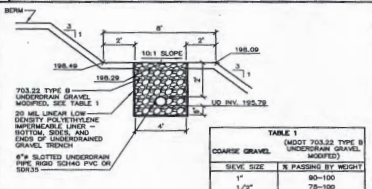


TABLE 1
(MDOT 703.22 TYPE B UNDERDRAIN GRAVEL MODIFIED)

COARSE GRAVEL	
SIEVE SIZE	% PASSING BY WEIGHT
1"	90–100
1/2"	75–100
#4	30–100
#20	15–80
#50	10–15
#200	0–5

UNDERDRAINED GRAVEL TRENCH

NOT TO SCALE

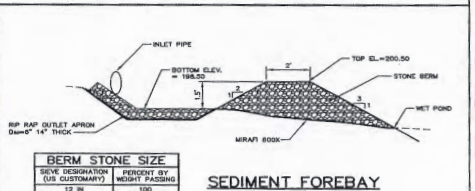
NOEP REQUIRED

CONSTRUCTION OVERSIGHT

THE APPLICANT WILL RETAIN THE SERVICES OF A PROFESSIONAL ENGINEER TO INSPECT THE CONSTRUCTION AND STABILIZATION OF ALL STORMWATER MANAGEMENT STRUCTURES. IF NECESSARY, THE INSPECTING ENGINEER WILL INTERPRET THE POND'S CONSTRUCTION PLAN FOR THE CONTRACTOR. ONCE ALL STORMWATER MANAGEMENT STRUCTURES ARE CONSTRUCTED AND STABILIZED, THE INSPECTING ENGINEER WILL SUBMIT A CERTIFICATION IN WRITING WITHIN 30 DAYS TO STATE THAT THE POND HAS BEEN COMPLETED, ACCOMPANYING THE ENGINEER'S NOTIFICATION MUST BE A LOG OF THE ENGINEER'S INSPECTIONS GIVING THE DATE OF EACH INSPECTION, THE TIME OF EACH INSPECTION, AND THE ITEMS INSPECTED ON EACH VISIT, AND INCLUDE ANY TESTING DATA OR SIEVE ANALYSIS DATA OF EVERY MINERAL SOIL AND SOIL MEDIA SPECIFIED IN THE PLANS AND USED ON SITE.

WETPONDS

INSPECTION BY A PROFESSIONAL ENGINEER WILL CONSIST OF WEEKLY VISITS TO THE SITE TO INSPECT THE INSTALLATION OF EACH POND'S EMBANKMENT CONSTRUCTION, STORMWATER INLET, UNDERDRAINED GRAVEL OUTLET, GRAVEL OUTLET FILTER MATERIAL MAKEUP AND PLACEMENT, OUTLET CONTROL STRUCTURE, CLAY LINER (IF APPLICABLE), AND EMERGENCY SPILLWAY CONSTRUCTION FROM INITIAL GROUND DISTURBANCE TO FINAL STABILIZATION OF THE POND. AN INSPECTION OF THE UNDERDRAINED GRAVEL OUTLET SHALL ALSO BE PERFORMED ONE YEAR AFTER THE FINAL STABILIZATION OF THE POND.



BERM STONE SIZE

SIEVE DESIGNATION (US CUSTOMARY)	PERCENT BY WEIGHT PASSING
12 IN	100
6 IN	54–100
3 IN	68–83
1 IN	42–55
NO. 4	9–12

SEDIMENT FOREBAY SECTION A–A

NOT TO SCALE

NOT FOR CONSTRUCTION
MAJOR DEVELOPMENT APPLICATION

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www.allied-eng.com
Allied Project No: 13057 Cad File:

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

	DATE
FED PIN NO:	
PIN NO: 020118.00	

WILLIAM C. HASKELL No. 8818 REGISTERED PROFESSIONAL ENGINEER

		SIGNATURE
PROJECT INFORMATION		
PROGRAM		
PROJECT MANAGER	ALLIED ENG., INC.	ARCH. LIN. NUMBER
DESIGNER	GORRILL-PALMER	
CONSULTANT		DATE OCTOBER 17, 2013
PROJECT RESIDENT		
CONTRACTOR		
PROJECT COMPLETION DATE		

RELOCATION OF
MAINE DOT FLEET SERVICES
68 INDUSTRIAL DRIVE, AUGUSTA, MAINE

WET POND PLAN AND DETAILS

SHEET NUMBER
C505

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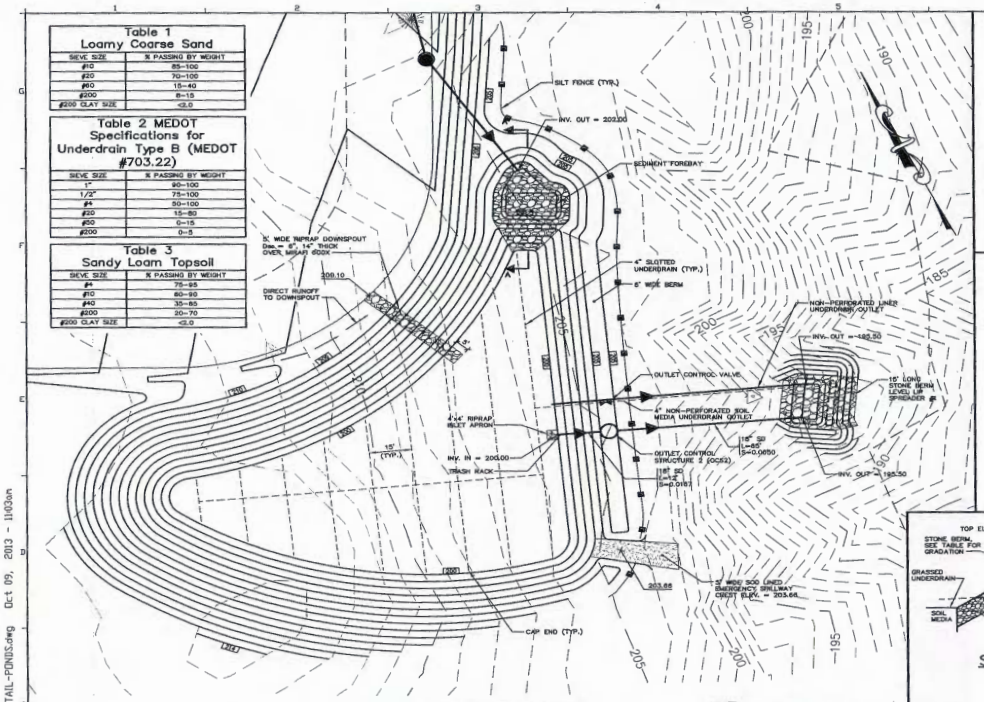
1642



