

## **ITEM C-102 TEMPORARY AIR AND WATER POLLUTION, SOIL EROSION, AND SILTATION CONTROL**

### **DESCRIPTION**

**102-1.** This item shall consist of temporary control measures as shown on the plans or as ordered by the Program Manager during the life of a contract to control pollution of air and water, soil erosion, and siltation through the use of silt fences, berms, dikes, dams, sediment basins, fiber mats, gravel, mulches, grasses, slope drains, and other erosion control devices or methods.

Temporary erosion control shall be in accordance with the approved erosion control plan; the approved Construction Safety and Phasing Plan (CSPP) and AC 150/5370-2, *Operational Safety on Airports During Construction*. The temporary erosion control measures contained herein shall be coordinated with the permanent erosion control measures specified as part of this contract to the extent practical to assure economical, effective, and continuous erosion control throughout the construction period.

Temporary control may include work outside the construction limits such as borrow pit operations, equipment and material storage sites, waste areas, and temporary plant sites.

Temporary control measures shall be designed, installed and maintained to minimize the creation of wildlife attractants that have the potential to attract hazardous wildlife on or near public-use airports.

**102-2 Tennessee Department of Environment and Conservation.** The Contractor must perform and certify that an inspection, as described in section 3.5.8.2 of the General Permit for Stormwater Discharges from Construction Activities (“Permit”) has been performed at least twice every calendar week and documented on form CN-1173 (Rev. 6-16), provided in the Contractor Storm Water Pollution Prevention Plan (SWPPP). The Contractor must certify the inspection of erosion and sediment controls and of outfall points was performed; and whether or not all planned and designed erosion and sediment controls are installed and in working order. The certification must be executed by a person who meets the signatory requirements described in Section(s) 3.5.8.2(g) and 7.7.2 of the General NPDES Permit for Discharges of Stormwater Associated with Construction Activities also referred to as the construction general permit (CGP). Inspections must be performed at least 72 hours apart. Inspection documentation will be maintained on-site and made available upon request. Inspection reports must be submitted to the Tennessee Department of Environment and Conservation (TDEC) – Division of Water Resources within 10 days of a request.

The record of inspections must be submitted to the following address:

Tennessee Department of Environmental and Conservation  
Division of Water Resources – Memphis Environmental Field Office  
8383 Wolf Lake Drive  
Bartlett, TN 38133

### **MATERIALS**

**102-2.1 Grass.** Grass that will not compete with the sod or grasses sown later for permanent cover per Item T-904 shall be a quick-growing species (such as cereal grasses) suitable to the area providing a temporary cover. Selected grass species shall not create a wildlife attractant. Rye grass, of any variety, shall not be allowed.

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**102-2.2 Mulches.** Mulches shall be a cellulose-fiber or wood-pulp, commercially available spray applied suitable material reasonably clean and free of noxious weeds and deleterious materials. Mulches shall not create a wildlife attractant.

**102-2.3 Fertilizer.** Fertilizer shall be a standard commercial grade and shall conform to all federal and state regulations, to the standards of the Association of Official Agricultural Chemists, and the requirements of Item T-904 Sodding.

**102-2.4 Slope drains.** Slope drains may be constructed of pipe, fiber mats, rubble, concrete, asphalt, or other materials that will adequately control erosion.

**102-2.5 Silt fence.** Silt fence shall consist of polymeric filaments which are formed into a stable network such that filaments retain their relative positions. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life. Silt fence shall meet the requirements of ASTM D6461.

**102-2.6 Other.** All other materials shall meet commercial grade standards and shall be approved by the Program Manager before being incorporated into the project.

## CONSTRUCTION REQUIREMENTS

**102-3.1 General.** In the event of conflict between these requirements and pollution control laws, rules, or regulations of other federal, state, or local agencies, the more restrictive laws, rules, or regulations shall apply.

The Program Manager shall be responsible for assuring compliance to the extent that construction practices, construction operations, and construction work are involved.

**102-3.2 Schedule.** Prior to the start of construction, the Contractor shall submit schedules in accordance with the approved Construction Safety and Phasing Plan (CSPP) and the plans for accomplishment of temporary and permanent erosion control work for clearing and grubbing; grading; construction; paving; and structures at watercourses. The Contractor shall also submit a proposed method of erosion and dust control on haul roads and borrow pits and a plan for disposal of waste materials. Work shall not be started until the erosion control schedules and methods of operation for the applicable construction have been accepted by the Program Manager.

**102-3.3 Construction details.** The Contractor will be required to incorporate all permanent erosion control features into the project at the earliest practicable time as outlined in the plans and approved CSPP. Except where future construction operations will damage slopes, the Contractor shall perform the permanent sodding and mulching and other specified slope protection work in stages, as soon as substantial areas of exposed slopes can be made available. Temporary erosion and pollution control measures will be used to correct conditions that develop during construction that were not foreseen during the design stage; that are needed prior to installation of permanent control features; or that are needed temporarily to control erosion that develops during normal construction practices but are not associated with permanent control features on the project.

Where erosion may be a problem, schedule and perform clearing and grubbing operations so that grading operations and permanent erosion control features can follow immediately if project conditions permit. Temporary erosion control measures are required if permanent measures cannot immediately follow grading operations. The Program Manager shall limit the area of clearing and grubbing, excavation, borrow, and embankment operations in progress, commensurate with the Contractor's capability and progress in keeping the finish grading, mulching, sodding, and other such permanent control measures current with the accepted schedule. If seasonal limitations make such coordination unrealistic, temporary erosion control measures shall be taken immediately to the extent feasible and justified as directed by the Program Manager.

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The Contractor shall provide immediate permanent or temporary pollution control measures to minimize contamination of adjacent streams or other watercourses, lakes, ponds, or other areas of water impoundment as directed by the Program Manager. If temporary erosion and pollution control measures are required due to the Contractor's negligence, carelessness, or failure to install permanent controls as a part of the work as scheduled or directed by the Program Manager, the work shall be performed by the Contractor and the cost shall be incidental to this item.

The Program Manager may increase or decrease the area of erodible earth material that can be exposed at any time based on an analysis of project conditions.

The erosion control features installed by the Contractor shall be maintained by the Contractor during the construction period.

Provide temporary structures whenever construction equipment must cross watercourses at frequent intervals. Pollutants such as fuels, lubricants, bitumen, raw sewage, wash water from concrete mixing operations, and other harmful materials shall not be discharged into any waterways, impoundments or into natural or manmade channels.

The Contractor shall provide equipment wash out areas and these areas will be so constructed and protected so as to not allow any discharge of silt, fuels, lubricants and other harmful materials into any waterways, impoundments or into natural or manmade channels.

The Contractor shall periodically inspect the pollution control features at the intervals stated in the approved SWPPP, and immediately after each rainfall and at least daily during prolonged rainfall and immediately correct any deficiencies. The Contractor shall review the location of pollution control features for effectiveness. If deficiencies exist, the Contractor shall correct as directed by the Program Manager.

The Contractor shall remove sediment deposits when the deposit reaches approximately 1/2 of the volume capacity of the sediment control feature, or as otherwise directed by the Program Manager. The Contractor shall also remove all sediment deposits when the sediment control feature is removed on completion of the project or applicable construction phase. The Contractor shall grade and dress the area and restore it to its pre-construction condition or the proposed finish grade, as called for on the plans. Sediment removal operations shall be considered normal maintenance operations for BMP's, incidental to the item requiring its use, and shall not be measured separately for pay.

In compliance with the General Provisions Section 50, Control of Work, Subsection 20-12, Maintenance During Construction, the Contractor shall continuously maintain permanent and temporary pollution control features. Maintenance shall include periodic watering and mowing of grassed areas. There shall be no additional or separate compensation paid to the Contractor for such work.

If construction is suspended, the Contractor shall inspect, maintain and operate temporary and permanent pollution control features during such suspension. If suspension is part of the project phasing and sequencing plan, or if the suspension is requested by the Contractor, the Contractor shall not be paid additional or separate compensation for, nor relieved of the responsibility to inspect, maintain and operate the pollution control facilities.

The Contractor is responsible for the removal of all temporary erosion and pollution control facilities as well as the restoration of those sites. This work shall include the repair of any trenching for silt fence, removal of all silt build-up, the removal of fencing, barriers and silt bales and the associated stakes and appurtenances, and the placing of seeding or sodding to restore those sites. All inlets, catch basins and manholes constructed for this project shall be cleaned and the new drainage pipes flushed. All materials taken from the facilities or flushed from the new piping system shall be collected by the Contractor and disposed of off-site.

**102-3.4 Installation, maintenance and removal of silt fence.** Silt fences shall extend a minimum of 26 inches and a maximum of 34 inches above the ground surface. Posts shall be set no more than 10 feet on

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center. Filter fabric shall be cut from a continuous roll to the length required minimizing joints where possible. When joints are necessary, the fabric shall be spliced at a support post with a minimum 12-inch overlap and securely sealed. A trench shall be excavated approximately 6 inches deep by 4 inches wide on the upslope side of the silt fence. The trench shall be backfilled and the soil compacted over the silt fence fabric. The Contractor shall remove and dispose of silt that accumulates during construction and prior to establishment of permanent erosion control. The fence shall be maintained in good working condition until permanent erosion control is established. Silt fence shall be removed upon approval of the Program Manager.

**102-3.5 Fugitive Dust Control.** The Contractor shall be responsible for providing temporary measures as needed to adequately control fugitive dust during construction. Dust, as discussed herein, may be from blowing soil, Portland cement, lime, dry grass, or other such materials.

Several methods of controlling dust and other air pollutants include:

- a. Exposing the minimum area of erodible earth.
- b. Applying temporary mulch with or without seeding.
- c. Using water sprinkler trucks.
- d. Using covered haul trucks
- e. Using dust palliatives or penetration asphalt on haul roads.
- f. Using Plastic sheet coverings.

Dust control at an operational airfield is of the utmost importance because excessive dust can restrict sight distance and damage aircraft engines. The Program Manager reserves the right to shut down or restrict construction operations when excessive dust, as determined by the Program Manager, could impact air navigation or airfield operations. Such a restriction or shut-down may not be the basis for additional costs or contract time.

The cost of temporary measures to control dust shall be incidental to the contract and no separate payment will be made for these measures.

**102-3.6 Suspended Solid Control.** The Contractor shall address and remove, to the Program Managers satisfaction, suspended solids in collected stormwater runoff which will be detained for sediment removal in the proposed temporary sediment basins for the project prior to release to stormwater systems. The Contractor shall be responsible for obtaining the services of a professional or a laboratory to analyze the soil and/or construction storm water and to recommend an effective blend of polymer flocculant and the application rate to be used for this site to promote effective sediment removal.

## **METHOD OF MEASUREMENT**

**102-4.1** Temporary erosion and pollution control work required will be performed as scheduled or directed by the Program Manager. Completed and accepted work will be measured as follows:

- a. Installation and removal of Silt Fence (with and without backing) and Filter Socks will be measured by the linear foot. Such measurement shall include removal upon completion of the project or phase requiring its use and upon establishment of an adequate stand of grass.
- b. Catch basin and inlet protection (Types A, B, & C) will be measured per each. This item includes the surrounding granular berm, wire mesh (where applicable), and geotextile fabric. Such measurement shall also include its removal upon completion of the project or phase requiring its use and upon establishment of an adequate stand of grass.

