ITEM 07680.9901 M - PERMANENT AUTOMATED ANTI-ICING SYSTEM FOR ROADS AND BRIDGES

DESCRIPTION

1.01 Under this item the Contractor shall design, fabricate, and install a permanent, fully automated anti-icing system able to service the project bridge(s) and approach(es). The system includes autonomous operation (no human activation required) being accomplished by interface with Road Weather Information System (RWIS) technology provided by a firm currently under contract with New York State. The work shall include all trenching, excavation, and installation of hardware and testing necessary for acceptance. The work shall also include all labor and materials to complete the electrical, and telephone/communications works from the electrical meter service pole, including communication links and override capabilities at the New York State Department of Transportation (NYSDOT) facility listed on the plans. The system shall be installed at the locations indicated on the Contract Plans or established by the Engineer and shall include the following general elements:

A. Control box, located in the pump station, providing most logic and program functions including a fully compatible communication interface with the Road Weather Information System (RWIS) at the site. The installation of the RWIS is not part of this contract.
B. Chemical reservoir tank(s).
C. Water-flush reservoir tank(s).
D. Pump Station building that encloses the elements of the system.
E. Concrete slab and foundation with spill containment sump for anti-icing chemical reservoirs located in the pump station.
F. A 13.1 m heavy duty fold-over truss tower with anti-climb panels, including concrete foundation.
G. Pump assemblies and motors.
H. 75 mm x 75 mm (minimum) rigid plastic conduit raceway. The raceway will provide housing for non-galvanized chemical distribution piping and conduit for control wiring to valve boxes and/or other control mechanisms.
I. A separate rigid plastic conduit system for each highway(s) to house wiring/cables for pavement sensors installed by others.
J. A separate rigid plastic conduit and electrical wiring to flashing beacons at motorist warning signs.
K. Raceway, conduit expansion joints, pull boxes, and junction boxes as required for the installation.
L. Chemical distribution flexible piping with a 1379 kPa (200 psi) operating rating or approved equal, unless there is a pressurizing mechanism at the nozzle.
M. Nozzles (pavement-flush mounted).
N. Junction boxes consisting of control mechanisms capable of obtaining equal pressure application (1379 kPa, 200-psi min.) at each spray nozzle and inactivation of spray nozzle firing.
O. Fasteners, mounts and attachments necessary for carrying raceways on the bridges.
P. Communication equipment for manual remote control of the system: computer, pager and wireless activation.
Q. An IBM compatible PC at the local NYSDOT facility with specifically programmed anti-icing software for monitoring and displaying various anti-icing functions required under this specification.
R. Battery back-up power with notification of power loss at the local NYSDOT facility identified on the plans.
S. Connection of utility services and furnishing of required electrical components.
T. Manual pushbutton operation at the pump station site.
U. Programmable system controller with software for flexible system operation.
V. Integration with flashing beacons mounted on stationary motorist warning signs.
W. Notification system for automatic and manual initiation of system.
X. Warning system for loss of pressure in chemical distribution line, when tank is at 30% of capacity, if system fires more than a given number of times over a period of time specified by the owner, and if the flashing beacons on the sign assemblies are not operating.
Y. Automatic shutdown for loss of pressure in chemical distribution line.
Z. Installation of any service conductors, conduit with weatherhead, clamps, ground and padlocked disconnect cabinet at a new utility service pole provided by the utility (not included in the utility installation).
AA. Trenching, conduit and conductor installation, backfill and compaction for electrical and telephone service conduit runs between the pump house and new utility service pole (by others) as shown on the plans. All associated work shall be in conformance with the specifications and the respective utility company’s requirements.
BB. Trenching, conduit and conductor installation, backfill and compaction for conduit runs between the pump house and the fold-over tower, the light poles on site, as well as the flashing beacon motorist warning sign assemblies as shown on the plans. All associated work shall be in conformance with the specifications and respective utility company’s requirements.
CC. Trenching, conduit and conductor installation, backfill and compaction for conduit runs from the pump station to the bridge(s) and to the highway(s) for the anti-icing system conduits. All associated trenching work shall be in conformance with the specifications and the respective utility company’s requirements.

1.02 Design Requirements

A. System

1. The Contractor will be required to provide a system that applies a liquid, chemical anti-icing agent directly onto the bridge deck(s) and roadway(s) surface by manual wireless methods, pushbutton at the control box, and automatic methods by signal from the RWIS (installed by others).