GRASSED UNDERDRAIN PROJECT DETAILS

1"=20'

1 inch = 20 ft

Table 1
Loamy Coarse Sand

SIEVE SIZE	% PASSING BY WEIGHT
#10	85-100
#20	70-100
#60	15-40
#200	8-15
#200 CLAY SIZE	<3.0

Table 2 MEDOT Specifications for Underdrain Type B (MEDOT #703.22)

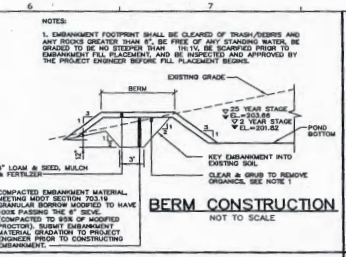
SIEVE SIZE	% PASSING BY WEIGHT
1"	90-100
1/2"	75-100
#4	50-100
#20	15-80
#60	0-15
#200	0-5

Table 3
Sandy Loam Topsoil

SIEVE SIZE	% PASSING BY WEIGHT
#4	75-95
#10	60-90
#40	35-65
#200	20-70
#200 CLAY SIZE	<3.0

NOTE:
TWO UNDERDRAIN SYSTEMS ARE REQUIRED FOR THE VEGETATED UNDERDRAIN. ONE SYSTEM DRAINS THE SOIL MEDIA, AND ONE SYSTEM DRAINS THE LINER. THE LINER UNDERDRAIN IS NOT SHOWN ON THE PLAN VIEW FOR CLARITY PURPOSES. SEE GRASSED UNDERDRAIN DETAIL.

NOTES:
1. EMBANKMENT FOOTPRINT SHALL BE CLEARED OF TRASH/DEBRIS AND ANY ROCKS GREATER THAN 6", BE FREE OF ANY STANDING WATER, BE GRADED TO BE NO STEEPER THAN 1H:1V, BE SCARIFIED PRIOR TO EMBANKMENT FILL PLACEMENT, AND BE INSPECTED AND APPROVED BY THE PROJECT ENGINEER BEFORE FILL PLACEMENT BEGINS.



BERM CONSTRUCTION
NOT TO SCALE

MOEP REQUIRED:

CONSTRUCTION OVERSIGHT

THE APPLICANT WILL RETAIN THE SERVICES OF A PROFESSIONAL ENGINEER TO INSPECT THE CONSTRUCTION AND STABILIZATION OF ALL STORMWATER MANAGEMENT STRUCTURES. IF NECESSARY, THE INSPECTING ENGINEER WILL INTERPRET THE POND'S CONSTRUCTION PLAN FOR THE CONTRACTOR. ONCE ALL STORMWATER MANAGEMENT STRUCTURES ARE CONSTRUCTED AND STABILIZED, THE INSPECTING ENGINEER WILL NOTIFY THE DEPARTMENT IN WRITING WITHIN 30 DAYS TO STATE THAT THE POND HAS BEEN COMPLETED. ACCOMPANYING THE ENGINEER'S NOTIFICATION MUST BE A LOG OF THE ENGINEER'S INSPECTIONS GIVING THE DATE OF EACH INSPECTION, THE TIME OF EACH INSPECTION, AND ITEMS INSPECTED ON EACH VISIT, AND INCLUDE ANY TESTING DATA OR SIEVE ANALYSIS DATA OF EVERY MINERAL SOIL AND SOIL MEDIA SPECIFIED IN THE PLANS AND USED ON SITE.

UNDERDRAINED FILTER BASINS

CONSTRUCTION SEQUENCE: THE SOIL FILTER MEDIA AND VEGETATION MUST NOT BE INSTALLED UNTIL THE AREA THAT DRAINS TO THE FILTER HAS BEEN PERMANENTLY STABILIZED WITH PAVEMENT OR OTHER STRUCTURE, SOD VEGETATION COVER, OR OTHER PERMANENT STABILIZATION UNLESS THE RUNOFF FROM THE CONTRIBUTING DRAINAGE AREA IS DIVERTED AROUND THE FILTER UNTIL STABILIZATION IS COMPLETED.

- AFTER THE UNDERDRAIN LAYER IS CONSTRUCTED, TEST THE SOIL FILTER MEDIA MIXTURE FOR PERMEABILITY (ASTM D2434) AND 92% STANDARD PROCTOR. THE BED SHOULD BE INSTALLED IN AT LEAST 3 LIFTS OF 8 INCHES TO PREVENT POCKETS OF LOOSE MEDIA.

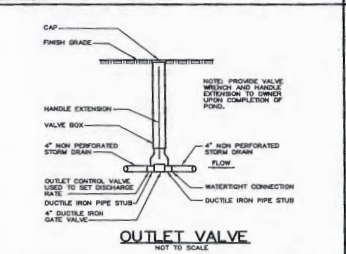
CONSTRUCTION OVERSIGHT: INSPECTION BY A PROFESSIONAL ENGINEER WILL OCCUR AT A MINIMUM:

- AFTER THE PRELIMINARY CONSTRUCTION OF THE FILTER GRADES AND ONCE THE UNDERDRAIN PIPES ARE INSTALLED BUT NOT BACKFILLED.
- AFTER THE DRAINAGE LAYER IS CONSTRUCTED AND PRIOR TO THE INSTALLATION OF THE FILTER MEDIA.
- AFTER THE FILTER MEDIA HAS BEEN INSTALLED AND SETTLED.
- AT THE FINAL WALK TO INSPECT HEALTH OF VEGETATION AND MAKE CORRECTIONS, AND

ALL THE MATERIALS USED IN THE CONSTRUCTION OF THE FILTER BASIN MUST BE CONFIRMED AS SUITABLE BY THE DESIGN ENGINEER. TESTING MUST BE DONE BY A CERTIFIED LABORATORY TO SHOW THAT THEY ARE PASSING DEP SPECIFICATIONS.