**ISSUED FOR BID**

c. Culvert protection will be measured per each. This item includes the surrounding granular berm and geotextile fabric. Such measurement shall also include its removal upon completion of the project or phase requiring its use and upon establishment of an adequate stand of grass.

d. Enhance Rock Check Dam will be measured per each. This item includes the granular berm and geotextile fabric. Such measurement shall also include its removal upon completion of the project or phase requiring its use.

e. Filter Sock Check Dam will be measured per each. This item shall have a minimum installed height of 19-inches. This item includes the filter socks and stakes. Such measurement shall also include its removal upon completion of the project or phase requiring its use.

f. Machined Rip Rap for stabilization will be measured per ton, utilized and installed on Geotextile (Type III) Erosion Control fabric (TDOT Specification) as shown on the plans.

g. Temporary slope drains will be measured by the linear foot of pipe and shall include the rip-rap outlet pad.

h. Temporary Diversion Berm shall be measured by the linear foot of berm compacted in place and shall include the removal of the berm upon completion of the project or phase requiring its use.

i. Construction of the temporary sediment basins will be measured by the cubic yard of excavation performed for each basin and shall include the necessary quantity of compacted in-placed embankment to construct the sediment basin, as directed by the Program Manager.

j. Application of Flocculent for removal of suspended solids from collected runoff shall be per application, with approval from the Program Manager. The application rate shall be as specified by the manufacturer of the product.

k. Sediment Basin Dewatering/Principal Spillway Assembly. This item shall consist of furnishing and complete installation of the 36” CMP Riser Pipe, 30” CMP Outlet Pipe and Rip-rap Apron, Anti-seep Collars, Trash Rack, Anti-vortex device, Gate Valve, Skimmers and skimmer resting piers and Access Platform.

l. Sediment Removal. Sediment shall be removed from behind the erosion control structures when it has accumulated to one-half the original height of the structure or as directed by the Program Manager, and shall be measure per cubic yard of sediment removed. Sediment accumulated in Sediment Basins shall be removed when it reaches the elevation as shown in the plans.

m. Concrete Washout shall be measured per each and shall include the cleaning and/or removal and proper disposal of the waste material upon the completion of the project or phase requiring its use.

n. Fertilizer shall be measured by the ton and shall include its proper application.

**102-4.2** Control work performed for protection of construction areas outside the construction limits, such as borrow and waste areas, haul roads, equipment and material storage sites, and temporary plant sites, will not be measured and paid for directly but shall be considered as a subsidiary obligation of the Contractor.

**BASIS OF PAYMENT**

**102-5.1** Accepted quantities of temporary water pollution, soil erosion, and siltation control work ordered by the Program Manager and measured as provided in paragraph 102-4.1 will be paid for under:

- Item C-102-5.1            Silt Fence – per Linear Foot
- Item C-102-5.2            Silt Fence with Backing – per Linear Foot

**ISSUED FOR BID**

Item C-102-5.3	Filter Sock (12-Inch) – per Linear Foot
Item C-102-5.4	Sediment Removal – per CY
Item C-102-5.5	Enhanced Rock Check Dam – per Each
Item C-102-5.6	Filter Sock Check Dam – per Each
Item C-102-5.7	Sediment Filter Bag (15-feet by 10-feet) – per Each
Item C-102-5.8	Curb Inlet Protection (Type 2) – per Each
Item C-102-5.9	Catch Basin Protection (Type A) – per Each
Item C-102-5.10	Catch Basin Protection (Type B) – per Each
Item C-102-5.11	Catch Basin Protection (Type C) – per Each
Item C-102-5.12	Culvert Protection (Type 1) – per Each
Item C-102-5.13	Temporary Drainage Pipe (18-inch CMP) – per Linear Foot
Item C-102-5.14	Machined Rip-Rap (Class A-1) – per Ton
Item C-102-5.15	Machined Rip-Rap (Class A-2) – per Ton
Item C-102-5.16	Machined Rip-Rap (Class B) – per Ton
Item C-102-5.17	Geotextile (Type III) Erosion Control – per Square Yard
Item C-102-5.18	Temporary Construction Exit (50-feet by 20-feet) – per Each
Item C-102-5.19	Temporary Culvert Crossing (125-feet by 20-feet) (24" CMP) – per Each
Item C-102-5.20	Temporary Diversion Berm (1.5-feet height) – per Linear Foot
Item C-102-5.21	Concrete Washout – per Each
Item C-102-5.22	Application of Flocculent (East Basin) – per Application
Item C-102-5.23	Application of Flocculent (West Basin) – per Application
Item C-102-5.24	Sediment Basin Dewatering/Principal Spillway Assembly – per Lump Sum
Item C-102-5.25	Excavation (Sediment Basin) – per Cubic Yard
Item C-102-5.26	NOT USED
Item C-102-5.27	NOT USED
Item C-102-5.28	Temporary Slope Drains with Rip-Rap Outlet - per linear foot
Item C-102-5.29	NOT USED
Item C-102-5.30	Temporary Sealing of Catch Basin - per Each

Where other directed work falls within the specifications for a work item that has a contract price, the units of work shall be measured and paid for at the contract unit price bid for the various items.

Temporary control features not covered by contract items that are ordered by the Program Manager will be paid for in accordance with Section 90, paragraph 90-05 *Payment for Extra Work*.

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**REFERENCES**

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

## Advisory Circulars (AC)

AC 150/5200-33      *Hazardous Wildlife Attractants on or Near Airports*

AC 150/5370-2      *Operational Safety on Airports During Construction*

## ASTM International (ASTM)

ASTM D6461      *Standard Specification for Silt Fence Materials*

## United States Department of Agriculture (USDA)

FAA/USDA Wildlife Hazard Management at Airports, A Manual for Airport Personnel

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**ITEM G-100 DEICE AND ANTI-ICE SYSTEM GENERAL REQUIREMENTS****DESCRIPTION****100-1.1 Summary.**

- a. Furnish all labor, equipment and material for the complete installation of the aircraft Type I deicing, Type IV anti-icing systems and Non-Potable Water systems as indicated and specified.
- b. Contractor shall obtain and pay for all permits required by this Contract.
- c. Pumping, piping and dispensing systems shall be designed and provided by a vendor specialized in aircraft deicing systems. Final pumping and dispensing system make-up and arrangement shall be determined by vendor to fit in allotted space as indicated on Plans and shall interface with tank and all piping installations. All piping outside of the pumphouse has been shown for initial coordination and design intent. Final pipe routing outside of the pumphouse shall be detailed by the installing contractor based on final equipment selections (tanks, equipment, etc) and submitted for approval. See submittal details in subsequent paragraphs.

**100-1.2 Related Requirements.**

- a. G-200 - Deice and Anti-ice System Pipe, Connections, and Installation.
- b. G-300 - Deice and Anti-ice System Coatings for Corrosion Protection.
- c. G-400 - Deice and Anti-ice System Valves.
- d. G-500 - Deice and Anti-ice System Equipment and Accessories.
- e. G-600 - Deice and Anti-ice System Inspection, Testing and Commissioning.
- f. G-700 - Deice and Anti-ice Underground Storage Tanks.
- g. G-800 – Vibration and Seismic Controls for Piping and Equipment
- h. G-900 – Glycol Control System

**100-1.3 Submittals.**

- a. Submittals shall constitute a representation to Owner that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog/model numbers and similar data or he assumes full responsibility for doing so, and that he has coordinated each Submittal with the requirements of the Work and the Contract Documents. Contractor certifies that the Material and Equipment shown and marked on the Submittals are in compliance with the Contract Documents and can be installed, operated, and maintained in the allocated space.
- b. Include, but not limited to, the following:
  1. Piping fabrication drawings:
    - a. Include in-plan view of all systems piping 2-1/2 inches and larger. Provide isometrics for piping systems or tubing 2 inches in diameter and smaller.
    - b. Show the actual Equipment furnished, Equipment location by dimension and connections. Drawings shall be coordinated with all disciplines to ensure proper installation and operation of the system.
    - c. Dimension pipelines in plan view and locate in elevation. Indicate support locations.
    - d. Submit before fabrication is begun.
  2. Concrete Foundations: Submit detailed drawings which include the following information:
    - a. Plan size, height, configuration and top elevation of foundation.

**ISSUED FOR BID**

- b. Location of each Equipment foundation dimensioned to a common reference point.
  - c. Equipment anchor bolt location projection and dimensions.
  - d. Type, size, and length of anchor bolts.
  - e. Indicate reinforcing steel and size.
  - f. List Equipment manufacturer's reference drawing numbers used for anchor bolt location.
3. Motors and Drives:
    - a. List all motor nameplate data on drawings including full load amps, locked rotor amps and service factor for the motor at the voltage specified.
    - b. List operating brake hp of the Equipment furnished.
    - c. Furnish dimensioned motor drawing.
    - d. Provide drawings for shop or field fabricated guards.
  4. Hangers and Supports:
    - a. Detailed drawings of support assemblies indicating the following:
      - (1) Plan and elevation of piping.
      - (2) Plan and elevation of support components.
      - (3) Concrete pad, grout and foundation details.
  5. Pumps, including performance curve and specified accessories.
  6. Manual valves.
  7. Control valves.
  8. Check valves.
  9. Thermal relief valves.
  10. Meters.
  11. Dispensers
  12. Blending cubes.
  13. Coating materials.
  14. Pipe, fittings and accessories.
  15. Welder certificates signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" Article.
  16. Instruction books and maintenance manuals include, but not limited to, the following:
    - a. Pumps.
    - b. Control valves.
    - c. Manual-operated valves.
    - d. Meters.
    - e. Dispensers
    - f. Blending cubes.
    - g. Controlling instruments.
    - h. Pressure gauges.
    - i. Pipe supports, hangars and connection details.
    - j. Fittings and specials.
    - k. Installation and erection details.
  17. Provide electronic copies of instruction books and manuals complete with cover sheet and index clearly identified with Contract name and number.
  18. Each manual shall include the Equipment purchase order.

#### **100-1.4 Quality Assurance.**

- a. All Equipment and Materials shall be the latest design, new, undeteriorated and the first quality standard product of manufacturers regularly engaged in the production of such Equipment and Materials for a minimum of 5 years.
- b. When two or more units of the same class of Equipment are required, they shall be products of a single manufacturer.

**ISSUED FOR BID**

- c. Unless otherwise specified, all items, materials and components specified herein shall be suitable for use within Type I deicing, Non-Potable Water, and Type IV anti-icing systems with maximum operating condition of 150 psig, -20°F to 100°F, and having a specific gravity of 1.0 to 1.07.
- d. Qualify welding processes and welding operators in accordance with ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications."

## **PRODUCTS**

**100-2.1 Not applicable**

## **EXECUTION**

### **100-3.1 Installation.**

- a. Receive, unload, check and store in suitable facilities all Equipment and Materials.
- b. Examine all Equipment and Materials for concealed damage and report any damage to Owner.
- c. Be responsible for the safety and protection from loss or damage of all Equipment and Materials received until the Work is complete.
- d. Pay all demurrage charges and claims for damage to vehicles resulting from the unloading operation.
- e. Protect all Equipment and Materials during storage and prior to start-up which shall include the coverings of all openings, protection against rust and other damage, and other similar measures. Equipment may be stored outdoors only when approved. Contractor shall protect all coated pipe and fittings from ultraviolet deterioration.
- f. Furnish all labor, Materials and Equipment necessary to make a complete installation as indicated and specified.
- g. Provide all necessary supports, brackets or foundations for properly installing all Equipment or temporary piping.
- h. Coordinate with the other trades before installation of Materials. Extra charges shall not be approved for interferences due to lack of coordination.
- i. All Equipment shall be properly aligned, adjusted and lubricated before final acceptance.
- j. Spot paint all Equipment where the shop paint has been damaged or flaked off. Finish painting of all exposed piping and mechanical Equipment is specified in SECTION G-300, unless otherwise specified.
- k. Furnish all bolts, studs, nuts and gaskets for makeup of all connections to the Equipment and replace all gaskets damaged during storage, inspection, cleaning or placing into service.
- l. Retighten all threaded and bolted connections after installation
- m. Contractor shall be responsible for all added expenses due to his choice of Equipment.
- n. All Materials shall be installed at times necessary to avoid delays in construction.
- o. All connections to valves 3 inches and larger shall be made with flanges unless indicated otherwise; all connections to Equipment shall be made with unions or flanges.
- p. Piping shown on the Drawings is partially diagrammatic and not necessarily the exact routing. Provide all necessary bends that may be required to avoid conflict and interferences. Bends required in addition to those indicated shall be submitted for approval by Owner prior to fabrication to ensure pumps can handle additional head loss.
- q. Provide sleeves and flashings for all piping penetrating walls and slabs. Provide all required openings in walls and slabs.
- r. Installation shall equal or exceed the minimum requirements of the applicable codes and these specifications; however, where local codes and ordinances are more stringent, they shall govern.