2. The system shall be designed to meet the climate and traffic conditions of the project site. This will affect the nozzle spray pattern, valve panel design, pipe sizing and location, pump selection and operational details of the system. Design considerations shall include the number of annual ice events, duration of ice events, wind speeds, blowing snow, snow pack and ice build-up in the nozzle recess, and traffic volumes.
3. The sizing of the chemical reservoir tank(s) shall be designed according to climate and traffic conditions in order to provide a one-season supply of anti-icing solution for the bridge(s) but shall not be less than the capacity shown on the plans. The water reservoir tank(s) shall be designed to allow for flushing the chemical reservoirs and the pumping system. The owner shall approve all reservoir tank sizes.

4. Process piping shall be designed to link the chemical and water reservoir tanks to the pumping system.

5. The system shall work automatically in response to advance warning of imminent icing conditions based on RWIS technology and equipment installed by others utilizing multiple pavement sensors as well as key atmospheric sensors.

6. Autonomous operation is dependent on various weather parameters within the RWIS. Upon receiving a signal to initiate operation, either manually or automatically, the flashing beacons mounted on the stationary motorist warning signs will be activated. Then the pump will begin operation, pressurizing the system, purging any air out of the piping, and pumping the liquid chemical freeze suppressant from the reservoir tank(s) to the control mechanisms within the system and on the bridge superstructure. The liquid chemical freeze suppressant will then be sprayed, via the nozzles, onto the pavement by operation of control mechanisms that open and close in response to signals from the anti-icing system programmable logic controller to produce the desired anti-icing coverage indicated on the plans.

7. The system shall also work manually via dial-up communication links with security access code or by means of push button control at the control box.

B. Controls

1. The communication interface (serial and/or analog) between the RWIS and the pumping system will be housed in a control box located in the pump station building.

2. In addition to the RWIS communication interface, the control box shall also house the following equipment and/or functions:

   • Programmable system controller for independent nozzle zone firings on each one-directional traffic roadway for divided highways.
   • The programmable system controller shall have the capability to select sequential firings of each nozzle and only staggered firings for every other nozzle. The PC supplied at the local NYSDOT facility shall have the capability to initiate sequential or staggered firings.
   • The programmable system controller, along with other control mechanisms provided for the anti-icing system, shall have the capability to vary anti-icing chemical solution discharge volume (95 liters per lane mile to 135 liters per lane mile) by varying the nozzle spray timing for each individual nozzle head or other means. The PC supplied at the local NYSDOT facility shall have the capability to adjust the spray nozzle timing.
   • Computer storage, (20 gigabyte) retrieval (local and remote means), and transmission of system data.
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- Any one and/or combination of the following types of communication links as directed by the department:
  i) Private Carrier
  ii) Cellular
  iii) Wire line public network auto-dial, private line, etc.
- Failsafe re-set to automatic spray mode
- Activation and transmission of multiple alarms

3. There will be one or two RWIS Remote Processing Units (RPU) installed by others. One RPU will be designated for a single highway or two RPU’s will be designated for divided highways.

4. One serial (digital) data transfer port for each RWIS (RPU) and the control box will be interface connected. Text format for each serial interface will be in ASCII comma delineated format. One direct relay contact closure link for each RWIS (RPU) and the control box will be interface connected and shall activate the pumping operation for the highway zone that is monitored.

5. A technical representative of the firm providing maintenance services for the RWIS will be available to provide technical information regarding RWIS data port configurations, voltage, and signals after the contract has been awarded.

6. The system shall have the capability to be initiated either by manual operation or autonomous operation with manual over-ride. The manual over-ride function will be activated at the pump station, through the computer (by phone line) at the NYSDOT facility listed in the contract drawings, or by wireless activation. The system shall be designed to have a remote emergency shutdown.

7. The personnel operating the system will have the ability, by manual operation, to activate the system by local pushbutton, wireless means using designated security access, or computer supplied under this specification at the NYSDOT facility listed in the contract drawings.

8. The personnel operating the system will have the ability to shut down the system through the PC located at the NYSDOT facility, by manual push-button means at the pump station or by wireless means using designated security access.

9. Upon system initiation, both automatically and manually, the system shall notify the PC at the NYSDOT facility listed on the plans in the form of a printed message. The system shall also have the capability to notify a designated cordless pager. The pager number will be provided. In the case of the system being manually initiated by phone or PC, the system shall issue a confirmation signal that the system fired.

10. In the event of any system alarm or failure, the system shall notify the PC at the NYSDOT facility listed on the plans in the form of a printed message, accompanied by a distinct audible signal. The system shall also have the capability to notify a designated cordless pager. The pager number will be provided. Events that warrant an alarm shall include:
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- Anti-icing liquid level in tank(s) at less than or equal to 30% of storage capacity,
- Repeated firing cycles of pumping system, in automatic mode, three times in succession within a 20 minute period,
- Failure to spray programmed volume,
- Loss of pressure or excess pressure in chemical distribution line,
- Loss of electric power,
- Failure of the system to switch from manual mode to automatic mode, after a preset programmable interval (0 to 600 seconds),
- Flashing beacons not operating.