TESTING AND SUBMITTALS: THE CONTRACTOR SHALL IDENTIFY THE LOCATION OF THE SOURCE OF EACH COMPONENT OF THE FILTER MEDIA. ALL RESULTS OF FIELD AND LABORATORY TESTING SHALL BE SUBMITTED TO THE PROJECT ENGINEER FOR CONFIRMATION. THE CONTRACTOR SHALL:

- SELECT SAMPLES FOR SAMPLING OF EACH TYPE OF MATERIAL TO BE BLENDED FOR THE MIXED FILTER MEDIA AND SAMPLES OF THE UNDERDRAIN BEDDING MATERIAL. SAMPLES MUST BE A COMPOSITE OF THREE DIFFERENT LOCATIONS (GRABS) FROM THE STOCKPILE OR PIT
- SUBMIT A 75 LB. SAMPLE OF EACH TYPE OF MATERIAL TO THE PROJECT ENGINEER.
- PERFORM A SIEVE ANALYSIS CONFORMING TO ASTM C136 (STANDARD TEST METHOD FOR SIEVE ANALYSIS OF FINE AND COARSE AGGREGATES 1996a) ON EACH TYPE OF THE SAMPLE MATERIAL. THE RESULTING SOIL FILTER MEDIA MIXTURE MUST HAVE 6% TO 12% BY WEIGHT PASSING THE #200 SIEVE, A CLAY CONTENT OF LESS THAN 2% (DETERMINED HYDROMETER GRAIN SIZE ANALYSIS) AND HAVE 10% DRY WEIGHT OF ORGANIC MATTER.
- PERFORM A PERMEABILITY TEST ON THE SOIL FILTER MEDIA MIXTURE CONFORMING TO ASTM D2434 WITH THE MIXTURE COMPACTED TO 90-92% OF MAXIMUM DRY DENSITY BASED ON ASTM D698.



OUTLET VALVE
NOT TO SCALE

GRASSED UNDERDRAIN NOTES:

SOIL SPECIFICATIONS:

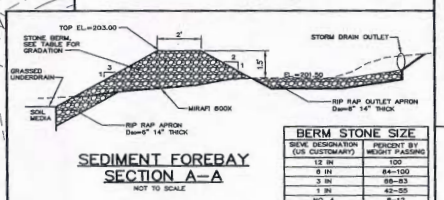
1. THE SOIL FILTER MEDIA SHALL BE A LAYERED SYSTEM CONSISTING OF THE FOLLOWING FROM THE BOTTOM:
   - A. 12" OF LOAMY COARSE SAND, SEE TABLE 1.
   - B. 2" LAYER OF TOPSOIL (SEE BELOW) ROTOTILLED INTO THE LOAMY COARSE SAND LAYER.
   - C. 8" OF NON-CLAYEY, LOAMY TOPSOIL SUCH AS USDA SANDY LOAM TOPSOIL WITH 5-8% HUMIFIED ORGANIC MATTER. SUPERHUMUS TOPSOIL OR EQUIVALENT MAY BE ADDED TO THE TOPSOIL TO INCREASE ORGANIC CONTENT, SEE TABLE 3.
2. SOIL FILTER MEDIA MIXTURE SHALL HAVE A PERMEABILITY OF 2.4 IN./HR. TO 4 IN./HR UPON COMPACTION BETWEEN 90% AND 92% STANDARD PROCTOR (ASTM D698).

SUBMITTALS:

1. SUBMIT RESULTS OF FIELD AND LABORATORY TESTING TO PROJECT ENGINEER.
2. SUBMIT 75 lb. SAMPLE OF EACH TYPE OF MATERIAL: SUBMIT IN AIR TIGHT CONTAINERS TO PROJECT ENGINEER.
3. THE FOLLOWING MATERIAL SHALL BE SUBMITTED:
   - A. SAND.
   - B. UNDERDRAIN BEDDING MATERIAL.
4. PERFORM A SIEVE ANALYSIS CONFORMING TO ASTM C136 – STANDARD TEST METHOD FOR SIEVE ANALYSIS OF FINE AND COARSE AGGREGATES, 1996a ON EACH TYPE OF THE SAMPLE MATERIAL AND SUBMIT RESULTS TO PROJECT ENGINEER.
5. PERFORM A PERMEABILITY TEST ON THE SOIL FILTER MEDIA MIXTURE CONFORMING TO ASTM D2434 WITH THE MIXTURE COMPACTED TO 90% TO 92% OF MAXIMUM DRY DENSITY BASED ON ASTM D698. SUBMIT RESULTS TO THE PROJECT ENGINEER.
6. PERFORM ONE COMPACTION DENSITY TEST ON THE IN PLACE SOIL FILTER FOR EVERY 2,000 SQUARE FEET OF FILTER SURFACE AREA. TEST SHALL CONFORM TO ASTM D 2922 – STANDARD TEST METHODS FOR DENSITY OF SOIL AND SOIL-AGGREGATE IN PLACE BY NUCLEAR METHODS (SHALLOW DEPTH); 1996. SUBMIT RESULTS TO THE PROJECT ENGINEER.

CONSTRUCTION:

1. SOIL FILTER MEDIA AND UNDERDRAIN BEDDING MATERIAL SHALL BE COMPACTED TO BETWEEN 90% AND 92% STANDARD PROCTOR.
2. SLOTTED UNDERDRAIN PIPE SHALL BE SLOTTED 4" SCHEDULE 40 OR SDR 35 PVC PIPE, SPACED 15 FEET ON CENTER MAXIMUM.
3. TRIBUTARY AREAS SHALL BE STABILIZED PRIOR TO INSTALLATION OF THE SOIL FILTER MEDIA MIXTURE AND UNDERDRAIN. STABILIZED IS DEFINED AS PAVED IF IN A PARKING AREA OR ROADWAY, AND SOD GRASS CATCH IF IN A VEGETATED AREA.
4. OUTFLOW OF THE VEGETATED UNDERDRAIN SHALL BE CONTROLLED BY A 4" DUCTILE IRON GATE VALVE WITH VALVE WRENCH AND EXTENSION (AVAILABLE FROM E.J. PRESCOTT OR EQUIVALENT). A THREE PIECE VALVE BOX (AVAILABLE FROM E.J. PRESCOTT OR EQUIVALENT) SHALL BE INSTALLED OVER THE VALVE.
5. ALL EQUIPMENT USED WITHIN THE LIMITS OF THE VEGETATED UNDERDRAIN SHALL BE LOW GROUND PRESSURE VEHICLES (LESS THAN 2.0 PSI) WHEN FULLY LOADED.
6. UPON COMPLETION OF THE INSTALLATION OF THE SOIL FILTER MEDIA AND THE ESTABLISHMENT OF A 90% CATCH OF GRASS OVER THE FILTER MEDIA, THE CONTRACTOR SHALL FLOOD THE VEGETATED UNDERDRAIN TO THE DESIGN ELEVATION WITH CLEAN WATER AND ADJUST THE VALVE TO OBTAIN A 24 HOUR TO 32 HOUR RELEASE TIME.