**ISSUED FOR BID**

- s. Verify all measurements and location of existing facilities and underground piping before commencing work.
- t. Certain permanent and temporary piping and equipment systems shall be installed, inspected, tested, flushed and placed into operation prior to complete installation of the Work. Contractor shall provide all gaskets, companion flanges, bolting, weld caps, temporary blank-off plates, temporary piping systems, labor, materials and accessories required to place these systems into operation.

### **100-3.2 Welding Qualification and Approval.**

- a. Procedure: Upon award of the Contract, the Welding Procedure Specification (WPS) that is intended to be used on the job shall be submitted to Owner.
- b. Submit certified copies of the Procedure Qualification Records (PQR) as evidence that the intended procedures have been qualified in accordance with the latest revisions of the following codes:
  - 1. ASME B31.3 – Process Piping.
  - 2. ASME Boiler and Pressure Vessel Code, Section I and Section IX.
- c. Design for the conditions of this Contract. Be complete and specific, and, where necessary, differentiate between shop and field welding.
- d. Welder Performance Qualification (WPQ) Test Certificates:
  - 1. Furnish welder performance qualification test certificates for positions 2G and 5G or 6G, made in strict compliance with the above codes.
  - 2. Submit current qualification test records for each welder on the Project and keep record files current. Welder shall have been qualified to the WPS within the last 6 months.
  - 3. Welder Performance Qualification test certificates shall be submitted to Owner before the welder shall be permitted to work on the Project.
  - 4. Welders shall be certified for the type of pipe material welded.
  - 5. Submit copies of the Welder Performance Qualification (WPQ) test certificates to Owner for review as specified for Submittals.
  - 6. Welders and welding operators shall be qualified without the use of backing rings for all welding.
- e. Submit WPS, PQR and WPQ on the forms contained within Appendix A of the ASME Boiler and Pressure Vessel Code, Section IX.
  - 1. Stamp all welds with the welders or welding operators' identification number or symbol.
- f. Costs: Costs incident to procedure and welder's qualification tests shall be assumed by Contractor.

### **100-3.3 Field Tests.**

- a. Service and Test Engineers:
  - 1. Furnish the services of experienced factory service engineers for at least the minimum time specified and additional time as required to perform and/or supervise the erection, start-up, testing and placing into successful operation all piping systems and equipment and to instruct Owner's personnel in the operation of equipment.
  - 2. Travel and living expenses shall be paid by Contractor.
  - 3. The services of the service engineer shall be provided upon request at the times required by Owner.
  - 4. The service engineer shall be directly responsible to Owner and when requested shall make daily reports to Owner.
  - 5. The service engineer's performance shall be satisfactory and acceptable to Owner. Unsatisfactory performance time shall not be considered as qualified service time.
  - 6. The service engineer shall be replaced at the request of Owner.

### 100-3.4 OPERATION AND MAINTENANCE MANUALS

- b. O&M Manual will be prepared for the purpose of assisting the Glycol Storage and Conveyance System personnel operate the overall System. The emphasis of the O&M manual will be for the operators responsible for managing glycol fluid receipt and distribution to the load stands. The O&M manual will include a schedule of preventative maintenance activities for equipment in the deice house, tanks, and recommended actions between the off-season and deicing season. The glycol vendor will provide separate O&M manuals for the individual components (e.g. equipment and control system). Subconsultant will review and compile O&M information provided by the vendor into an overall system O&M manual. The Draft System O&M Manual will be distributed to Consultant, Owner, and system operators for review and comment prior to Commissioning. Comments will be incorporated in a Final O&M Manual.
- c. Commissioning Plan and System Commissioning
  - 1. Prepare a Commissioning Plan for the Glycol Storage and Conveyance System. The Commissioning Plan will include provisions to test individual components and the overall capacity of the Glycol Storage and Conveyance System to deliver glycol and water to the dispensers.
  - 2. Provide Draft Commissioning Plan to Consultant, Owner, and system Operators for review and comment.
  - 3. Provide Final Commissioning Plan
  - 4. Subconsultant will lead and participate in a Commissioning Event with Consultant, Contractor, and Owner. Commissioning Event is assumed to occur over a period of one week.
  - 5. Subconsultant will prepare a brief memorandum summarizing key findings and recommendations (if any).
  - 6.
  - 7. Upon arriving or leaving the site, the manufacturer's service engineer shall report to Owner.
  - 8. The service and test engineers are required to conduct start-up and tests of the systems and Equipment furnished shall be called to the Site only after the installation is complete and ready, and Owner has been notified at least 24 hours in advance.

### 100-3.5 Testing:

- 9. Perform all tests as specified, recommended by the manufacturer, and required by the codes. Additional tests deemed necessary by Owner shall be performed to ensure proper operation and function of the Equipment furnished, and to certify that the furnished Equipment meets the performance specified.
- 10. Perform tests before Work is concealed and only after notifying Owner that items are ready. All tests shall be witnessed by Owner.
- 11. Conduct tests in a safe and orderly manner with qualified trained personnel in accordance with safety codes and local ordinances.
- 12. Obtain all necessary approvals, acceptances and permits.
- 13. Correct all deficiencies resulting from tests.
- 14. Equipment and System Performance and Acceptance Tests:
  - a. Contractor shall coordinate and schedule all performance and acceptance tests and ensure that all required factory service engineers and test personnel will be present. The required test equipment and instruments will be available and calibrated for the tests.
  - b. Contractor shall conduct all performance and acceptance tests and provide all test labor.

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- c. Furnish all instruments, thermometers, and gauges required for testing. If the accuracy or completeness of installed instrumentation is not sufficient, Contractor shall provide additional instrumentation.
  - d. Provide all pipeline connections, valves, temporary connections and lines as specified or as required for testing.
  - e. Make all performance tests as soon as practical after successful operation to determine if the Equipment furnished meets the Specifications and guarantees.
  - f. Notify Owner at least one week in advance before the test. Contractor shall submit a written notice containing the test schedule, test procedure and the personnel to be present at the test.
  - g. Contractor shall prepare a typewritten report of the test and submit 4 copies of all test log sheets and reports to Owner as specified.
  - h. Contractor shall furnish electrical power, water, and operating personnel for start-up, operating and performance testing.
  - i. In the event of failure of any Equipment or systems specified in this Contract to operate and perform as specified, or if the Equipment fails to meet the performance guarantees provided for in this Contract, Owner shall have the right to operate the system or Equipment until such defects have been remedied by Contractor, and the guarantees complied with. If defects necessitate the rejection of the system or Equipment, Owner shall have the right to operate the Equipment without additional cost until such time as new Equipment is provided to replace the rejected Equipment. Replacement of the Equipment shall be coordinated and scheduled with Owner.
15. Tests and Checks of Piping and Blending Systems for Acceptance:
- a. Inspection, Testing and Commissioning shall be as specified in Section G-600.

#### **100-3.6 Factory Tests.**

- a. For factory testing of Equipment, refer to specific sections where Equipment is specified.

#### **100-3.7 AS-Built Drawings**

- a. **Contractor shall provide red-line as built drawings to design team at substantial completion and prior to project commissioning. This shall reflect accurate layouts to scale for equipment, piping and wiring.**

### **METHOD OF MEASUREMENT**

**100-4.5 Measurement.** No separate measurement of payment shall be made for General requirements. General requirements and practices shall be considered necessary and incidental to the work of this contract as shown on drawings and specifications.

### **BASIS OF PAYMENT**

**100-5.5 Payment.** No payment will be made separately or directly for general requirements. General requirements shall be considered necessary and incidental to the work of this contract.

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**END OF ITEM G-100**

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**ITEM G-400 DEICE AND ANTI-ICE SYSTEM VALVES****DESCRIPTION****400-1.1 Summary.**

- a. This Section covers valves applicable to the Type I Deice, non-potable water, and Type IV Anti-ice systems.
- b. Extent of Work shall be as follows:
  1. All special valves, pilots, fittings, equipment, and related items, shall meet the following requirements:
    - a. Be furnished, installed, tested, and put into successful operation.
    - b. Be complete with all necessary miscellaneous pipe, valves, unions, fittings, auxiliaries, and related items, whether shown on the Drawings or not, but required.
    - c. Meet the requirements of applicable codes and standards as specified.
  2. Piping connected to Equipment which must vary from the Drawings shall be furnished and installed as required to make a complete and workable installation without additional cost to Owner. This requirement includes changes due to the selection of a different Equipment manufacturer than what is indicated on the Drawings, specified, or a design change made by the manufacturer between the time the piping system was designed and the time of installation.
  3. Control Valves: Furnish complete with pilots, couplings, tubing, etc.
  4. Spare, Replacement, or Additional Parts:
    - a. Where spare, replacement, or additional parts are required for the Equipment specified herein, these items shall be delivered to Owner immediately upon receipt at the Site.
    - b. Parts shall be packaged and sealed for long storage and be securely and visibly labeled as to part, function, and name of Equipment to which they apply.
    - c. Contractor shall prepare an inventory list of the items delivered to Owner.
- c. This Section covers valves related to the aircraft deicing system for this Project. All items, materials, and components specified herein shall be suitable for use within a deice, anti-ice or non-potable water system with a maximum operating condition of 150 psig, -20 degrees F to 100 degrees F, and having a specific gravity of 1.00 to 1.07.
- d. Contractor or any Subcontractor or Supplier shall not supply, furnish, or install any pipe, flanges, fittings, bolts, or nuts of foreign manufacture. All pipe, flanges, fittings, bolts, and nuts shall be manufactured in the United States of America and Contractor shall warrant the U.S.A. origin of all such items. Flanges and fittings shall bear a stamp attesting to their place of origin. Contractor shall provide written certification from the manufacturer as to the origin of all pipe, flanges, fittings, bolts, and nuts installed on the Project. If at any time Owner determines that any pipe, flanges, fittings, bolts, or nuts are not of U.S.A. origin, Owner shall be entitled to replace all pipe, flanges, and/or fittings, and/or bolts, and/or nuts (as the case may be) without the need for individual testing for conformance to technical Specifications, or for proof of non-U.S.A. origin of the other items. Contractor shall be responsible for all labor, materials, and consequential costs connected with such replacement.

**400-1.2 Related work.****ISSUED FOR BID**



- a. G-100 – Deice and Anti-ice System General Requirements.
- b. G-200 - Deice and Anti-ice System Pipe, Connections, and Installation.
- c. G-300 - Deice and Anti-ice System Coatings for Corrosion Protection.
- d. G-500 - Deice and Anti-ice System Equipment and Accessories.
- e. G-600 - Deice and Anti-ice System Inspection, Testing, and Commissioning.
- f. G-700 - Deice and Anti-ice Above grade Storage Tanks
- g. G-800 – Vibration and Seismic Controls for HVAC Piping and Equipment.