11. In the case of abnormal pressure loss in the chemical distribution line, the system will automatically shut down the main valve controlling the anti-icing solution supply at the pump station upon issuing the alarm.

12. Manual shutoff valves shall be provided for each individual nozzle head that are accessible from the bridge railing to facilitate replacement and to avoid spill or leakage into the environment.

13. The system will automatically maintain a history database in ASCII comma delineated format. The history database will include the date & time of spray applications, the quantity sprayed per cycle, identification of anti-icing agent used, origin of spray command, and system activation mode (automatic or manual). At the end of a pre-designated period, if there were any firings, this data will be automatically transmitted, via communication link to the PC at the local NYSDOT facility.

14. The system controller shall be designed to activate flashing beacons at 4 stationary motorist-warning signs located within 1 Km of the system controller by hard-wired connection. Each stationary sign will contain 2 flashing beacons. The beacons shall consist of 305-millimeter diameter yellow flash indicators that shall be aligned vertically, above and below each stationary sign panel. The system controller shall activate the flashing beacons 10 seconds before initiating the spray operation. The flashing beacons shall operate continuously during spray application and cease operation 60 seconds after the completion of spraying. The controller shall be capable of adjusting the flashing beacon cycle length up to 600 seconds after completion of the spray operation. The controller shall notify the PC at the NYSDOT facility on the plans that the flashing beacons have been activated. An audible alarm and message shall be provided to the PC at the NYSDOT facility on the plans if any of the Flashing Beacons are not activated. Signs and beacons will be paid for under their respective items. Trenching, conduit installation, compaction, jacking conduit under the highway, and backfill for the flashing beacon activation are included under this item.

C. If, at the time of award, there is a National Transportation Communications for ITS Protocol (NTCIP) standard or draft standard for object definitions for pumping systems, then the contractor will comply with the standard at no additional cost to New York State. The standard, if it exists, will take priority. However, the Contractor will be required to provide a system/equipment with the specified capabilities regardless of whether NTCIP standards exist for object definitions for system components.
D. A potassium acetate based liquid, containing no chlorides, is the designated anti-icing agent. However, the chemical reservoir and all system components in contact with the anti-icing agent including the containment system, must be designed to meet all current Federal and State environmental laws pertaining to: Calcium Chloride (CaCl), Magnesium Chloride (MgCl), Potassium Acetate (Kac), Sodium Chloride (NaCl), Calcium Magnesium Acetate (CMA), and CMA/Kac blend (CMAK). Metal surfaces in contact with the anti-icing agent shall be non-galvanized. After successful testing of the system with water, the chemical reservoir tank(s) shall be filled (cost included in the price bid for the anti-icing system) with the anti-icing agent meeting the following specifications:

- **Composition**: 50% aqueous potassium acetate solution plus corrosion inhibitors, by weight
- **Appearance**: Clear, colorless, mobile liquid, free from matter in suspension
- **Density**: 1.28 gm/cm³ @ 20 deg C
- **Viscosity**: 10 cp maximum @ 20 deg C and 20 cp maximum @ 0 deg C
- **Flash Point**: Nonflammable
- **Freezing Point**: -60 deg C
- **Miscibility with H2O**: Complete
- **Typical pH**: 11.0 ± 0.5
- **Specific Gravity**: 1.25 – 1.30 at 20 deg C

E. The nozzles provided for the spray system should be flush mounted with the roadway surface and be able to withstand normal traffic and snow plowing procedures conducted with maintenance trucks. The liquid stream from the nozzle will have a minimum spray range as indicated in the plans. The height of the liquid stream from the nozzle shall not exceed 400 mm above the roadway surface. The system shall be capable of controlling the amount of liquid applied in the range of 0.006 to 0.10 liters per square meter, for each nozzle.

F. Telephone service and electrical service shall be installed in the pump house on site, as shown on the Contract Plans.

G. The system shall also be equipped with the capability to switch to stand-by generator power (stand-by generator is not part of the project). The control system shall be equipped with 20 hours of battery back-up power to provide notification of the power loss to the NYSDOT facility indicated on the plans.

H. The truss tower, anchorage, foundation, lightning protection, and grounding shall be designed to industry standards, comply with New York State and Local Building Codes. Bedrock is present at approximately 1.5 m below grade. The foundation shall be keyed into bedrock a minimum of 300 mm. Wind load design shall be a minimum of 145-km/h (90-mph) and account for anti-climb panels and an RWIS sensor area load at the heights provided by NYSDOT. The truss tower shall be capable of folding over at or above the 4.6-m height and capable of being raised or lowered by one person to a horizontal position. The design of the truss tower, anchorage, and foundation shall be certified by a New York State licensed Professional Engineer.
I. The contractor shall furnish and install an IBM compatible computer at the NYSDOT facility listed in the plans. The PC at minimum, or equal, will contain a 766 MHz processor, 30 GB hard drive, 128 MB RAM, 19” CRT monitor, and all necessary software and licenses to operate.