SEDIMENT FOREBAY
SECTION A-A
NOT TO SCALE

BERM STONE SIZE

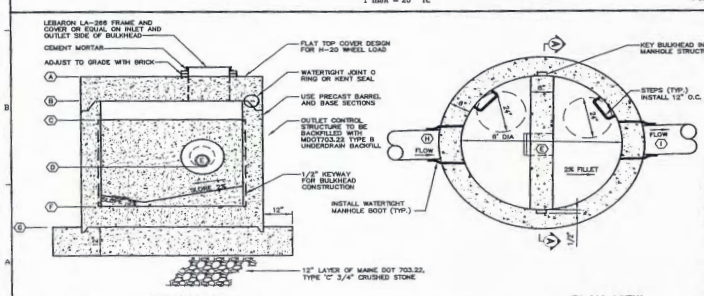
SIEVE DESIGNATION (US CUSTOMARY)	PERCENT BY WEIGHT PASSING
12 IN	100
6 IN	64-100
3 IN	66-83
1 IN	42-55
NO. 4	6-12

SCHEDULE A

	ITEM DESCRIPTION	GRASSED UNDERDRAIN DIMENSION/ ELEVATION
A	CHANNEL PROTECTION VOLUME STAGE	201.28
B	TOP SOIL FILTER	200.00
C	TOP UNDERDRAIN BEDDING STONE	198.50
D	PIPE INVERT) 4" PERF. UD	197.83
E	BOTTOM UNDERDRAIN BEDDING	197.50
F	LINER UNDERDRAIN INVERT	196.83

GRASS VEGETATION

CREEPING RED FESCUE	20 LBS./ACRE
TALL FESCUE	20 LBS./ACRE
BIRDSFOOT TREFOIL	8 LBS./ACRE

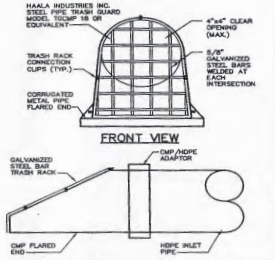


SECTION A-A
OUTLET CONTROL STRUCTURE 2 (OCS2)
SEE SCHEDULE B
NOT TO SCALE

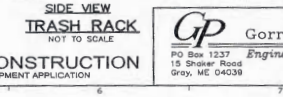
PLAN VIEW
6' OUTLET CONTROL STRUCTURE 2 (OCS2)
SEE SCHEDULE B
NOT TO SCALE

SCHEDULE A

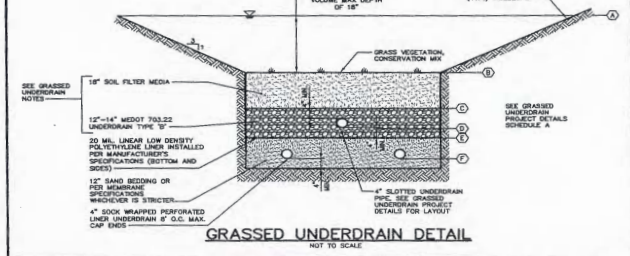
	ITEM DESCRIPTION	DIMENSION/ ELEVATION
A	TOP OF STRUCTURE	205.00
B	UNDERSIDE TOP SLAB	204.33
C	TOP CONCRETE BULKHEAD	203.66
D	ORIFICE INVERT	201.28
E	ORIFICE DIAMETER	1"
F	MANHOLE INVERT	195.82
G	BOTTOM OF STRUCTURE	194.82
H	PIPE DIAMETER	18"
	INVERT IN	199.80
I	PIPE DIAMETER	18"
	INVERT OUT	195.82



FRONT VIEW



SIDE VIEW
TRASH RACK
NOT TO SCALE



GRASSED UNDERDRAIN DETAIL
NOT TO SCALE

NOT FOR CONSTRUCTION
MAJOR DEVELOPMENT APPLICATION

Gorrill-Palmer Consulting Engineers, Inc.
PO Box 1237
15 Shaker Road
Gray, ME 04039
Engineering Excellence Since 1998
207-657-6910
FAX: 207-657-6912
E-Mail: mailbox@gorrillpalmer.com

Allied Engineering
Structural Mechanical Electrical Consultants
160 Veranda Street
Portland, Maine 04103
207.221.2240
207.221.2346
www.allied-eng.com

Allied Project No: 11057 Cad File:

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

DATE	
FED PIN NO:	
PIN NO:	020118.00

WILLIAM C. HARRELL, No. 8615, 10/11/13, LICENSED PROFESSIONAL ENGINEER

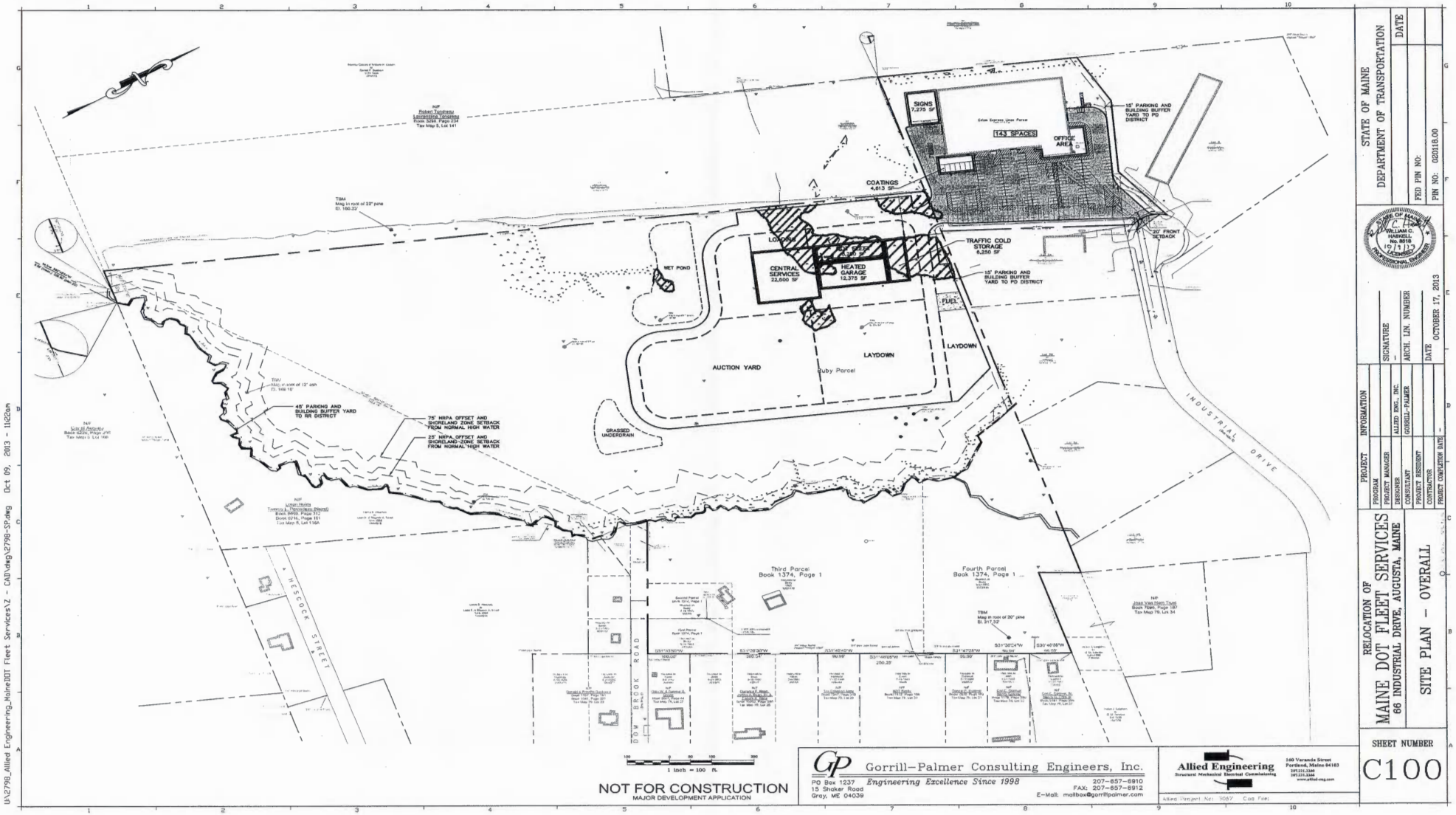
PROJECT	INFORMATION	SIGNATURE	DATE
PROGRAM		-	
PROJECT MANAGER	ALLIED ENG., INC.	ARCH. LIN. NUMBER	
DESIGNER	GORRILL-PALMER		
CONSULTANT		DATE	OCTOBER 17, 2013
PROJECT RESIDENT			
CONTRACTOR			
PROJECT COMPLETION DATE	-		

RELOCATION OF
MAINE DOT FLEET SERVICES
66 INDUSTRIAL DRIVE, AUGUSTA, MAINE

GRASSED UNDERDRAIN PLAN AND DETAILS

SHEET NUMBER
C506

1643



NOT FOR CONSTRUCTION
MAJOR DEVELOPMENT APPLICATION

Gorrill-Palmer Consulting Engineers, Inc.
PO Box 1237
15 Shaker Road
Gray, ME 04039
Engineering Excellence Since 1998
207-657-6910
FAX: 207-657-6912
E-Mail: mailbox@gorrillpalmer.com

Allied Engineering
Structural Mechanical Electrical Consultancy
160 Veranda Street
Portland, Maine 04103
207.231.3366
207.231.3344
www.allied-eng.com

Allied Project No: 5087 Cad File:

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

DATE	
FED PIN NO:	
PIN NO:	020118.00

STATE OF MAINE
WILLIAM D. HANSEL
No. 8515
REGISTERED PROFESSIONAL ENGINEER

PROJECT	INFORMATION
PROGRAM	
PROJECT MANAGER	
DESIGNER	ALLIED ENG. INC.
CONSULTANT	GORRILL-PALMER
PROJECT RESIDENT	
CONTRACTOR	
PROJECT COMPLETION DATE	

SIGNATURE
–
ARCH. LIN. NUMBER
DATE OCTOBER 17, 2013

RELOCATION OF
MAINE DOT FLEET SERVICES
66 INDUSTRIAL DRIVE, AUGUSTA, MAINE

SITE PLAN – OVERALL

SHEET NUMBER
C100

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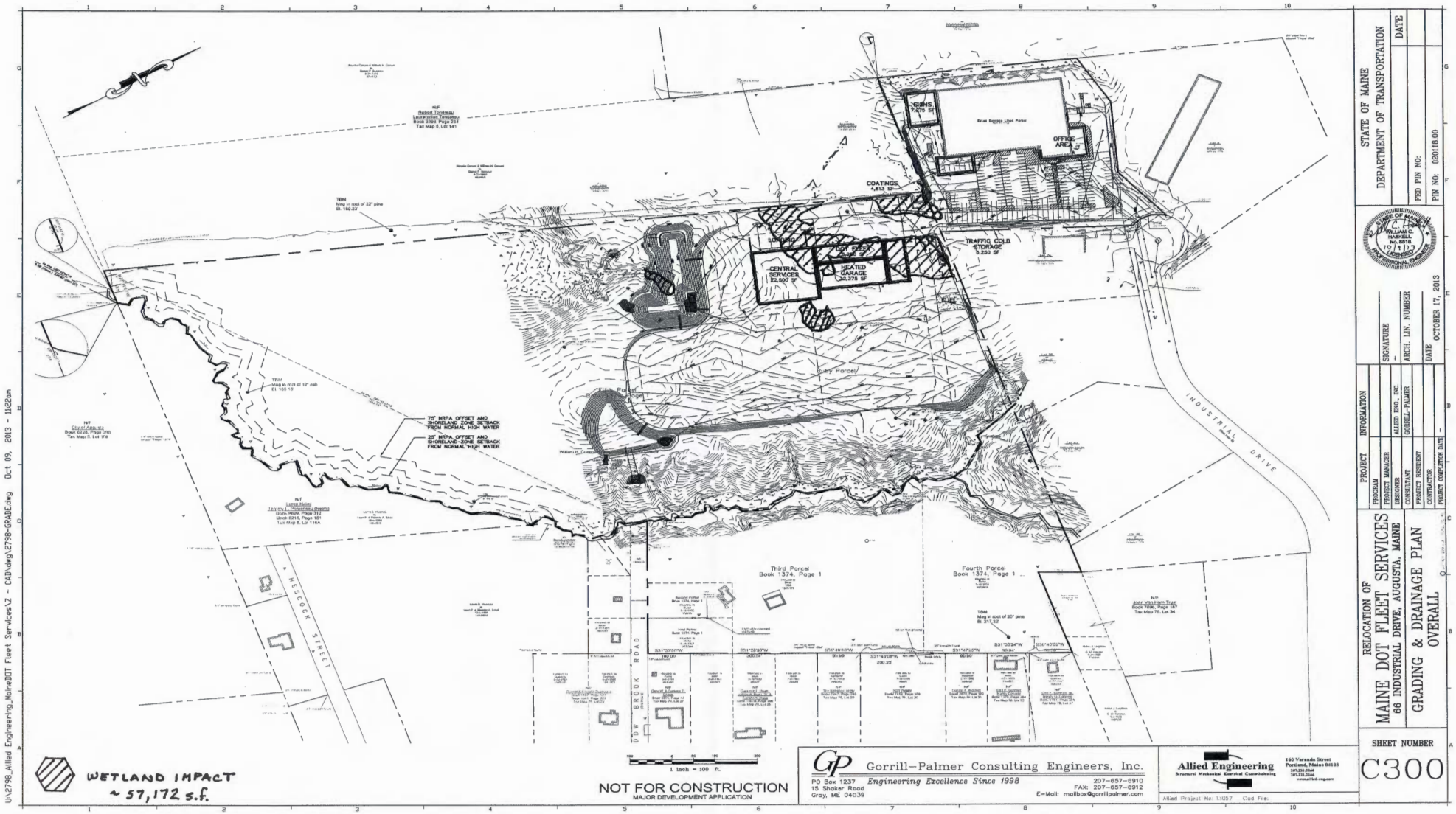
1644