#### 400-1.3 Quality Assurance.

- a. Manufacturer's Qualification: Firms regularly engaged in manufacture of valves of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

## PRODUCTS

#### 400-2.1 Ball Valves.

- a. For 2-1/2-inch and smaller ball valves, valve body for non-potable water valves shall be cast bronze with chrome plated brass/bronze ball and TFE seats. Two-piece valve, standard port, anti-blowout stem, having a 600 psi non-shock pressure rating. End connections shall be threaded, and valves shall comply with MSS SP-110. Valves shall be approved for potable water service.
- b. For 3” and larger ball valves, valve body for non-potable water valves shall be ductile iron conforming to ASTM A536 with 316 stainless steel ball and glass reinforced PTFE (Polytetrafluoroethylene) seats. Two-piece valve, standard port, anti-blowout stem, having a minimum 600 psi non-shock pressure rated. End connections shall be grooved ends with flange adapters. Valves shall be approved for potable water service.
- c. Valve body for Type I deice valves shall be full port carbon steel with 316 stainless steel ball and stem. Valve body for Type IV anti-ice valves shall be full port 304 Stainless steel with 316 stainless steel ball and stem. Valve shall be rated for 150 psig working pressure.
- d. Provide all ball valves with a vinyl-coated, stainless steel locking handle suitable for padlocking. Valves 6-inch size and larger shall be provided with a closed case gear operator.

#### 400-2.2 Check Valves.

- a. Check valves 2-1/2-inch and smaller:
  1. Check valves for non-potable water shall be manufactured from forged carbon steel, Class 800, lift check. Check valves shall be suitable for potable water service, when used in non-potable water systems.
  2. Check valves for and Type IV anti-ice fluid shall be swing check style. Type 1 deice fluid valves shall be manufactured from carbon steel. Check valves for Type IV anti-ice fluid shall be manufactured from stainless steel. Disc shall swing completely out of the flow path. Bolted cover, full port openings at inlet and outlet.
  3. Elastomers shall be compatible with the fluid in service.
  4. End connections shall be threaded.
  5. Check valves used for thermal pressure relief shall have a 125-psi cracking pressure.
- b. Check valves 3-inch and larger:
  1. Valve shall be dual-plate wafer style suitable for 275 psig working pressure.
  2. Valve body and plate shall be carbon steel for Type I and Non Potable Water with resilient Viton seat and 316 SS pins, and springs. Each plate shall have an independent spring (two springs).

**ISSUED FOR BID**

3. Ends shall be suitable for installation between ANSI 150-lb raised-face flanges.

**400-2.3 Instrument Valves.**

- a. Shall have a replaceable seat insert of Delrin and Teflon stem packing.
- b. Body shall be carbon steel for Type I and Non Potable Water, stainless steel for Type IV.
- c. Working pressure shall be 3,000 psi.
- d. Shall have a needle type bleed valve.
- e. End connections shall be screwed.

**400-2.4 Solenoid Valves.**

- a. Two-way pilot operated. Normally closed, energize to open.
- b. NPT ends, stainless steel body, 0 psi minimum differential pressure to open, 100 psi maximum operating pressure differential.
- c. Watertight, 120VAC.
- d. Provide with maintained-position manual operator.
- e. Adjustable closure rate or slow acting.

**400-2.5 Pressure Reducing Valves (Type I Deice and Non-Potable Water Only).**

- a. Valve shall automatically reduce a higher inlet pressure to a steady lower downstream pressure regardless of changing flow rate and or varying inlet pressure.
- b. Valve shall close quickly to prevent downstream surge when flow is stopped suddenly.
- c. Pilot operator shall hold downstream pressure to pre-determined limit.
- d. Cast steel body
- e. Cast steel disc retainer and diaphragm washer.
- f. Stainless steel disc guide, seat and cover bearing.
- g. Disc shall be of material compatible with glycol. PTFE, Viton, EPDM, Hypalon are examples.
- h. Diaphragm shall be of material compatible with glycol. PTFE, Viton, EPDM, Hypalon are examples.
- i. Stainless steel nut.
- j. Suitable for outdoor installation.
- k. 2 to 30 psi output pressure range.
- l. Class 150, 275 psi maximum working pressure.

**400-2.6 THERMAL RELIEF VALVES:**

- a. Carbon-steel body, stainless-steel internals, disc, and seat type, Viton elastomers (seat, O-ring), closed cap (no lever). Thermal relief valves for Type IV Anti-ice fluid shall be of all stainless steel construction.
- b. Valves shall include ASME, BPVC Section VIII code stamp.
- c. Valves shall be set to relieve at 125 psi.
- d. All set points shall be a nominal point within a "SET POINT" range, adjustable for field conditions.
- e. Where indicated or specified, provide "balanced" type thermal relief valves, which shall open at setpoint regardless of downstream pressure.
- f. Inlet and outlet shall be 1/2-inch, with flanged connections.

**400-2.7 DIGITAL HYDRAULIC CONTROL VALVE:**

- a. Recirculation Control Valves - Shall be located in the pump discharge recirculation piping and modulate to maintain the pump minimum flow rate as indicated in the Sequence of Operation. Valves shall be normally closed, fail open ("normal" flow), and flow to open. Provide the following trim/accessories:

**ISSUED FOR BID**

- b. 24Vdc control solenoid pilot valves, with maintained position type manual override. Solenoid valves shall be UL-listed and shall be normally closed and normally open as specified herein. Valves shall be provided with a dual solenoid control (digital control) to open, close, and
- c. sustain the valve position to control the recirculation flow from the pump discharge manifold to the tank from which fuel is being issued for the purpose of maintaining pump minimum flow and protecting the into-hydrant pumps. The dual solenoid valves shall modulate the hydraulic control valve to maintain recirculation flow rate set point as indicated in the Sequence of Operation. When both solenoids are de-energized, the control valve shall close. The solenoids shall include manual ball valves that isolate the normally closed (N.C.) solenoid valve and bypass the normally open (N.O.) solenoid valve that permit manual modulation of the valve when both solenoid valves are de-energized. The digital signal to the solenoid valves shall be an output for the programmable logic controller (PLC):
- d. Valve Opening Cycle: The normally open (N.O.) digital solenoid valve in the pilot tubing between the diaphragm cover and the port on the inlet of the control valve shall be energized and closed while the normally closed (N.C.) digital solenoid valve in the pilot tubing between the diaphragm cover and the outlet port of the control valve is energized and open (both the N.C. and N.O. solenoid valves shall be energized).
- e. Valve Closure Cycle: The N.O. digital solenoid valve in the pilot tubing between the diaphragm cover and inlet port shall de-energized be open while the N.C. solenoid valve in the pilot tubing between the diaphragm cover and the outlet port is de-energized and closed (both the N.C. and N.O. solenoid valves shall be de-energized).
- f. Steady State Valve Position: The N.O. digital solenoid valve in the pilot tubing between the diaphragm cover and inlet port shall be energized and closed while the N.C. digital solenoid valve in the pilot tubing between the diaphragm cover and the outlet port is de-energized and closed (the N.C. solenoid valve shall be de-energized and closed and N.O. solenoid valve shall be energized and closed, both solenoid valves closed).
- g. Manually Enabled, Parallel Backpressure Pilot: A parallel backpressure control pilot valve shall be enabled with a manual ball valve. When the N.C. manual ball valve in the backpressure pilot tubing is opened along with solenoid valves being de-energized, the backpressure feature of the control valves shall be enabled. Backpressure set point shall initially be [45] psig (adjustable). The backpressure pilot valve shall be adjustable up to a set pressure of [50] psig adjustable.
  1. Valve position indicator.
  2. Anti-cavitation trim (caged trim).
  3. Opening and closing speed adjustment.
  4. Integral and independent check feature.
  5. Independent differential pressure pilot to keep valve "in control" at reduced flows (70- to 150-psi adjustable setpoint).

## EXECUTION

### 400-3.1 Examination.

- h. Inspect valve for cleanliness, corrosion and operability. Remove special packing materials, such as blocks used to prevent disc movement during shipping and handling.
- i. Actuate valve through an open-close and close-open cycle. Examine functionally significant features, such as guides and seats made accessible by such actuation. Following examination, return the valve's closure member to the shipping position.

**ISSUED FOR BID**

- j. Examine threads or flanges on both the valve and the mating pipe for form (i.e., out-of-round or indentation) and cleanliness.
- k. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, defects, and damage.
- l. Prior to valve installation, examine the pipe for cleanliness and proper alignment.
- m. Replace defective valves with new valves.

#### **400-3.2 Valve Ends Selection.**

- a. Unless indicated otherwise, select valves with the following end connections.
  - 1. Sizes 2-1/2 inches and smaller: Threaded unless specified or indicated to be flanged.
  - 2. Sizes 3 inches and larger: Flanged.

#### **400-3.3 Adjustments and Calibration.**

- a. Contractor shall adjust all valves for the flows, level settings, and pressure settings indicated and specified.
- b. Set rate of closure of control valves to eliminate surges and shocks in the systems as installed.
- c. Final adjustments shall be made with system in operation during system commissioning. Contractor shall frequently check all valve settings following final adjustment to monitor for potential drift. Adjustments back to original setting shall be performed immediately if drift occurs.
- d. Modify adjustments during start-up, including flow rates, pressure settings, meter settings, and other variables as required by Owner.

#### **400-3.4 Tubing Installations.**

- a. Assemble and tighten fittings as recommended by the manufacturer.
- b. Route as required to interconnect the instrumentation provided.
- c. Provide an instrument valve and a weldolet for all "root" valve locations where instrumentation tubing connections are made to the piping system.

#### **400-3.5 Valve and Equipment Installation.**

- a. Install where indicated on the Drawings and in accordance with manufacturer's recommendations.
- b. Replace any and all valves and equipment that prove defective during testing. Arrange all valves during installation such that operating handles and controls are accessible, have sufficient clearance, and in the correct orientation for Owner's operation.
- c. Provide spool pieces or spacers in the piping as necessary to ensure valve parts and operators have sufficient operating clearances.
- d. For adapters with integral screens; remove, clean, and reinstall screen after completion of flushing, before putting system into service.

#### **400-3.6 Cleaning and Protection.**

- a. Clean all fabricated assemblies and all equipment items thoroughly before operating or testing.
- b. Protect equipment from damage, deterioration, paint or coating spills or spots, corrosion, or harm from any source.

#### **400-3.7 Equipment Test and Checkout.**

- c. Before equipment installations will be accepted, the equipment shall be tested and demonstrated to be correctly connected and installed.
- d. All testing and checkout procedures of the manufacturer shall be carried out completely.

**ISSUED FOR BID**

- e. All tested equipment found to be defective or inoperable to any extent is to be reported to Owner immediately.
- f. Any operating difficulty or defective item as a result of Contractor's work shall be repaired or replaced and put into proper operation by Contractor immediately.
- g. Protect all equipment and surrounding areas from damage resulting from testing operations. Clean up any spills or leakage from testing.