The anti-icing software provided shall be specifically designed for monitoring and displaying, at minimum, under the specification the following items:

1. The chemical reservoir tank(s) solution volume.
2. Automatic signal initiation to operate from the RWIS.
5. Automatic Shutdown.
6. Events that warrant an alarm including:
   • Anti-icing liquid level in tank(s) at less than or equal to 30% of storage capacity
   • Repeated firing cycles of pumping system, in automatic mode, three times in succession within a 20 minute period
   • Failure to spray programmed volume
   • Loss of pressure or excess pressure in chemical distribution line
   • Loss of electric power
   • Failure of the system to switch from manual mode to automatic mode, after a pre-set programmable interval (0 to 600 seconds)
   • Flashing beacons not operating
7. Display of the history database described in Section 1.02 B, Item 13 above.
8. Any other item not specifically listed here but identified in the specification to be displayed on the PC at the NYSDOT facility described in the plans.

MATERIALS

This specification is intended to encompass all work associated with the permanent installation, 1 year warranty, and 2 years of maintenance service of the anti-icing system. The materials shall include a fully operational anti-icing system, chemical storage tanks, pump house, foundation slab and spill containment sump for pump house, foundation and a fold-over tower, conduit and conductors for motorist warning flashing beacon signs, and conduit systems for pavement sensors to be installed by others. A computer monitoring program that is compatible with the PC system furnished at the NYSDOT facility location described on the plans (windows compatible) and capable of integrating with NYSDOT RWIS installations shall be included.

2.01 The anti-icing system furnished by the Contractor must be acceptable to the Regional Construction Engineer. Three organizations currently involved in the manufacture and supply of automatic anti-icing systems are listed below:

- Boschung Company, Inc.
  (303) 681-8942
  Contact: Jerry Waldman
- Energy Absorption Systems, Inc.
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(312)467-6750
Contact: Joan Cornell
(Transpo @ 914-636-1000 ext.650)
• Odin Systems International, Inc.
(912)638-2400
Contact: Hall Ware III

2.02 The foundation and spill containment sump for the pump house shall be Class A Footing Concrete and be in conformance with §555-2 of NYSDOT Standard Specifications dated January 2, 1995 and the latest addenda.

2.03 The foundation for the fold-over tower shall be Class A Footing Concrete and be in conformance with §555-2 of NYSDOT Standard Specifications dated January 2, 1995 and the latest addenda.

2.04 The rigid plastic conduit, single conductors and ground wire for the anti-icing system, the security lighting, the pavement sensors, and the stationary motorist warning sign flashing beacons shall conform to section §670-2 specification of NYSDOT Standard Specifications dated January 2, 1995 and the latest addenda.

2.05 Raceways, conduits and pressure lines shall be fastened to the bridge(s) superstructure as indicated in the plans with flange clamps and conduit clips made by Linport International, Norwell, Massachusetts, phone 617-982-1400, or approved equal. Steel channel concrete inserts and conduit clips shall be used to fasten raceways, conduits and pressure lines to the bridge(s) railing or concrete as indicated in the plans. Furnish Unistrut Buffalo, Inc. products or approved equal.

2.06 Pump Station Structure

A. The concrete foundation and spill containment sump for the structure shall be as specified on the Contract Drawings.

B. The Contractor shall be responsible for the design and detailing of the pump station structure. The Contractor shall submit design calculations, stamped by a New York State Professional Engineer, and shop drawings to the Engineer.

C. The size of the building and foundation shall be equal to, or greater, than the dimensions indicated on the Contract Drawings.

D. The structure shall be designed to comply with all applicable New York State and Local Building Codes.

E. The roof panels shall be precast concrete planks with smooth form finish. The roof panels shall be insulated sandwich panels, with an interior layer of rigid insulation providing an R-value of 12.

F. The walls shall be precast concrete panels with exposed aggregate finish, color to be selected by owner. The wall panels shall be insulated sandwich panels, with an interior layer of rigid insulation providing an R-value of 12.
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G. The design, fabrication, and installation of precast concrete planks or panels shall conform to the latest recommendations and requirements of the Precast Concrete Institute (PCI) and be in conformance with material specification 704-03 of NYSDOT Standard Specifications dated January 2, 1995 and the latest addendum’s.

H. Steel Door: 18 gauge steel, tamper-proof hinges, dead-bolt lock, no windows, adjustable door holder, door stop & holder, and rain guard.

