

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

**1.2 SYSTEM DESCRIPTION**

- .1 This work shall consist of the installation of a complete and functional Ground Temperature Monitoring System within the Runway 15-33 area to be used to monitor the ground temperature immediately following the completion of this Project for at least the next 10 years. The system includes data collection equipment connected to multi conductor thermistor strings installed in PVC pipes placed into boreholes drilled into the runway pavement area to a maximum depth up to 10 m or auger refusal (whichever comes first).

**1.3 MEASUREMENT AND PAYMENT**

- .1 Ground temperature monitoring equipment and borehole installation will be measured in units installed and accepted into the Work. The unit price shall include materials including pavement coring, borehole drilling, granular backfill, pipe, ground temperature monitoring equipment, inset base, flange ring, spacers, cover and snow plow ring, QC testing and all work incidental thereto.

**1.4 REFERENCE STANDARDS**

- .1 ASTM International
  - .1 ASTM C78/C78M, Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third Point Loading).
  - .2 ASTM C266, Standard Test Method for Time of Hydraulic Cement Paste by Gillmore Needles.
  - .3 ASTM C596, Standard Test Method for Drying Shrinkage of Mortar Containing Hydraulic Cement.
  - .4 ASTM C666/C666M, Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
  - .5 ASTM C672/C672M, Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals.
  - .6 ASTM D5329, Standard Test Methods for Sealants and Fillers, Hot-Applied, for Joints and Cracks in Asphaltic and Portland Cement Concrete Pavements.
- .2 Transport Canada
  - .1 TP 312, Airfield Standards and Recommended Practices, 5th Edition.
- .3 US Federal Aviation Administration
  - .1 FAA AC 150/5345-42D

## **1.5 ADMINISTRATIVE REQUIREMENTS**

- .1 Pre-Installation Meetings:
  - .1 Convene one week prior to beginning on-site installations, with Departmental Representative to:
    - .1 Verify project requirements.
    - .2 Review installation and substrate conditions.
    - .3 Co-ordination with other sub-trades.
    - .4 Review manufacturer's written installation instructions and warranty requirements.
  - .2 Arrange for site visit with Departmental Representative prior to start of Work to examine existing site conditions adjacent to demolition work.

## **1.6 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature and data sheets for ground temperature monitoring equipment and inset base equipment and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Submit drawings.
- .4 Sustainable Design Submittals:
  - .1 Erosion and Sedimentation Control: submit copy of erosion and sedimentation control plan.

## **1.7 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for airfield ground temperature monitoring equipment system for incorporation into manual.

## **1.8 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Extra Stock Materials: submit extra materials listed:
  - .1 4 C Type 3.6V lithium spare batteries specified by equipment manufacturer.

## **1.9 QUALITY ASSURANCE**

- .1 Mock-ups:
  - .1 Construct mock-ups where indicated by Departmental Representative in accordance with Section 01 45 00 - Quality Control.

- .1 Purpose: to judge quality of work, substrate preparation, operation of equipment and material application.
- .2 Ensure mock-up is of sufficient size to include both of airfield runway and taxiway inset lighting installation assemblies.
- .3 Proceed with work after receipt of written acceptance of mock-up.
- .4 When accepted, mock-up will demonstrate minimum standard of quality required for Work of this Section.
- .5 Approved mock-up may remain part of finished Work.
- .6 Bear costs for replacement or repair of unacceptable Work as directed by Departmental Representative.

#### **1.10 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

### **Part 2 Products**

#### **2.1 GROUND TEMPERATURE MONITORING EQUIPMENT**

- .1 Products: to LogR Systems or equivalent.
- .2 Data collection device: Model ULogC32 including software for configuration and data transfer using SD Card and bluetooth capable, suitable for low temperature operating environment to -40C.
- .3 Multi-conductor thermistor cable: shielded 64 multi-conductors, 32 sensors, 22 AWG stranded tinned copper with polyurethane jacket for low temperature operating environment to -55C, length as required for borehole depth.
- .4 Connectors: IP68
- .5 Spare batteries: Type C lithium battery, 3.6V 5.8 Ah.

#### **2.2 INSET BASES**

- .1 Products: to FAA AC 150/5345-42D.
- .2 For use with pavement coring and borehole drilling method in existing asphalt pavement on concrete base: light unit base, 203 mm deep (bottom section), height as required for top section, for L-868, size B unit complete with open bottom, anti-rotational cleats, frost ring, and 2 inside clamp lugs. Jacquith Industries AE2419X or equivalent.
- .3 Base riser section extension, if required to suit existing asphalt pavement depth, 286 mm bolt circle, for L-868, size B unit, for mounting on top of inset unit bases. Jacquith Industries AE2419X or equivalent
- .4 Spacer and bevel rings, height to suit, for L-868, size B inset unit, with 286 mm bolt circle. Jacquith Industries AR5424AL or equivalent

- .5 Flange ring, 13 mm height with pavement ring for L-868, size B inset unit, with 286 mm bolt circle including gasket silicone O ring supplied by manufacturer. Jacquith Industries AF540208YM or equivalent
- .6 Solid inset cover and snow plow ring for mounting on flange ring with L-868 size B inset unit with 286 mm bolt circle. Jacquith Industries AK80, AW5008HLEDO or equivalent