#### **400-3.8 Operation and Maintenance Manuals**

- a. **O&M Manual will be prepared for the purpose of assisting the Glycol Storage and Conveyance System personnel operate the overall System. The emphasis of the O&M manual will be for the operators responsible for managing glycol fluid receipt and distribution to the load stands. The O&M manual will include a schedule of preventative maintenance activities for equipment in the deice house, tanks, and recommended actions between the off-season and deicing season. The glycol vendor will provide separate O&M manuals for the individual components (e.g. equipment and control system). Subconsultant will review and compile O&M information provided by the vendor into an overall system O&M manual. The Draft System O&M Manual will be distributed to Consultant, Owner, and system operators for review and comment prior to Commissioning. Comments will be incorporated in a Final O&M Manual.**
- b. **Commissioning Plan and System Commissioning**
  - 1. **Prepare a Commissioning Plan for the Glycol Storage and Conveyance System. The Commissioning Plan will include provisions to test individual components and the overall capacity of the Glycol Storage and Conveyance System to deliver glycol and water to the dispensers.**
  - 2. **Provide Draft Commissioning Plan to Consultant, Owner, and system Operators for review and comment.**
  - 3. **Provide Final Commissioning Plan**
  - 4. **Subconsultant will lead and participate in a Commissioning Event with Consultant, Contractor, and Owner. Commissioning Event is assumed to occur over a period of one week.**
  - 5. **Subconsultant will prepare a brief memorandum summarizing key findings and recommendations (if any).**

#### **METHOD OF MEASUREMENT**

**400-4.1 Measurement.** No separate measurement for payment shall be made for valves. Valves shall be considered necessary and incidental to the work of this Contract and covered in the linear foot price of the pipe under G-200.

#### **BASIS OF PAYMENT**

**400-4.2 Payment.** No payment shall be made for valves. Valves shall be considered necessary and incidental to the work of this Contract and covered in the linear foot price of the pipe under G-200.

#### **REFERENCES**

- a. American Society for Testing and Materials (ASTM):
  - 1. A126 - Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

#### **ISSUED FOR BID**

2. A216 - Carbon Steel Castings Suitable for Fusion Welding for High-Temperature Service.
3. A325 - Structural Bolts, Steel, and Heat Treated.
- b. American Society of Mechanical Engineers (ASME):
  1. 16.34 - Valves - Flanged, Threaded and Welding End.
- c. American Petroleum Institute (API):
  1. 6D - Specification for Pipeline Valves (Gate, Plug, Ball and Check Valves).
  2. 600 - Steel Gate Valves, Flanged and Buttwelding End.
  3. 607 - Fire Tests for Soft-Seated Quarter-Turn Valves.
- d. American Water Works Association (AWWA):
  1. C504 - AWWA Standard for Rubber-Seated Butterfly Valves.
  2. C515 - AWWA Standard for Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.
- e. Factory Mutual Engineering Division (FM).
- f. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):
  1. SP70 - Gray Iron Gate Valves Flanged and Threaded Ends
- g. National Electrical Manufacturers' Association (NEMA).

**END OF ITEM G-400**

**ISSUED FOR BID**

**ITEM G-500 DEICE AND ANTI-ICE SYSTEM EQUIPMENT AND ACCESSORIES****DESCRIPTION****500-1.1 Summary.**

- a. This Section covers special Equipment and mechanical accessories applicable to the Type I deice, non-potable water and type IV anti-ice systems.
- b. Related Work Specified Elsewhere:
  1. For general requirements of fueling system: G-100 – Deice and Anti-ice System General Requirements.
  2. DIVISION 26 "Electrical Work".
- c. Extent of Work shall be as follows:
  1. All special valves, pilots, fittings, equipment, and related items shall meet the following requirements:
    - a. Be furnished, installed, tested, and put into successful operation.
    - b. Be complete with all necessary miscellaneous pipe, valves, unions, fittings, auxiliaries, and other items, whether shown on the Drawings or not, but required.
    - c. Meet the requirements of applicable codes and standards as specified.
  2. Piping connected to Equipment which must vary from the Drawings shall be furnished and installed as required to make a complete and workable installation without additional cost to Owner. This requirement includes changes due to the selection of a different Equipment manufacturer than what is indicated on the Drawings, specified, or a design change made by the manufacturer between the time the piping system was designed and the time of installation.
  3. Spare, Replacement, or Additional Parts:
    - a. Where spare, replacement, or additional parts are required for the equipment specified herein, these items shall be delivered to the Owner immediately upon receipt at the Site.
    - b. Parts shall be packaged and sealed for long storage and be securely and visibly labeled as to part, function, and name of Equipment to which they apply.
    - c. Contractor shall prepare an inventory list of the items delivered to Owner.
- d. This Section covers fittings, meters, and accessories related to the Type I deice fluid, non-potable water and type IV anti-ice systems for this project. All items, materials, and components specified herein shall be suitable for use within a deice, anti-ice or non-potable water system with a maximum operating condition of 150 psig, -20°F to 100°F, and having a specific gravity of 1.00 to 1.05.
- e. Lightning Protection:
  1. All field inputs and power inputs shall have lightning protection devices installed on them.

**500-1.2 Quality Assurance.**

- a. Manufacturer's Qualification: Firms regularly engaged in manufacture of valves and Equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

**ISSUED FOR BID**

## PRODUCTS

### 500-2.1 Manufacturers.

- a. Subject to compliance with requirements, provide products by one of the following:
1. Type I Deice Fluid and Water Blending System
    - a. Liquid Automation Systems, LLC - DeiceCube™250
    - b. Approved equal.
  2. Reblend System
    - a. Liquid Automation Systems, LLC
    - b. Approved equal
  3. Type I Deice Fluid Load Stands:
    - a. Liquid Automation Systems, LLC.
    - b. Approved equal.
  4. Type IV Anti-ice Fluid Load Stands:
    - a. Liquid Automation Systems, LLC.
    - b. Approved equal.
  5. Type I Deice Fluid Issue Pump:
    - a. Taco
    - b. Grundfos
    - c. Approved equal
  6. Type I Deice Fluid Offload Pump:
    - a. Blackmer
    - b. Dixon
    - c. Parker
    - d. Approved equal.
  7. NPW Issue Pump:
    - a. Taco
    - b. Grundfos
    - c. Approved equal.
  8. Type IV Anti-ice Fluid Primary Issue Pump:
    - a. Moyno
    - b. Seepex
    - c. Approved equal.
  9. Type IV Anti-ice Fluid Secondary Issue Pump:
    - a. Blackmer
    - b. Dixon
    - c. Approved equal
  10. Type IV Anti-ice Fluid Offload Pump:
    - a. Moyno
    - b. Seepex
    - c. Dixon
    - d. Approved Equal

### 500-2.2 Blending System.

- a. Type I deice fluid and non-potable water blenders shall mix the two fluids at controlled ratios and flow rates in order to make deicing fluid to meet current weather condition requirements. The deicing fluid will then be directed to a load stand.
- b. Blender manufacturer shall have at least five (5) years' experience in the design, construction and installation of deice fluid and non-potable water blenders and service personnel to provide after

ISSUED FOR BID



sale support. All performance of the blenders shall be in accordance with FAA standards and requirements.

**c. Blender Construction:**

1. Blending systems shall be self-contained, modular with all controls, actuators, meters, valves, microprocessors, and instrumentation required to blend Type I deice fluid with non-potable water at a ratio selected by the operator.
2. Blender and all internals shall operate on 120VAC, 1 phase , 60 Hz power.
  - a. Current load 40 Amperes
    - (1) 8.5A on 1,000 W heater
    - (2) 5A on controls
    - (3) 15A on auxiliary power receptacle
    - (4) 120VAC single phase 10A load stand
3. Provide control panel for selection of de-ice fluid/non-potable water blend ratio. Blend ratio shall be adjustable in 1% increments.
4. At a minimum, touchscreens will be protected from UV and other weather related elements by a stainless steel hinged cover.
5. All internal piping shall be stainless steel.
6. High Accuracy Flow Meters 0.25% of reading
7. 3" Stainless Steel Pipe Male NPT inbound Type I connection
8. 3" Stainless Steel Pipe Male NPT inbound water connection
9. 3" Stainless Steel Pipe Male NPT outbound connection
10. Freeze prevention for the water lines must be provided.
11. Insulation packed walls
12. Internal temperature control to stay above 40°F/4°C in ambient conditions down to -40°C.
13. Latching/Lockable door on front.
14. Door can be opened from inside in case of entrapment.
15. Fork lift slots allow for easy movement.
16. LED light illuminates internal components.
17. Provide NEMA 4x rated controls for alarm silence and reset.
18. NEMA 4x enclosure shall be constructed of 304 SS with a hinged access panel for ease of maintenance.
19. Provide heat tracing per G-903.

**d. Blender Operation:**

1. Blenders shall be capable of mixing Type I deice fluid and non-potable water at any mix ratio between 0% deice fluid / 100% non-potable water and 100% deice fluid / 0% non-potable water, in 1% increments between 20% and 65%. Mix ratio shall be adjustable from the blender control pane and remotely.
2. Blending accuracy shall be  $\pm 2\%$  of setpoint.
3. The deicing fluid flow rate at 20% deice fluid / 65% non-potable water shall not be less than 250 gpm.
4. The blended deicing fluid flow rate at a 50% mix ratio shall not be less than 250 gpm.
5. The deicing fluid flow rate at 65% deice fluid / 35% non-potable water shall not be less than 250 gpm.

**e. Blender Controls:**

1. 8" Touch Screen Interface
2. Emergency Stop Push Button Operator
3. Blend Set Point Adjustment 20% - 65% in 1% increments
4. Freeze point display for selected Type I fluid
5. Alarm Indication and Acknowledgement
6. Instantaneous Blend Percentage Indicator

**ISSUED FOR BID**

7. Accumulated meter totals
8. Process Pump Status Indication
9. Supervisor Password Protected for Event Staging
10. Start/Stop Control
11. Deadman Switch Operation
12. Manual Mode - The system allows for manual operation in the event of a controls malfunction.
13. The system shall allow for automatic adjustment of the current truck mix ratio
14. Provide internal valves, meters, motor speed control system, and feedback control system via microprocessor in order to regulate blend ratio.
15. Provide meters with pulse transmitters for Type I deice fluid inventory control. Pulse rate shall be 100 pulses/gallon. Transmit type I deice fluid meter pulses to card reader for inventory control.
16. Provide automatic shutdown with a selectable deviation range from 2-5%. and alarm if the mix ratio is more than % (adjustable) in error of the desired setpoint.
17. Provide heater to prevent freezing of above grade non-potable water piping.

#### **500-2.3 Re-Blending System.**

- a. Type I deice fluid concentrate, Type I deice reclaim and non-potable water blenders shall mix the two fluids at controlled ratios and flow rates in order to make deicing fluid to meet current weather condition requirements. The deicing fluid will then be directed to a load stand.
- b. Blender manufacturer shall have at least five (5) years' experience in the design, construction and installation of deice fluid and non-potable water blenders and service personnel to provide after sale support. All performance of the blenders shall be in accordance with FAA standards and requirements.
- c. Blender Construction:
  1. Blending systems shall be self-contained, modular with all controls, actuators, meters, valves, microprocessors, and instrumentation required to blend Type I deice fluid with non-potable water at a ratio selected by the operator.
  2. Blender and all internals shall operate on 120VAC, 1 phase , 60 Hz power.
    - a. Current load 40 Amperes
      - (1) 8.5A on 1,000 W heater
      - (2) 5A on controls
      - (3) 15A on auxiliary power receptacle
      - (4) 120VAC single phase 10A load stand
  3. Provide control panel for selection of de-ice fluid/non-potable water blend ratio. Blend ratio shall be adjustable in 1% increments.
  4. At a minimum, touchscreens will be protected from UV and other weather related elements by a stainless steel hinged cover .
  5. All internal piping shall be stainless steel.
  6. High Accuracy Flow Meters 0.25% of reading
  7. 3" Stainless Steel Pipe Male NPT inbound Type I connection
  8. 3" Stainless Steel Pipe Male NPT inbound Reclaim connection
  9. 3" Stainless Steel Pipe Male NPT inbound water connection
  10. 3" Stainless Steel Pipe Male NPT outbound Type I/Reclaim connection
  11. 3" Stainless Steel Pipe Male NPT outbound Reclaim/NPW connection
  12. Freeze prevention for the water lines must be provided.
  13. Insulation packed walls. Minimum 4" thick metal encased closed cell foam.
  14. Internal temperature control to stay above 40°F/4°C in ambient conditions down to -40°C.
  15. Latching/Lockable door on front.