I. Overhead Coiling Door: 18 gauge galvanized metal door slats and 24 gauge overhead hood, galvanized steel guides, hardware and locking devices, manual chain hoist operated.

J. Threshold: Extruded aluminum, commercial grade.

K. Screened Vents: 2 each, 180mm x 460mm, 12.5 gauge aluminum, rainproof.

L. The structure shall be watertight.

M. Two knockout blocks with steel sleeves and hinged exterior metal flap covers with locking hasps for padlocks shall be provided in the wall facing the access road to accommodate a chemical reservoir filler pipe and vent pipe.

N. Interior lights shall be as scheduled on the drawings.

2.07 Pump Station Electrical

A. General
   1. NFPA 70 (National Fire Protection Association) – National Electrical Code. All Electrical Work shall conform to the requirements of the latest edition of the National Electrical Code (NEC).
   2. All electrical devices, materials, and packaged equipment shall meet the requirements of a recognized testing agency such as the Underwriter's Laboratories, and shall bear its label.

B. Wall Switches
   1. Product Description: NEMA WD 1, Heavy-Duty AC only general-use snap switch.
   2. Ratings: Match branch circuit and load characteristics.

C. Receptacles
   1. Product Description: NEMA WD 1, Heavy-duty general use receptacle.
   2. Convenience Receptacle: Type 5-20.
   3. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

D. Equipment Connections
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1. Obtain and review shop drawings, product data, manufacturer’s wiring diagrams, and manufacturer's instructions for equipment furnished under other sections of this specifications.

2. Determine connection locations and requirements.

3. Sequence rough-in of electrical connections to coordinate with installation of equipment.

4. Sequence electrical connections to coordinate with start-up of equipment.

5. Make electrical connections.

6. Make conduit connections to equipment using flexible conduit. Use liquid-tight flexible conduit with watertight connectors in damp or wet locations.

7. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

8. Install receptacle outlet to accommodate connection with attachment plug.

9. Install cord and cap for field-supplied attachment plug.

10. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

11. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

12. Install terminal block jumpers to complete equipment wiring requirements.

13. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

E. Electric and Telephone Utility Service
(Cost for furnishing electric and telephone utility services shall be paid for separately under their respective items.)

1. Arrange with Utility Company for permanent electric and telephone service.

2. Utility Company: Niagara Mohawk (power) and Verizon (telephone)


8. Utility meter base. Furnished and installed by the contractor per Niagara Mohawk specifications.

9. Install service entrance conduits and conductors to building service entrance equipment. Utility Company will connect service lateral conductors to service entrance conductors at the Utility pole.

10. Provide conduits for the telephone system. Provide a grounding conductor, point of demarcation, and cross-connect per Verizon specifications.

F. Fusible Switch Assemblies

1. Product Description: NEMA KS 1, Type HD enclosed load interrupter knife switch. Handle lockable in OFF position.

2. Fuse clips: Designed to accommodate NEMA FU 1, Class R fuses.

3. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.

   a. Interior Dry Locations: Type 1.
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b. Exterior Locations: Type 3R.

4. Furnish switches with entirely copper current carrying parts.

5. Switch Rating: Horsepower rated for AC. Coordinate with equipment manufacturer for specific sizes.

G. Panelboards
1. Product Description: NEMA PB1, circuit breaker type panelboard.
2. Panelboard Bus: Copper current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard.
3. Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical for 240 volt panelboards; 14,000 amperes rms symmetrical for 480 volt panelboards.
4. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as Type SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers as indicated on Drawings. Do not use tandem circuit breakers. Number and size of circuit breakers shall be as shown on the drawings.
5. Enclosure: NEMA PB 1, Type 1.
6. Cabinet Front: Surface cabinet front with concealed trim clamps, concealed hinge, metal directory frame, and flush lock keyed alike. Finish in manufacturer's standard gray enamel.

H. Two-Winding Transformers
1. Product Description: NEMA ST 20, factory-assembled, air-cooled, dry type transformers, ratings as indicated on Drawings. UL listed.
   a. The 30 kVA transformer shall be energy efficient and comply with NEMA standard TP-1 for optimum energy efficiency at 35% load and shall be labeled for the EPA Energy Star Program.
2. Primary Voltage: 480 volts, 3 phase (30 kVA) and 480 volts, 1 phase (1 kVA).
3. Secondary Voltage: 208Y/120 volts, 3 phase (30 kVA) and 120/240 volts, 1 phase (1 kVA).
4. Insulation system and average winding temperature rise for rated kVA as follows:
   a. Class 220 with 150 degrees C rise.
5. Case temperature: Do not exceed 35 degrees C rise above ambient at warmest point at full load.
6. Winding Taps (30 kVA only): 6 full capacity – 2.5%, 2 above normal, and 4 below normal.
7. Basic Impulse Level: 10 kV.
8. Ground core and coil assembly to enclosure by means of visible flexible copper grounding strap.
9. Mounting:
   a. 1-15 kVA: Suitable for mounting in an exterior enclosure.
   b. 16-75 kVA: Suitable for floor mounting.
10. Coil Conductors: Continuous copper or aluminum windings with terminations brazed or welded.
11. Enclosure (30 kVA only): NEMA ST 20, Type 1 ventilated. Furnish lifting eyes or brackets.
   a. The 1 kVA transformers shall be open-type.
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12. Isolate core and coil from enclosure using vibration-absorbing mounts.