WETLAND IMPACT
~ 57,172 s.f.

NOT FOR CONSTRUCTION
MAJOR DEVELOPMENT APPLICATION

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

DATE	
FED PIN NO:	
PIN NO: 020118.00	

WILLIAM C. HASKELL No. 8518 10/11/13 REGISTERED PROFESSIONAL ENGINEER

PROJECT INFORMATION		SIGNATURE	
PROGRAM			
PROJECT MANAGER		ALLIED ENG., INC.	ARCH. LIC. NUMBER
DESIGNER		CORRELL - PALMER	
CONSULTANT			
PROJECT RESIDENT			DATE OCTOBER 17, 2013
CONTRACTOR			
PROJECT COMPLETION DATE		-	

RELOCATION OF
MAINE DOT FLEET SERVICES
66 INDUSTRIAL DRIVE, AUGUSTA, MAINE
GRADING & DRAINAGE PLAN
OVERALL

SHEET NUMBER
C300

Gorrill-Palmer Consulting Engineers, Inc.
PO Box 1237
15 Shaker Road
Gray, ME 04039
Engineering Excellence Since 1998
207-657-8910
FAX: 207-657-8912
E-Mail: mailbox@gorrillpalmer.com

Allied Engineering
Structural Mechanical Electrical Consulting
160 Veranda Street
Portland, Maine 04103
207.221.2346
207.331.2346
www.allied-eng.com

Allied Project No: 13057 Cad File:

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1645

STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION
17 STATE HOUSE STATION AUGUSTA, MAINE 04333-0017

DEPARTMENT ORDER

IN THE MATTER OF

MAINE DEPARTMENT	) SITE LOCATION OF DEVELOPMENT ACT
OF TRANSPORTATION	)
Augusta, Kennebec County	)
TRANSFER OF LOTS 5 & 6	) TRANSFER
L-17197-25-C-T (approval)	) FINDINGS OF FACT AND ORDER

Pursuant to the provisions of 38 M.R.S.A. Sections 481 et seq. and Department Rules (Chapter 2, dated April 1, 2003) concerning the processing of applications, the Department of Environmental Protection has considered the application of the MAINE DEPARTMENT OF TRANSPORTATION with the supportive data, agency review comments, and other related materials on file and FINDS THE FOLLOWING FACTS:

1. In Department Order #L-17197-25-A-N, dated April 7, 1992, the Department approved existing development and the proposed expansion of commercial development on Lot 5/6 of a locally approved 43-acre industrial park referred to as J & D Business and Industrial Park, which included the construction of Industrial Drive. The existing development on Lot 5/6 of the commercial subdivision included a 59,310-square foot warehouse/distribution center and a 64,743-square foot storage area for the parking of trucks and moving vans. The proposed expansion included an 85,500-square foot addition, 80,000 square feet of additional outside truck and van storage area, a 10,000-gallon above-ground diesel fuel tank, and a stormwater detention basin. In Department Order L-17197-25-B-B, dated January 18, 2008, the Department approved after-the-fact the division of Lot 5/6 into Lots 5 and 6, as well as additional expansion. The additional expansion included four separate storage buildings, totaling 61,000 square feet in size and a 73,425 square foot paved access area on Lot 6 and a stormwater management basin on Lot 5. The subject portion of the commercial subdivision is located at the end of Industrial Drive in the City of Augusta.

2. The applicant is applying to transfer Department Order #L-17197-25-B-B as it pertains to Lot 6, currently held by Estes Express Lines.

3. The applicant submitted the following information in support of this transfer request:

   A. Transfer application, dated October 1, 2013, and signed by Judy Gates, Director of the Environmental Office, on behalf of the Maine Department of Transportation, including a quit claim deed with covenant, dated September 12, 2013, and signed by Angela J. Maidment, Vice President of Corporate Real Estate on behalf of Estes Express Lines.

   B. Financial Capacity: The total cost of the project is estimated to be $10.5 million. It will be constructed using general funds approved by the Maine State Legislature as stipulated in the Maine Department of Transportation 2013-2015 Work Plan.

C. Technical Ability: The applicant has successfully operated its Fleet Services for many years. The applicant has retained the services of Allied Engineers, a professional engineering firm, to manage the design and engineering of the project. Other members of the project team include subcontracting consultants, Simons Architect and Gorrill Palmer. The applicant provided supporting information on the architectural and engineering qualifications of the consultants.

BASED on the above findings of fact, the Department CONCLUDES that the MAINE DEPARTMENT OF TRANSPORTATION has provided adequate evidence of financial capacity and technical ability to comply with all conditions of Department Order #L-17197-25-B-B and to satisfy all applicable statutory and regulatory criteria.