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16. Door can be opened from inside in case of entrapment.
  17. Fork lift slots allow for easy movement.
  18. LED light illuminates internal components.
  19. Provide NEMA 4x rated controls for alarm silence and reset.
  20. NEMA 4x enclosure shall be constructed of 304 SS with a hinged access panel for ease
  21. Provide heat tracing per G-903.
- d. Blender Operation:
1. Blenders shall be capable of mixing Type I deice fluid and non-potable water at any mix ratio between 0% deice fluid / 100% non-potable water and 100% deice fluid / 0% non-potable water, in 1% increments between 20% and 65%. Mix ratio shall be adjustable from the blender control pane and remotely.
  2. Blending accuracy shall be  $\pm 2\%$  of setpoint.
  3. The deicing fluid flow rate at 30% deice fluid / 70% non-potable water shall not be less than 250 gpm.
  4. The blended deicing fluid flow rate at a 50% mix ratio shall not be less than 250 gpm.
  5. The deicing fluid flow rate at 70% deice fluid / 30% non-potable water shall not be less than 250 gpm.
- e. Blender Controls:
1. 8" Touch Screen Interface
  2. Emergency Stop Push Button Operator
  3. Blend Set Point Adjustment 20% - 65% in 1% increments
  4. Freeze point display for selected Type I fluid
  5. Alarm Indication and Acknowledgement
  6. Instantaneous Blend Percentage Indicator
  7. Accumulated meter totals
  8. Process Pump Status Indication
  9. Supervisor Password Protected for Event Staging
  10. Start/Stop Control
  11. Deadman Switch Operation
  12. Manual Mode - The system allows for manual operation in the event of a controls malfunction.
  13. The system shall allow for automatic adjustment of the current truck mix ratio
  14. Provide internal valves, meters, motor speed control system, and feedback control system via microprocessor in order to regulate blend ratio.
  15. Provide meters with pulse transmitters for Type I deice fluid inventory control. Pulse rate shall be 100 pulses/gallon. Transmit type I deice fluid meter pulses to card reader for inventory control.
  16. Provide automatic shutdown and alarm if the mix ratio is more than 2% in error of the desired setpoint.
  17. Provide heater to prevent freezing of above grade non-potable water piping.
  18. Blending up or blending down of reblend fluid is to be automated.

#### 500-2.4 Load Stands.

- a. Type I and Type IV load stand to issue to fluid de-icing trucks.
- b. Inbound:
  1. ADF Type I blend -2" NPT
  2. AAF Type IV -2" NPT
- c. Outbound:
  1. ADF Type I blend -10' of 2" hose and camlock style SS adapter
  2. AAF Type IV -10' of 2" hose and camlock style SS adapter

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3. All pipe work to be 304 stainless steel
  4. Fluid test port on each line
  5. Provide breakaway couplings on piping outlet to protect against drive offs with hoses connected.
- d. Hose Management**
1. Counterweight balanced hose retractors
  2. Breakaway connectors to protect loadstand from drive offs with hoses connected to truck.
  3. Breakaway connector on hose retriever to prevent damage from drive offs
  4. Provide deadman control which will signal motor starter relays to start a Type I deice fluid and non-potable water pump.
  5. Provide 3-inch dry break coupling truck connection.
- e. Controls**
- a. Simple Operator Interface
  - b. ADF Type I blend Start/Stop Push Button Operators
  - c. AAF Type IV Start/Stop Push Button Operators
  - d. Deadman switch for Type I and Type IV
  - e. Load stand solenoid valve should have a slow acting closure rate to avoid surge issues.
- f. Power Requirements**
1. 120VAC single phase 15A. Powered by blending system. A light is required

**500-2.5 Type I Deice Fluid Issue Pump.**

- a. Type I Glycol issue pump shall distribute glycol to blending cube.
- b. Pump Construction:
  1. Pump shall have flanged connections to connect to 6" flanged pipe. Verify pipe size on plans.
  2. Pumps shall be positive displacement, sliding vane or centrifugal horizontal split case.
  3. Pumps shall be split coupled.
  4. Provide components that are compatible with propylene glycol.
  5. Provide pumps complete with gear reducer (if required), motor, Variable Frequency Drive as specified in Section G-901, coupling, baseplate, anchors and all accessories required for operation.

**500-2.6 Type I Deice Fluid Offload Pump.**

- a. Type I Glycol offload pump shall off load Type I Glycol from delivery transport trucks and transfer Glycol to the aboveground Glycol tanks.
- b. Pump Construction:
  1. Pump shall have flanged connections to connect to 3" flanged pipe. Verify pipe size on plans.
  2. Pumps shall be positive displacement.
  3. Provide components that are compatible with propylene glycol.
  4. Provide pumps complete with gear reducer (if required), motor, Variable Frequency Drive as specified in Section G-901, coupling, baseplate, anchors and all accessories required for operation.

**500-2.7 Non-Potable Water Issue Pump.**

- a. Non-Potable Water Issue Pump shall distribute Non-Potable Water to blending cube.
- b. Pump Construction:
  1. Pump shall have flanged connections to connect to 6" flanged pipe. Verify pipe size on plans.

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2. Pumps shall be positive displacement, sliding vane or rotary gear type design or centrifugal vertical inline.
3. Pumps shall be split coupled.
4. Provide pumps complete with gear reducer (if required), motor, Variable Frequency Drive as specified in Section G-901, coupling, baseplate, anchors and all accessories required for operation.

**500-2.8 Type IV Anti-ice Fluid Issue Primary Pump.**

- a. Type IV Glycol issue primary pumps shall transfer Type IV Glycol from the centralized tanks to the primary glycol loop.
- b. Pump Construction:
  1. Pump shall have flanged connections to connect to 8" suction and 6" discharge flanged pipe. Verify pipe size on plans.
  2. Pumps shall be positive displacement, progressive cavity type design.
  3. Stainless steel internal construction
  4. Provide components that are compatible with propylene glycol.
  5. Provide pumps complete with gear reducer (if required), motor, Variable Frequency Drive as specified in SECTION G-901, coupling, baseplate, anchors and all accessories required for operation.

**500-2.9 Type IV Anti-ice Fluid Issue Secondary Pump.**

- a. Type IV Glycol issue secondary pump shall pull from primary glycol loop and distribute to load stand.,
- b. Pump Construction:
  1. Pump shall have flanged connections to connect to 3" flanged pipe. Verify pipe size on plans.
  2. Pumps shall be positive displacement.
  3. Provide pumps complete with gear reducer (if required), motor, motor starter, coupling, baseplate, anchors and all accessories required for operation.
  4. Pump shall have integral bypass.

**500-2.10 Type IV Anti-ice Fluid Offload Pump.**

- a. Type IV Glycol offload secondary pumps shall transfer Glycol from Delivery trucks to the storage tanks.
- b. Pump Construction:
  1. Pump shall have flanged connections to connect to a 4" flanged pipe. Verify pipe size on plans.
  2. Pumps shall be positive displacement.
  3. Provide pumps complete with gear reducer (if required), motor, Variable Frequency Drive as specified in Section G-901, coupling, baseplate, anchors and all accessories required for operation

**500-2.11 Deice, Anti-ice And Non-Potable Water Loading Hose.**

- a. Hose shall be 2-inch or 3-inch diameter as required and capable of 150 psi working pressure to full vacuum.
- b. Tube shall be nitrile with single ply, high-tensile nylon cord reinforcement interwoven hard wall construction. Cover shall be black neoprene.

**500-2.12 Deice, Anti-ice And Non-Potable Water Hose Swivel Joint.**

- a. Swivel Joint shall match hose diameter.

- b. Swivel joint shall be capable of 150 psi working pressure to full vacuum.
- c. Provide stainless steel ball bearings and raceway.
- d. End connections shall be flanged body with female threaded sleeve.
- e. Breakaway couplers shall be installed on the load stand outlet piping to protect against drive offs.

**500-2.13 Deice and Anti-ice Truck Unloading Hose Coupler.**

- a. Shall be a quick dry disconnect coupling adaptor and dust cap, size as indicated.
- b. Construction of adaptor and cap shall be aluminum.
- c. 2" Type I
- d. 3" Type IV

**500-2.14 Spill Containment Box.**

- a. Shall be a weatherproof containment box to house unloading connections.
- b. Construction of containment box shall be stainless steel.
- c. Containment box shall house the truck unloading hose adapters with dust caps, 3" ball valves, and piping.
- d. Shall be designed with a lid that can be locked closed when not in use and will stay open during unloading.
- e. Containment box shall also include a 3/4" NPT drain.
- f. Containment box size shall be a minimum of 24 inches wide by 16-1/2 to 30 inches tall by 24 inches deep. Size shall allow for acceptable operation of coupler and valve and shall be confirmed by Contractor. Coupler may be installed offset within the containment box without interfering with unloading connection and operation.

**500-2.15 Deicing Truck Loading Hose Dry Break Coupler.**

- a. Coupler shall mate with adapters as provided on existing vehicles. Size as indicated.
- b. All wetted parts shall be aluminum or stainless steel.
- c. Shall have an interlock such that coupler cannot be opened unless coupled to adaptor; unit cannot be uncoupled from an adaptor while in the open position.
- d. Provide dust cap.

**500-2.16 Surge Tank**

- a. Bladder type surge tank with bladder compatible with glycol (PTFE, Viton, EPDM, Hypalon)
- b. All wetted parts are stainless steel.
- c. 5 gallon capacity
- d. Pressure shall be set for 80% of the system design pressure.
- e. Surge tank shall have isolation valve for service and replacement.
- f. ASME Coded Section VIII DIV 1.

**500-2.17 Air Separator**

- a. Air separation tank shall have an internal design constructed of stainless steel and suitable for creating the required vortex and subsequent air separation. Tank shall be steel, constructed for, and tested to pressure-temperature rating of 125 psi at 150 degrees F.
- b. Tank shall have tangential inlets and outlets connections, threaded for 2 inches and smaller and flanged for sizes 2-1/2 inches and larger. Air released from a tank shall be to the atmosphere.
- c. Tank shall be provided with a blow-down connection.
- d. Design to separate air from water and to direct released air to automatic
- e. air vent.

- f. Unit shall be of one-piece cast-iron construction with internal baffles and two air chambers at top of unit; one air chamber shall have outlet to expansion tank and other air chamber shall be provided with automatic air release device.
- g. Tank shall be steel, constructed for, and tested to a ANSI Class 125 pressure-temperature rating.

## **EXECUTION**

### **500-3.1 Setting and Aligning Equipment.**

- a. Set and align all Equipment supplied under this Section in accordance with manufacturer's recommendations.
- b. Set true and level all Equipment at the locations shown. Demonstrate adequate leveling of installed Equipment.
- c. Provide coupling alignment records indicating parallel and angular dial indicator readings as well as coupling manufacturer's tolerances. Alignment for blenders, couplings, and drivers requiring "cold" and "hot" settings shall be checked in both conditions and so indicated on the alignment record.
- d. Retighten all bolted and threaded connections after installation.

### **500-3.2 Inspections.**

- a. The Work will be inspected by Owner at intervals appropriate to the stage of construction during the course of construction.
- b. Provide for inspection by all others having jurisdiction over the work performed under the various Sections of these Specifications during the proper phase.
- c. At time of final inspection, furnish certificate or certificates of final approval by all others having jurisdiction.