I. Electric Unit Heaters
   1. Assembly: UL listed and labeled assembly with terminal box and cover, and built-in controls.
   2. Heating Elements: Enclosed copper tube, aluminum finned element of coiled nickel-chrome resistance wire centered in tubes and embedded in refractory material or exposed helical coil of nickel-chrome resistance wire with refractory ceramic support bushings.
   3. Cabinet: 0.0478-inch (1.2 mm) thick steel with easily removed front panel with integral air outlet and inlet grilles.
   4. Element Hangers: Quiet operating, ball bearing cradle type providing unrestricted longitudinal movement, on enclosure brackets.
   5. Fan: Direct-drive propeller type, statically and dynamically balanced, with fan guard.
   7. Control: Separate fan speed switch and thermostat heat selector switch, factory wired, with switches built-in behind cover. Furnish thermal overload.
   8. Electrical Characteristics:
      a. 5 kW.
      b. 480 volts, three phase, 60 Hz.
      c. Disconnect Switch: Factory mount.

2.08 Chemical and Water Reservoir Tanks & Piping

   A. The tanks shall be fiberglass reinforced plastic (FRP) tanks meeting or exceeding the requirements of ASTM D4097-95a. Galvanized steel valves or fittings shall not be used.

   B. The tanks shall be equipped with lifting lugs to permit unloading from the delivery truck using machine hoisting equipment, and manual transfer into the pump station building.

   C. Each chemical tank shall be supplied with a factory-installed 100-mm diameter, top-mounted, non-gusseted flange for product supply.

   D. Each chemical tank shall be supplied with a factory-installed bottom discharge fitting to provide gravity drainage.

   E. Each tank shall be equipped with a 254-mm fillwell, quarter turn with cover.

   F. 100 mm piping with necessary fittings and elbows shall be furnished to allow venting and filling pipes to protrude through the pump station wall facing the access road.

   G. Structural steel fabricated industrial saddle assemblies (2 per tank) shall be furnished and installed to provide 200-mm clearance between the sump floor and the bottom of the tank. The saddle assemblies shall be shop-primed. The saddle assemblies shall be equipped with heavy-duty rubber pads and stainless steel strap and bolts. The saddle assemblies shall be fixed to the floor with stainless steel anchor bolts.
H. The chemical tanks shall be Part No. A8654 as produced by Design Tanks, Inc., 1810 E. Avenue, Sioux Falls, SD, 57104, (605) 336-2750 or (888) 366-8265, or equal.

I. The water tank (850-L min.) shall be Part No. D4583 as produced by Design Tanks, Inc., or equal.

J. The saddle assemblies shall be Part No. A5032 as produced by Design Tanks, Inc., or equal.

K. On the upstream side of the pump, piping, joints, and fittings between tanks or between tanks and the pump shall be polyvinyl chloride (PVC) meeting the requirements of ASTM D2241-89 Polyvinyl Chloride Pressure Rated Pipe (SDR Series).

2.09 Pumps

A. Pump surfaces, and all other metal surfaces, in contact with the anti-icing agent shall be stainless steel.

2.10 Fold-Over Truss Tower

A. The tower shall be a Glen Martin Unit MF-1336 heavy-duty 13.1 m fold-over truss tower with 4.6 m anti-climb panels made by Glen Martin or an approved equal.

2.11 Accessories

A. Hand-held temperature compensating digital fiberoptic refractometer, capable of detecting and displaying the concentration of the potassium acetate based anti-icing agent in the on-site storage tank. Furnish a Cole-Parmer refractometer or approved equal. Cryotech Deicing supplies the product, phone 319-372-6012.

B. Portable, removable, electric powered agitator/mixer. The mixer shall be temporarily clamped or otherwise supported at the 254-mm fillwell at the top of one of the chemical tanks. The mixer shall have a 1.219-m long x 16-mm diameter shaft with a 250-mm A100 impeller driven by a 0.43HP/350 RPM motor. Furnish a Lightnin Mixer, model XJ43 from Siewert Equipment Company, Inc., phone 716-381-3979 or an approved equal.