THEREFORE, the Department APPROVES the above noted application of MAINE DEPARTMENT OF TRANSPORTATION to transfer Department Order #L-17197-25-B-B SUBJECT TO THE FOLLOWING CONDITIONS and all applicable standards:

1. The Standard Conditions of Approval, a copy attached.

2. Severability. The invalidity or unenforceability of any provision, or part thereof, of this License shall not affect the remainder of the provision or any other provisions. This License shall be construed and enforced in all respects as if such invalid or unenforceable provision or part thereof had been omitted.

3. All other Findings of Fact, Conclusions and Conditions remain as approved in Department Order #L-17197-25- B-B and are incorporated herein.

THIS APPROVAL DOES NOT CONSTITUTE OR SUBSTITUTE FOR ANY OTHER REQUIRED STATE, FEDERAL OR LOCAL APPROVALS NOR DOES IT VERIFY COMPLIANCE WITH ANY APPLICABLE SHORELAND ZONING ORDINANCES.

DONE AND DATED IN AUGUSTA, MAINE, THIS 15 DAY OF November, 2013.

DEPARTMENT OF ENVIRONMENTAL PROTECTION

BY: Patricia W. Aho
For: Patricia W. Aho, Commissioner

Filed
NOV 15 2013
State of Maine
Board of Environmental Protection

PLEASE NOTE THE ATTACHED SHEET FOR GUIDANCE ON APPEAL PROCEDURES…

AL/L17197CT/ATS#76730

Department of Environmental Protection

SITE LOCATION OF DEVELOPMENT (SITE) STANDARD CONDITIONS

STRICT CONFORMANCE WITH THE STANDARD AND SPECIAL CONDITIONS OF THIS APPROVAL IS NECESSARY FOR THE PROJECT TO MEET THE STATUTORY CRITERIA FOR APPROVAL.

A. **Approval of Variations from Plans.** The granting of this approval is dependent upon and limited to the proposals and plans contained in the application and supporting documents submitted and affirmed to by the applicant. Any variation from these plans, proposals, and supporting documents is subject to review and approval prior to implementation. Further subdivision of proposed lots by the applicant or future owners is specifically prohibited without prior approval of the Board, and the applicant shall include deed restrictions to that effect.

B. **Compliance with All Applicable Laws.** The applicant shall secure and comply with all applicable federal, state, and local licenses, permits, authorizations, conditions, agreements, and orders prior to or during construction and operation, as appropriate.

C. **Compliance with All Terms and Conditions of Approval.** The applicant shall submit all reports and information requested by the Board or the Department demonstrating that the applicant has complied or will comply with all preconstruction terms and conditions of this approval. All preconstruction terms and conditions must be met before construction begins.

D. **Advertising.** Advertising relating to matters included in this application shall refer to this approval only if it notes that the approval has been granted WITH CONDITIONS, and indicates where copies of those conditions may be obtained.

E. **Transfer of Development.** Unless otherwise provided in this approval, the applicant shall not sell, lease, assign or otherwise transfer the development or any portion thereof without prior written approval of the Board where the purpose or consequence of the transfer is to transfer any of the obligations of the developer as incorporated in this approval. Such approval shall be granted only if the applicant or transferee demonstrates to the Board that the transferee has the technical capacity and financial ability to comply with conditions of this approval and the proposals and plans contained in the application and supporting documents submitted by the applicant.

F. **Time frame for approvals.** If the construction or operation of the activity is not begun within four years, this approval shall lapse and the applicant shall reapply to the Board for a new approval. The applicant may not begin construction or operation of the development until a new approval is granted. A reapplication for approval may include information submitted in the initial application by reference. This approval, if construction is begun within the four-year time frame, is valid for seven years. If construction is not completed within the seven-year time frame, the applicant must reapply for, and receive, approval prior to continuing construction.

G. **Approval Included in Contract Bids.** A copy of this approval must be included in or attached to all contract bid specifications for the development.

H. **Approval Shown to Contractors.** Work done by a contractor pursuant to this approval shall not begin before the contractor has been shown by the developer a copy of this approval.

(2/81)/Revised November 1, 1979/ December 27, 2011/DEPLW 0429

DEP INFORMATION SHEET

Appealing a Department Licensing Decision

Dated: March 2012 **Contact: (207) 287-2811**

SUMMARY

There are two methods available to an aggrieved person seeking to appeal a licensing decision made by the Department of Environmental Protection's ("DEP") Commissioner: (1) in an administrative process before the Board of Environmental Protection ("Board"); or (2) in a judicial process before Maine's Superior Court. An aggrieved person seeking review of a licensing decision over which the Board had original jurisdiction may seek judicial review in Maine's Superior Court.

A judicial appeal of final action by the Commissioner or the Board regarding an application for an expedited wind energy development (35-A M.R.S.A. § 3451(4)) or a general permit for an offshore wind energy demonstration project (38 M.R.S.A. § 480-HH(1)) or a general permit for a tidal energy demonstration project (38 M.R.S.A. § 636-A) must be taken to the Supreme Judicial Court sitting as the Law Court.

This INFORMATION SHEET, in conjunction with a review of the statutory and regulatory provisions referred to herein, can help a person to understand his or her rights and obligations in filing an administrative or judicial appeal.

I. ADMINISTRATIVE APPEALS TO THE BOARD

LEGAL REFERENCES

The laws concerning the DEP's *Organization and Powers*, 38 M.R.S.A. §§ 341-D(4) & 346, the *Maine Administrative Procedure Act*, 5 M.R.S.A. § 11001, and the DEP's *Rules Concerning the Processing of Applications and Other Administrative Matters* ("Chapter 2"), 06-096 CMR 2 (April 1, 2003).

HOW LONG YOU HAVE TO SUBMIT AN APPEAL TO THE BOARD

The Board must receive a written appeal within 30 days of the date on which the Commissioner's decision was filed with the Board. Appeals filed after 30 calendar days of the date on which the Commissioner's decision was filed with the Board will be rejected.