### **500-3.3 Adjustments and Calibration.**

- a. Contractor shall adjust all valves for the flows, level settings, and pressure settings indicated and specified.
- b. Set rate of closure of control valves to eliminate surges and shocks in the systems as installed. Final adjustments shall be made during system operation prior to final start-up.
- c. Final adjustments shall be made during system operation prior to final start-up.
- d. Adjust all items at start-up, including flow rates, pressure settings, meter settings, and other variables as required by Owner.

### **500-3.4 Tubing Installations.**

- a. Assemble using Hy-Fer-Set presetting device as recommended by manufacturer.
- b. Route as required to interconnect the instrumentation provided.
- c. Provide an instrument valve and weldolet for all "root" valve locations where instrumentation tubing connections are made to the piping system.

### **500-3.5 Gauges.**

- a. Install where indicated on the Drawings.

### **500-3.6 Valve and Equipment Installation.**

- a. Install where indicated on the Drawings and in accordance with manufacturer's recommendations.
- b. Replace any and all valves and Equipment that prove defective during testing.
- c. Arrange all valves during installation such that operating handles and controls are accessible, have sufficient clearance, and in the correct orientation for Owner's operation.

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- d. Provide spool pieces or spacers in the piping as necessary to ensure valve parts and operators have sufficient operating clearances.
- e. For adapters with integral screens; remove, clean, and reinstall screen after completion of flushing, before putting system into service.

#### **500-3.7 Cleaning and Protection.**

- a. Clean all fabricated assemblies and all Equipment items thoroughly before operating or testing.
- b. Protect Equipment from damage, deterioration, paint or coating spills or spots, corrosion, or harm from any source.

#### **500-3.8 Equipment Test and Checkout.**

- a. Before Equipment installations will be accepted, Contractor-furnished Equipment shall be tested and demonstrated to be correctly connected and installed.
- b. All testing and checkout procedures of manufacturer shall be carried out completely.
- c. All tested equipment found to be defective or inoperable to any extent is to be reported to Owner immediately.
- d. Any operating difficulty or defective item as a result of Contractor's Work shall be repaired or replaced and put into proper operation by Contractor immediately.
- e. Protect all Equipment and surrounding areas from damage resulting from testing operations. Clean up any spills or leakage from testing.
- f. At a minimum a functional operational test shall be performed by the glycol vendor and mechanical contractor on all equipment and systems to verify operation as intended. Several instances shall be tested based on 1, 4, 8, and 12 blending cubes operating at a time. Offload shall be functionally tested to ensure each above ground storage tank can be filled. Reclaim offload and issues shall be functionally tested and verified. Additional tests could be required to verify all systems are operational.

#### **500-3.9 Maintenance Program and Warranty.**

- a. The deice/anti-ice contractor shall provide a warranty that guarantees system materials and workmanship against defects for a minimum of five (5) years. The system warranty shall also be inclusive of a comprehensive maintenance and support program for the entire warranty duration. The program shall consist at a minimum of annual pre-season system startup inspection and training, annual post season system inspection and shut down, 24/7 remote on-call system support, and on-site system support. Remote support must include 24/7 on-call access to diagnose, adjust and repair the system. Contractor must also have sufficient personnel and technical resources to effectively carry out on-site support in a timely manner.

#### **500-3.10 Operation and Maintenance Manuals**

- a. **O&M Manual will be prepared for the purpose of assisting the Glycol Storage and Conveyance System personnel operate the overall System. The emphasis of the O&M manual will be for the operators responsible for managing glycol fluid receipt and distribution to the load stands. The O&M manual will include a schedule of preventative maintenance activities for equipment in the deice house, tanks, and recommended actions between the off-season and deicing season. The glycol vendor will provide separate O&M manuals for the individual components (e.g. equipment and control system). Subconsultant will review and compile O&M information provided by the vendor into an overall system O&M manual. The Draft System O&M Manual will be distributed to Consultant, Owner, and system operators for review and comment prior to Commissioning. Comments will be incorporated in a Final O&M Manual.**



**b. Commissioning Plan and System Commissioning**

1. **Prepare a Commissioning Plan for the Glycol Storage and Conveyance System. The Commissioning Plan will include provisions to test individual components and the overall capacity of the Glycol Storage and Conveyance System to deliver glycol and water to the dispensers.**
2. **Provide Draft Commissioning Plan to Consultant, Owner, and system Operators for review and comment.**
3. **Provide Final Commissioning Plan**
4. **Subconsultant will lead and participate in a Commissioning Event with Consultant, Contractor, and Owner. Commissioning Event is assumed to occur over a period of one week.**
5. **Subconsultant will prepare a brief memorandum summarizing key findings and recommendations (if any).**

**METHOD OF MEASUREMENT**

**500-5.1** The glycol vendor to provide equipment including but not limited to all load stands, blending cubes, reblend cubes, all pumps, all pump VFD's, all motor operated control valves, (no manual or isolation valves are provided by glycol vendor), all controls, all startup and commissioning. No install or labor associated with glycol vendor equipment lump sum price and should be provided by the installing contractor

**500-5.1** The contractor is responsible for install of all glycol vendor equipment, pumps, including pipe, pipe accessories, power wiring, controls, vibration and seismic design and apparatuses for equipment (interfaces, power wiring, control wiring, etc) and any other items to furnish a fully functional glycol system as shown on plans and specifications. The glycol vendor will provide control wiring schedules and verify completeness after contractor has terminated all wires. The cost for pump installs and all accessories including but not limited to strainers, isolation valves, suction diffusers, pressure gauges check valves housekeeping pads, vibration and seismic restraints shall be considered incidental to all other items of a pump and included in the install price.

**BASIS OF PAYMENT**

**500-5.2** Payment for the equipment meeting all acceptance criteria and identified as a pay item below shall be based on the contract lump sum. These prices shall be full compensation for furnishing all materials necessary to complete the item. Any other items either specified or required that are not specifically mentioned here shall also be included in this price.

**500-5.3** Payment for the equipment installation meeting all acceptance criteria and identified as a pay item below shall be based on the contract lump sum. These prices shall be full compensation for furnishing all materials necessary to complete the item. Any other items either specified or required that are not specifically mentioned here shall also be included in this price.

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Payment will be made under:

- Item G-500-5.1 Glycol Equipment provided by Glycol Vendor – LUMP SUM
- Item G-500-5.2 Glycol equipment install, accessories and accessories install – LUMP SUM

### **REFERENCES**

- a.** American Society for Testing and Materials (ASTM):
  - 1.** A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
  - 2.** A216 - Carbon Steel Castings Suitable for Fusion Welding for High-Temperature Service.
- b.** American Society of Mechanical Engineers (ASME):
  - 1.** B16.11 - Forged Fittings, Socket-Welding and Threaded.
  - 2.** B16.34 - Valves - Flanged, Threaded and Welding End.
  - 3.** Section VIII of Code.
- c.** American Bearing Manufacturers' Association (ABMA).
- d.** Factory Mutual Engineering Division (FM).
- e.** National Electrical Manufacturers' Association (NEMA).
- f.** Local governing code.

**END OF ITEM G-500**

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**ITEM G-700 DEICE AND ANTI-ICE ABOVEGROUND STORAGE TANKS****DESCRIPTION****700-1.1 Related Documents.**

- a. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 01 Specification Sections, apply to this Section.
- b. This Specification includes the requirements for single-compartment cylindrical horizontal welded single-wall steel shop fabricated tank systems for aboveground storage. Tank systems to be provided and contents are as follows:
  1. Type I Deicing fluid
  2. Type IV Anti-icing fluid
- c. The storage tanks shall be horizontal, cylindrical, welded steel tanks for aboveground storage as indicated.
- d. Tanks shall be located and oriented on a concrete pad as indicated.
- e. Each tank shall be equipped with a vents, manways, and appurtenances specified and indicated.
- f. Nozzle and appurtenance locations shall be as indicated subject to potential adjustment by Program Manager prior to fabrication.
- g. Contractor shall provide all items necessary for a complete, functional tank system to store deicing and anti-icing fluids including storage tanks, tank accessories, supports and service platform.
- h. Tanks shall be designed and constructed in accordance with ASME Section 8 Div 1 for atmospheric horizontal tanks.

**700-1.2 Related Requirements.**

- a. G-100 – Deice and Anti-ice System General Requirements.
- b. G-200 – Deice and Anti-ice System Pipe, Connections, and Insulation
- c. G-300 - Deice and Anti-ice System Coatings for Corrosion Protection.
- d. G-400 - Deice and Anti-ice System Valves.
- e. G-500 - Deice and Anti-ice and System Equipment and Accessories.
- f. G-600 - Deice and Anti-ice System Inspection, Testing, and Commissioning.

**700-1.3 Reference Standards.**

- a. Applicable Codes and Standards:
  1. American National Standards Institute (ASME):
    - a. B1.20.1 - General Purpose Pipe Threads.
    - b. B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges.
    - c. B16.5 - Pipe Flanges and Flanged Fittings.
    - d. Section 8 Div 1 Atmospheric horizontal tank
  2. National Electrical Manufacturers Association (NEMA).
  3. Steel Tank Institute (STI)
    - a. SP001 Standard for the Inspection of Aboveground Storage Tanks

**700-1.4 Submittals.**

- a. Submit as specified in Section 33 52 43.

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- b.** Submittals shall constitute a representation to Owner and Program Manager that Contractor has both determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers and similar data or he assumes full responsibility for doing so, and that he has coordinated each Submittal with the requirements of the Work and the Contract Documents. Contractor certifies that the Material and Equipment shown and marked on the Submittals are in compliance with the Contract Documents and can be installed, operated, and maintained in the allocated space.
1. Tank specifications, showing construction and location of all fittings.
  2. Manufacturer-field interface.
  3. Anchor bolt and foundation requirements.
  4. Tank appurtenances.
  5. Tank accessories.
  6. Internal and external coatings.
  7. Installation and start-up instructions and maintenance data for inclusion in the project maintenance manual.
  8. Certified gauging charts for tanks.
  9. Test reports.
- c.** Contractor shall provide results of all tightness testing.
- d.** Submit all items for approval before incorporation into the work. Prepare resubmittals as required to receive approvals.

#### **700-1.5 Quality Assurance.**

- a.** All Equipment and Materials shall be the latest design, new, undeteriorated, and the first quality standard product of manufacturers regularly engaged in the production of such Equipment and Materials for a minimum of 5 years.
- b.** When two or more units of the same class of Equipment are required, they shall be products of a single manufacturer. Probes, sensors, and the automatic tank gauging (ATG) system shall all be by the same manufacturer, unless otherwise specified.
- c.** Contractor or any Subcontractor or Supplier shall not supply, furnish, or install any pipe, flanges, fittings, bolts, or nuts of foreign manufacture. All pipe, flanges, fittings, bolts, and nuts shall be manufactured in the United States of America, and Contractor shall warrant the U.S.A. origin of all such items. Pipe, flanges and fittings shall bear a stamp attesting to their place of origin. Contractor shall provide written certification from the manufacturer as to the origin of all pipe, flanges, fittings, bolts, and nuts installed on the Project. If at any time Owner determines that any pipe, flanges, fittings, bolts, or nuts are not of U.S.A. origin, Owner shall be entitled to replace all pipe, flanges, and/or fittings, and/or bolts and/or nuts (as the case may be) without the need for individual testing for conformance to technical specifications, or for proof of non-U.S.A. origin of the other items. Contractor shall be responsible for all labor, materials, and consequential costs connected with such replacement.

## PRODUCTS

### 700-2.1.Manufacturers.

- a. Subject to compliance with requirements, provide products by one of the following:
1. Tanks:
    - a. Highland Tank & Mfg. Co.
    - b. Modern Welding Company, Inc.
    - c. Approved equal.