C. Back-up batteries shall be C & D Liberty Series type batteries, or equal capable of running for 20 hours at zero degrees Celsius.

2.12 At the successful conclusion of acceptance testing of the system, the contractor shall furnish and deliver anti-icing agent to the full capacity of the tanks in the pumping station. The anti-icing agent shall meet the specifications of the product described in Section 1.02 D above. The delivery shall include product certification and material safety data sheets (MSDS).

CONSTRUCTION DETAILS
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3.01 All excavation, foundations, conduit, conductors, pull boxes, junction boxes, and backfill required for the completion of this item shall meet the requirements of the following sections of the Standard Specifications:

A. Section 206 – Trench, Culvert and Structure Excavation
B. Section 203-3.15 – Fill and Backfill at Structures, Culverts, Pipes and Conduits and Direct Burial Cables
C. Section 670 – Highway Lighting Systems

3.02 The following conduits shall be cast into the pump station foundation to accommodate certain items (excluding the anti-icing pressure line and low voltage systems for operation of the spray nozzles):

A. 2 – 127-mm diameter conduits for RWIS pavement sensor cables,
B. 1 – 75-mm diameter conduit for underground telephone service,
C. 1 – 75-mm diameter conduit for underground electrical service,
D. 2 – 75-mm diameter conduits for RWIS atmospheric sensors,
E. 2 – 50-mm diameter conduits for Stationary Motorist warning sign flashing beacons,
F. 1 – 50-mm diameter conduits for power to the fold-over truss tower,
G. 2 – 19-mm diameter conduits for external pole mounted security lighting.

3.03 The following conduits shall be cast into the fold-over truss tower foundation to accommodate certain items:

A. 2 – 75-mm diameter conduits for RWIS atmospheric sensors,
B. 1 – 50-mm diameter conduit for power to the fold-over truss tower.

3.04 The contractor shall install the raceways, conduits, junction boxes, and manual nozzle cutoff valves on the outboard side of one bridge railing (per bridge) unless indicated otherwise on the plans.

3.05 A junction box shall be fastened to the under deck of the bridge structural deck at each pavement sensor location. Conduit “runs” from the raceway to the sensors and nozzles shall be fastened to the primary members with flange clamps and conduit clips. Conduit will not be fastened to the structural deck system. Approval from the Regional Design Engineer is required to locate pavement sensors in close proximity of railroad tracks.

3.06 The Contractor shall provide, at minimum, one week’s notice to the State’s vendor that provides maintenance service for the RWIS system after installation of the bridge railing is completed. The vendor shall install the pavement sensors and the contractor shall allow the vendor access to the site. If special access is required to make the installations, NYSDOT will make arrangements for the special access.

3.07 The Contractor shall provide for anti-icing system manufacturer’s technical representative to be on-site to supervise the contractor’s personnel in all phases of the system installation and testing. Skilled persons, proficient in the trades required shall install all work in a neat, orderly, and responsible manner.
3.08 The Contractor shall provide for the installation of the anti-icing system, including the start-up, alignment, and testing of the entire system. A technical representative of the system manufacturer shall provide a minimum 8-hour training session for NYSDOT maintenance personnel. The training will cover operation, commissioning, seasonal commissioning/decommissioning, testing, and maintenance of the system. The training session will be conducted at a local NYSDOT training facility and at the site of the anti-icing installation. The NYSDOT may elect to videotape the training session for use at future in-house training sessions.

3.09 Acceptance Testing

Upon completion of the anti-icing system installation, the contractor shall conduct on-site testing of the anti-icing system in the presence of the Engineer, using water in place of the anti-icing solution. The proper functioning of all components of the anti-icing system and the watertightness of the system, under specified operating pressure, shall be demonstrated and verified.

Between September 22nd and December 1st following the completion of the system installation, the contractor shall again conduct on-site testing of the anti-icing system in the presence of the Engineer, using the anti-icing solution prescribed by the specification. This test shall take place at 7°C ± 6°C (45°F ± 10°F). Proper functioning of all components of the anti-icing system and the watertightness of the system, under specified operating pressure, shall be demonstrated and verified. In addition, the ability of the system to operate automatically manually and remotely shall be demonstrated and verified. The ability of the system to integrate with the RWIS and carry out the prescribed warning and notification capabilities as described above shall be verified as well.