HOW TO SUBMIT AN APPEAL TO THE BOARD

Signed original appeal documents must be sent to: Chair, Board of Environmental Protection, c/o Department of Environmental Protection, 17 State House Station, Augusta, ME 04333-0017; faxes are acceptable for purposes of meeting the deadline when followed by the Board's receipt of mailed original documents within five (5) working days. Receipt on a particular day must be by 5:00 PM at DEP's offices in Augusta; materials received after 5:00 PM are not considered received until the following day. The person appealing a licensing decision must also send the DEP's Commissioner a copy of the appeal documents and if the person appealing is not the applicant in the license proceeding at issue the applicant must also be sent a copy of the appeal documents. All of the information listed in the next section must be submitted at the time the appeal is filed. Only the extraordinary circumstances described at the end of that section will justify evidence not in the DEP's record at the time of decision being added to the record for consideration by the Board as part of an appeal.

What your Appeal Paperwork Must Contain

Appeal materials must contain the following information at the time submitted:

1. *Aggrieved Status.* The appeal must explain how the person filing the appeal has standing to maintain an appeal. This requires an explanation of how the person filing the appeal may suffer a particularized injury as a result of the Commissioner's decision.
2. *The findings, conclusions or conditions objected to or believed to be in error.* Specific references and facts regarding the appellant's issues with the decision must be provided in the notice of appeal.
3. *The basis of the objections or challenge.* If possible, specific regulations, statutes or other facts should be referenced. This may include citing omissions of relevant requirements, and errors believed to have been made in interpretations, conclusions, and relevant requirements.
4. *The remedy sought.* This can range from reversal of the Commissioner's decision on the license or permit to changes in specific permit conditions.
5. *All the matters to be contested.* The Board will limit its consideration to those arguments specifically raised in the written notice of appeal.
6. *Request for hearing.* The Board will hear presentations on appeals at its regularly scheduled meetings, unless a public hearing on the appeal is requested and granted. A request for public hearing on an appeal must be filed as part of the notice of appeal.
7. *New or additional evidence to be offered.* The Board may allow new or additional evidence, referred to as supplemental evidence, to be considered by the Board in an appeal only when the evidence is relevant and material and that the person seeking to add information to the record can show due diligence in bringing the evidence to the DEP's attention at the earliest possible time in the licensing process or that the evidence itself is newly discovered and could not have been presented earlier in the process. Specific requirements for additional evidence are found in Chapter 2.

Other Considerations in Appealing a Decision to the Board

1. *Be familiar with all relevant material in the DEP record.* A license application file is public information, subject to any applicable statutory exceptions, made easily accessible by DEP. Upon request, the DEP will make the material available during normal working hours, provide space to review the file, and provide opportunity for photocopying materials. There is a charge for copies or copying services.
2. *Be familiar with the regulations and laws under which the application was processed, and the procedural rules governing your appeal.* DEP staff will provide this information on request and answer questions regarding applicable requirements.
3. *The filing of an appeal does not operate as a stay to any decision.* If a license has been granted and it has been appealed the license normally remains in effect pending the processing of the appeal. A license holder may proceed with a project pending the outcome of an appeal but the license holder runs the risk of the decision being reversed or modified as a result of the appeal.

What to Expect Once You File a Timely Appeal with the Board

The Board will formally acknowledge receipt of an appeal, including the name of the DEP project manager assigned to the specific appeal. The notice of appeal, any materials accepted by the Board Chair as supplementary evidence, and any materials submitted in response to the appeal will be sent to Board members with a recommendation from DEP staff. Persons filing appeals and interested persons are notified in advance of the date set for Board consideration of an appeal or request for public hearing. With or without holding a public hearing, the Board may affirm, amend, or reverse a Commissioner decision or remand the matter to the Commissioner for further proceedings. The Board will notify the appellant, a license holder, and interested persons of its decision.

II. JUDICIAL APPEALS

Maine law generally allows aggrieved persons to appeal final Commissioner or Board licensing decisions to Maine's Superior Court, see 38 M.R.S.A. § 346(1); 06-096 CMR 2; 5 M.R.S.A. § 11001; & M.R. Civ. P 80C. A party's appeal must be filed with the Superior Court within 30 days of receipt of notice of the Board's or the Commissioner's decision. For any other person, an appeal must be filed within 40 days of the date the decision was rendered. Failure to file a timely appeal will result in the Board's or the Commissioner's decision becoming final.

An appeal to court of a license decision regarding an expedited wind energy development, a general permit for an offshore wind energy demonstration project, or a general permit for a tidal energy demonstration project may only be taken directly to the Maine Supreme Judicial Court. See 38 M.R.S.A. § 346(4).

Maine's Administrative Procedure Act, DEP statutes governing a particular matter, and the Maine Rules of Civil Procedure must be consulted for the substantive and procedural details applicable to judicial appeals.

ADDITIONAL INFORMATION

If you have questions or need additional information on the appeal process, for administrative appeals contact the Board's Executive Analyst at (207) 287-2452 or for judicial appeals contact the court clerk's office in which your appeal will be filed.

Note: The DEP provides this INFORMATION SHEET for general guidance only; it is not intended for use as a legal reference. Maine law governs an appellant's rights.

Environmental Summary Sheet

Pin: **20118.55** **Date Submitted: 1/29/14**
Town: **Augusta**
CPD Team Leader: David Gardner
ENV Field Contact: **Val Derosier**

NEPA Complete: N/A

☒ **Section 106** No Historic Properties

☒ **Section 4(f) and 6(f)** **N/A** No 4(f) resources

☒ **Maine Department of Inland Fisheries and Wildlife Essential Habitat**

Not Applicable **Timing Window: Not Applicable**

☒ **Section 7**

No Effect
Species of Concern: Northern Long Eared Bat

Comments/References: **All clearing prior to 10/1/14**

**Special Provision 105 is included with the contract*

☒ **Maine Department of Conservation/Public Lands, Submerged Land Lease**
Not Applicable

☒ **Maine Land Use Regulation Commission**
N/A

**Applicable Standards and Permits are included with the contract*

☒ **Maine Department of Environmental Protection**
Individual/Site Location of Development

**Applicable Standards and Permits are included with the contract*

☒ **Army Corps of Engineers, Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act.**
Category 2

**Applicable Standards and Permits are included with the contract*

☒ **Stormwater Review**
Chapter 500

☒ **Special Provisions Required**

Special Provision 105-Timing of Work Restriction	N/A☐	Applicable☒
Special Provision 656-Erosion Control Plan	N/A☐	Applicable☒
Special Provision 203-Dredge Spec	N/A☒	Applicable☐
General Note for Hazardous Waste	N/A☒	Applicable☐
Special Provision 203-Hazardous Waste	N/A☒	Applicable☐
Special Provision 105.9	N/A☒	Applicable☐