### 700-2.2.Aboveground Storage Tanks (AST).

- a. Fabricate conforming to ASME Section 8 Div 1 with steel conforming to ASTM materials, grades and thicknesses. Tanks shall be shop fabricated single-compartment cylindrical horizontal welded single-wall steel construction. Tank heads shall be flat. Exterior and interior seams shall be continuously welded on the sides to be coated (inside and out). Tanks shall meet the requirements of and be acceptable to local governing authorities. Upon satisfactory completion of testing a permanent record of the test results shall be presented to the owner.
- b. Type I and Type IV tanks shall be carbon steel with epoxy coatings on interior and exterior in accordance with specification G-300.
- c. Tank Dimensions:
1. Type I Tanks (T-04, T-05, TT-06, T-07, T-08, T-09, T-10):
    - a. Overall Dimensions: 144" dia by 59'-2" long
    - b. Nominal Capacity: 50,000 gallons.
  2. Type IV Tanks (T-01, T-02, T03):
    - a. Overall Dimensions: 126" dia by 38'-10" long .
    - b. Nominal Capacity: 25,000 gallons.
  3. Type I Reclaim Tanks (T-11, T-12, T-13):
    - a. Overall Dimensions: 144" dia by 59'-2" long.
    - b. Nominal Capacity: 50,000 gallons.
- d. Prior to shipment, prepare surfaces, prime coat and finish coat interior and exterior of tank and appurtenances. Exterior shall be coated with manufacturer's standard epoxy/polyurethane and the interior shall be completely lined with manufacturer's standard epoxy. Tank epoxy linings shall be compatible with the product stored.
- e. Tanks identification: Tanks shall have identification for first responders that meets the requirement of NFPA 704. Tanks shall have name plate that identifies Manufacturer, material stored, tank number, nominal volume, interior and exterior coatings and manufactured date.
- f. Lifting lugs shall be provided at the balance points.
- g. Provide anchor bolts for tanks. Coordinate quantity, size, location of anchor bolts and foundations between tank manufacturer and foundation Contractor.
- h. Tanks shall have factory fabricated saddles designed for loads of specific tank. The tanks shall ship with the saddles and wear plates welded to the tanks. Design of the steel supports shall be able to support the weight of the tank filled to capacity.  
Maximum height of saddle when measured from lowest portion of the tank shell to grade level shall be no more than 12 inches high.
- i. Provide tank openings and connections necessary for proper operations to include those indicated and as specified below. Provide striker plates on tank bottoms under all openings.
1. Type I Tanks
    - a. Three 36-inch manholes. Middle with ladder
    - b. One Automatic Tank Gauge (Top)
    - c. One 4-inch spare connection (Top)

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- d. One 4-inch vent (Top)
- e. One 4-inch fill connection (Top)
- f. One 12-inch issue connection (End)
- g. One 4-inch manual gauge (Top).
- 2. Type I Reclaim Tanks
  - a. Three 36-inch manholes. Middle with ladder
  - b. One Automatic Tank Gauge (Top)
  - c. One 4-inch spare connection (Top)
  - d. One 4-inch vent (Top)
  - e. One 4-inch fill connection (Top)
  - f. One 6-inch issue connection (End)
  - g. One 4-inch manual gauge (Top).
- 3. Type IV Tanks:
  - a. Three 36-inch manholes. Middle with ladder
  - b. One Automatic Tank Gauge (Top)
  - c. One 4-inch spare connection (Top)
  - d. One 3-inch vent (Top)
  - e. One 3-inch fill connection (Top)
  - f. One 10-inch issue connection (End)
  - g. One 4-inch manual gauge (Top).
- j. Tank openings, piping connections, and tank accessories shall be furnished as indicated.
  - 1. Flanged openings shall be ASME B16.5, Class 150 with glycol compatible composite gaskets, except for piping connection, which shall have gaskets, nuts, and bolts in accordance with Section G-200.
  - 2. Flanged openings shall be provided with blind flanges during shipment.
  - 3. Threaded openings shall be sealed with plugs during shipment.
  - 4. Tank nozzles and manways shall be designed to support the load of the connected Equipment.
- k. Provide a 9'-0" wide steel maintenance platform along the length of the top of each tank for access to all tank nozzles and tank accessories. Provide 4'-0" wide field mounted steel stairs from pad level to platform level. Provide OSHA complaint ladders, platforms, and stairs, with handrails. Platforms, stairs, ladders, and handrails shall be constructed of structural shapes and grates of ASTM carbon steel materials. Platforms shall provide access to and clearances from manways and all other tank appurtenances. Platforms, stairs, ladders, and handrails shall be hot-dipped galvanized. Stairs shall be fabricated per code to meet rise/run requirements. Tank shall have repads with clips for connection of platform.
- l. Provide a permanent sign at the fill point for the tank documenting the filling procedure and the tank calibration chart. The filling procedure shall require the person filling the tank to determine the gallons required to fill the tank to 95% of capacity before commencing the fill operation.

#### **700-2.3. Overfill Prevention Valve.**

- a. Provide float operated overfill prevention valve designed to shut off pressurized product delivery to an aboveground storage tank at 90% of tank capacity, size as indicated.
- b. Type IV anti-icing fluid will not have an overfill prevention valve.

#### **700-2.4. Gauge Hatch.**

- a. Provide a 4-inch side seal type adapter and cap with NPT connections.
- b. Adapter shall be of brass construction; cap shall be aluminum.

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- c. Provide calibrated tank gauging sticks

**700-2.5. Automatic Tank Gauge (ATG).**

- a. System shall include a magnetostrictive probes manufactured by Veeder-Root or approved equal.
- b. System shall continuously monitor the tank liquid level and storage capacity in gallons.
- c. ATG systems shall monitor tank interstitial sensors.
- d. System shall include water detection.
- e. Probes shall be UL listed.

**700-2.6. Gauging Charts and Stick Gauges.**

- a. Contractor shall provide two (2) certified gauging tables to Owner for each tank provided.
- b. Table shall indicate tank volume in gallons for each 1/16-inch.
- c. Gauging charts shall be adjusted for slope of tanks as indicated.
- d. Provide two (2) gauge sticks having a 1/16-inch graduation.

**700-2.7. Grounding.**

- a. Tank shall be bonded and grounded as identified by tank manufacturer. Refer to electrical specifications for additional bonding and grounding requirements.

## EXECUTION

**700-3.1. Installation.**

- a. Tanks and Equipment shall be installed per manufacturer's written recommendations and installation instructions, recognized industry standards, and federal, state, and local codes.
- b. Provide housekeeping pads, to level tank on sloped pad or foundation as specified and indicated.
- c. High level switch delay shall be set to zero.
- d. Slope tanks as indicated.
- e. Spare connections shall be properly secured:
  1. Provide permanent metal plugs sealed with nonhardening pipe sealant, compatible with glycol, to internal bushing threads, for all unused threaded piping couplings.
  2. Provide metal blind flanges with gaskets, compatible with glycol, for all unused flange connections.

**700-3.2. Handling and Staging.**

- a. Tanks shall be handled and staged in accordance with the tank manufacturer's written instructions.

**700-3.3. Tests.**

- a. Primary tank shall withstand an independent air pressure test and differential air pressure procedure applied in the manufacturer's shop. At the manufacturer's shop, the primary/inner tanks shall be air tested to 5 psig along with a soap solution applied to the tank nozzles shop and a differential air pressure test on the interstitial secondary/outer tanks. The air pressure shall hold for a period of 4 hours without a drop after the test apparatus has been removed. Submit shop test results to Program Manager.
- b. After tank is set on its foundation, Contractor shall perform 5 psig air test of the tanks. Tank tightness testing procedure after tank has been lowered into place and anchored:
  1. Tighten all tank connection fittings.
  2. Soap entire tank and fittings.
  3. Pressurize the tank with air to no more than 5 psig and visually inspect for leaks.

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- a. Use an air gauge with 1 lb. increments so that changes in pressure can be easily observed.
  - b. Retighten all leaking fittings until such leakage is stopped.
  - c. Any leakage or other defects shall be considered a failure of these tests. Necessary repairs shall be made upon failure and the test shall be repeated until all defects are eliminated as acceptable to the tank manufacturer and Program Manager.
  - d. Test shall not be considered complete until pressure has been maintained for 4 hours during which no leaks are detected.
4. Tanks which have been repaired and those which have been dropped or impacted after test shall be retested. Tanks shall continue to be retested until a successful leakage test is obtained.
- c. Contractor shall submit field test reports to Program Manager.
  - d. Inspection and testing per STI SP001.
  - e. Submit detailed procedures for testing methods for approval before starting tank installation.
  - f. Tests shall be witnessed by Program Manager.

#### **700-3.4. Certification.**

- a. Tank system manufacturer shall submit certification letter to the Program Manager certifying that the tank system is constructed in accordance with applicable standards. Tanks shall include nameplates listing the manufacturer's name, address, model and serial numbers, and tank capacity. Metallic nameplates shall be permanently affixed to the tanks.

#### **700-3.5. Operation and Maintenance Manuals**

- a. **O&M Manual will be prepared for the purpose of assisting the Glycol Storage and Conveyance System personnel operate the overall System. The emphasis of the O&M manual will be for the operators responsible for managing glycol fluid receipt and distribution to the load stands. The O&M manual will include a schedule of preventative maintenance activities for equipment in the deice house, tanks, and recommended actions between the off-season and deicing season. The glycol vendor will provide separate O&M manuals for the individual components (e.g. equipment and control system). Subconsultant will review and compile O&M information provided by the vendor into an overall system O&M manual. The Draft System O&M Manual will be distributed to Consultant, Owner, and system operators for review and comment prior to Commissioning. Comments will be incorporated in a Final O&M Manual.**
- b. **Commissioning Plan and System Commissioning**
  - 1. **Prepare a Commissioning Plan for the Glycol Storage and Conveyance System. The Commissioning Plan will include provisions to test individual components and the overall capacity of the Glycol Storage and Conveyance System to deliver glycol and water to the dispensers.**
  - 2. **Provide Draft Commissioning Plan to Consultant, Owner, and system Operators for review and comment.**
  - 3. **Provide Final Commissioning Plan**
  - 4. **Subconsultant will lead and participate in a Commissioning Event with Consultant, Contractor, and Owner. Commissioning Event is assumed to occur over a period of one week.**
  - 5. **Subconsultant will prepare a brief memorandum summarizing key findings and recommendations (if any).**

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## METHOD OF MEASUREMENT

**700-4.1** Aboveground storage tanks and all ancillary components shall be measured on a per each basis..

## BASIS OF PAYMENT

**700-5.1** Payment shall be made at the contract unit price per each that is in place, completed and accepted by the program manager. Payment for tanks, metering equipment, gauges, controls, safety devices, service platforms, saddles, stairs, factory and field coatings as specified in G-300 and all other accessories meeting all acceptance criteria as specified in G-700 and identified as a pay item below shall be based on the contract unit price. These prices shall be full compensation for furnishing all materials and for all preparation, delivery and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item G-700-5.1            Schedule 1 Phase 4 50,000 Gallon above ground storage tank-EA

Item G-700-5.2            Schedule 1 Phase 4 25,000 Gallon above ground storage tank-EA

## REFERENCES

**a.** Applicable Codes and Standards:

1. American National Standards Institute (ASME):
  - a. B1.20.1 - General Purpose Pipe Threads.
  - b. B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges.
  - c. B16.5 - Pipe Flanges and Flanged Fittings.
  - d. Section 8 Div 1 Atmospheric horizontal tank
2. National Electrical Manufacturers Association (NEMA).
3. STI
  - a. SP001 Standard for the Inspection of Aboveground Storage Tanks
4. Underwriters Laboratories (UL):
  - a. 142 - Steel Aboveground Tanks for Flammable and Combustible Liquids.

**END OF ITEM G-700**

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