3.10 Documentation

1) The following items shall be submitted:
   a) Name of proposed system manufacturer and proposed supervisor overseeing installation (at Bid)
   b) Shop Drawings for reservoir tanks, pumps, pump house building & accessories, anti-icing system (prior to installation)
   c) Calculations, Design, and Details for tower foundation by licensed NYS Professional Engineer (prior to installation)
   d) Construction and System Layouts (upon project award)
   e) Hydraulic Schematics (upon project completion)
   f) Electrical Schematics (upon project completion)
   g) Control box schematics (upon project completion)
   h) As Built Drawings (upon project completion)
   i) MSDS for anti-icing agent (at time of delivery)
   j) Acute aquatic toxicity report for anti-icing agent per U.S. EPA test methods (at time of delivery)

2) The Contractor will be required to provide documentation, including reference names and phone numbers for at least three prior installations that include the integration of an automated anti-icing system with an RWIS utilizing pavement sensor data. The contractor shall provide a supervisor on the job site during the installation of the anti-icing system with documented experience of 3 years at maintaining or/and installing anti-
icing systems. The documentation must be acceptable to the Department’s Regional Construction Engineer.

3) The Contractor shall furnish three (3) complete sets of operating instruction manuals in three-ring binders, which shall include definite and specific instructions on all mechanical and electrical, and communication systems involved in the work of this specification. Said instructions and manuals should set forth:

   a) The manner of operation.
   b) The necessary precautions and care to be followed.
   c) Periodic preventative maintenance requirements.
   d) Schedule of recommended replacement cycles for all components in the system.
   e) A complete set of spare parts lists, spare parts catalogues, service manuals and manufacturing data on said system components.
   f) Copies of the individual component warranties that comprise the anti-icing system.

Said instruction manuals are to be made available by the Contractor for review and comment by the Engineer a minimum of 4 weeks prior to the scheduled acceptance testing of the anti-icing system. Upon receipt of comments from the Engineer, the manual shall be updated to address the comments within 4 weeks after successful completion of acceptance testing.

3.11 System Warranty & Maintenance

The automated anti-icing system will be warranted from the completion date of the Acceptance Testing for all defects in material/equipment, workmanship, and full operation to design requirements of this specification for a period of one (1) year. All material, labor, equipment, and in-direct expenses will be covered by this warranty. Qualified and experienced technical personnel shall be on-site within 12 hours of notification under the terms of the warranty. The Contractor is required under terms of the warranty to return the system to full operational service within 36 hours of arrival at the site.

The Contractor shall provide 2 calendar years of maintenance service. The term of the service will start effective from the date the entire 1-year system warranty for all bridges in the contract has expired. The system maintenance service will include all labor, travel, lodging and per-diem. System Maintenance service functions include:

A. Preventative Maintenance Schedule

<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pumping System</td>
<td>Monthly during anti-icing season (10/1 to 3/31)</td>
</tr>
<tr>
<td>Solenoids</td>
<td>Monthly during anti-icing season (10/1 to 3/31)</td>
</tr>
<tr>
<td>Nozzles</td>
<td>Monthly during anti-icing season (10/1 to 3/31)</td>
</tr>
<tr>
<td>Computer System</td>
<td>Monthly during anti-icing season (10/1 o3/31)</td>
</tr>
<tr>
<td>Alarm System</td>
<td>Monthly during anti-icing season (10/1 to 3/31)</td>
</tr>
<tr>
<td>Communications System</td>
<td>Monthly during anti-icing season (10/1 to 3/31)</td>
</tr>
</tbody>
</table>
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B. Decommissioning and flushing of pumping system - at the conclusion of the anti-icing season.

C. Commissioning & startup testing – prior to the start of the anti-icing season upon notification by NYSDOT.

D. Emergency Service – qualified and experienced technical personnel shall be on-site within 12 hours of notification. The Contractor is required to return the system to full operational service within 36 hours of arrival at the site.

3.12 Service Performance Bond

The Contractor shall furnish a Performance Bond in the amount of $80,000 for Item 07680.99 as security for the faithful performance of all the Contractor’s obligations under Section 3.11 System Maintenance Service of this specification. The bond shall remain in effect for a period of three years, starting from the completion date of the Acceptance Testing, as described in Section 3.09 above. The bond shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations and shall be executed by such sureties as are named in the current list of “Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies” as published in Circular 570 (amended) by the Audit Staff, Bureau of Government Financial Operations, U.S. Treasury Department. A certified copy of such agent’s authority to act must accompany all bonds signed by an agent.

If the surety on the bond furnished by the Contractor is declared a bankrupt or becomes insolvent or its right to do business in New York State is terminated or it ceases to meet the requirements of the preceding paragraph, the Contractor shall within ten days thereafter substitute another bond and surety, both of which must be acceptable to the New York State Department of Transportation.

METHOD OF MEASUREMENT

Payment will be made at the lump sum price bid.

BASIS OF PAYMENT

The lump sum bid price shall include the cost of all labor, design services, testing, training, materials, equipment, and system service necessary to complete the work.