## 2.3 ACCESSORY MATERIALS

- .1 Stainless steel high strength bolts, to 304 or 18-8 SS grade including 2-piece lock washers for base and riser section connections.
- .2 Stainless steel high strength bolts, to 304 or 18-8 SS grade including 2-piece lock washers for connections to flange rings, adaptor type/snow plow rings and solid covers.
- .3 Never seize compound for stainless steel bolts.
- .4 High early strength mortar used to encapsulate inset base units: Set 45.
- .5 Sealing compounds as follows:
  - .1 Sealing material for inset base unit flange rings and spacer rings into asphalt pavements to FAA Specification P-606 Adhesive Compound and following requirements.
    - .1 Tensile Properties: ASTM D638, minimum 35 kg/sq cm (500 psi).
    - .2 Elongation: ASTM D638, minimum 50%.
    - .3 Expansion: ASTM C1168, Method B.
    - .4 Asphalt compatibility: ASTM D5329 no failure in adhesion.
  - .2 Rapid, high-early strength mortar for securing inset base unit to asphalt pavements: Set 45 or non-shrink grout mortar equivalent to:
    - .1 75 x 100 x 400 ASTM C78 mm prisms. Modulus of rupture one day 3.8 MPa minimum.
    - .2 ASTM C266 Final time of setting, Gillmore 20 minutes maximum.
    - .3 ASTM C596 Shrinkage 0.03% at 28 days (maximum).
    - .4 ASTM C666 (Procedure A) Relative dynamic modules at 300 cycles 80 %.
    - .5 ASTM C672 (minimum). At 15 cycles Rating 0. At 50 cycles Rating 2.
  - .3 Self-levelling joint sealant to FAA Specification P605 Joint Sealant for sealing flange ring and spacer ring into asphalt pavements.
- .6 Plastic conduit: rigid PVC.
- .7 Self-levelling sealant: RTV self-levelling silicone sealer to inset unit base manufacturer's recommendations.
- .8 Lubricant: silicone supplied with top assembly, to inset base unit manufacturer's recommendations.

## **2.4 EQUIPMENT**

- .1 Non-impact methods of installation using pavement coring and borehole augering methods.
  - .1 Characteristics:
    - .1 Coring equipment shall be supplied by Contractor.
    - .2 Auger drilling equipment may be supplied by Transport Canada Churchill Airport for use by Contractor as follows:
      - .1 Equipment operators and drilling crew shall be designated by Transport Canada based on previous crew experience at Churchill Airport.
      - .2 Auger drilling equipment labour costs, crew expenses, equipment fuel and operating costs to be paid by Contractor.
      - .3 Auger drilling equipment located at Churchill Airport will be provided by Transport Canada at no cost to Contractor.
      - .4 Auger drilling equipment consists of CME 75 truck mounted drill rig equipped with 125 mm diameter solid stem and 200 mm diameter hollow stem augers capable of 10 m borehole depth or auger refusal.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for airfield equipment installation in accordance with manufacturer's instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

### **3.2 GENERAL REQUIREMENTS**

- .1 Obtain acceptance of Work from Departmental Representative before and after each stage of installation, including:
  - .1 Preparation (coring, drilling).
  - .2 Installation of inset base units.

### **3.3 PREPARATION**

- .1 Install control measures in accordance with project's Erosion and Sedimentation Control Plan:

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff, according to sediment and erosion control plan.
  - .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction.
  - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- .2 Where existing shallow glue in bases are to be replaced, use core drill, [50] mm larger than bases being replaced, to core through pavement to depth allowing [150] mm clearance under new base.
  - .3 In existing pavement, core hole asphalt and concrete pavement to accommodate new inset base unit to diameter and depth as indicated on Drawings.

### **3.4 BOREHOLE**

- .1 Bore holes to diameters and maximum 10 m depth as indicated or until auger refusal as determined by Departmental Representative.
- .2 Contractor to complete borehole log observations, documentation, sampling and complete subsurface soil investigation and classification during drilling. Departmental Representative to inspect and test bottom of bore holes.
- .3 Dispose of excavated materials as indicated Departmental Representative.
- .4 Install PVC pipe as indicated.
- .5 Fill void space between PVC pipe and shaft excavation with mixture of auger cuttings, and sand.

### **3.5 INSTALLATION: INSET BASE IN EXISTING PAVEMENT**

- .1 Place inset base unit in its respective hole and set at proper elevation using installation jig.
  - .1 Bolt jig to base and adjust to hold base at correct elevation with respect to pavement surface and to keep base in level position both laterally and longitudinally.
- .2 Mix mortar and sealing compounds as indicated and apply in appropriate weather conditions.
- .3 Insert inset base into hole in pavement, align marks and seal into position with mortar and sealing compounds to required alignment and elevation.
- .4 Set final elevation of base so that no portion of flange ring or solid cover is less than 5 mm below pavement surface or greater than 10 mm below the pavement surface.
- .5 Cover bases immediately after removal of jig using appropriate inset base units, flange ring, spacers, bevel rings and steel cover plates with snow plow ring.
- .6 Measure depth of pavement over inset base.
- .7 Apply thin layer of self-levelling sealant between flange of base and flange of base riser extension.

- .8 Fasten sections together using bolts and anti-rotational washers, using recommended torque.
- .9 If actual elevation of pavement equals estimated elevation, top of extension base will be 38 mm below surface: this allows for light fixture 19 mm thick, and flange and spacer ring having total combined thickness of 19 mm.
  - .1 If actual and estimated elevations differ, add difference to spacer ring thickness.
- .10 Place spacer ring and flange ring between inset base unit and top of base extension.
  - .1 Provide layer of self-levelling sealant between spacer ring and top of base extension and between spacer ring and flange ring.
  - .2 Insert an "O" ring in groove of flange ring and fasten inset base unit with bolts and anti-rotational washers at recommended torque.
- .11 Fill space between base extension and asphalt with P606 sealing compound not higher than bottom of spacer ring.
  - .1 Mix sealing compound and pour during appropriate weather conditions.
- .12 Fill space between flange ring, including spacer ring, and asphalt, with P605 sealing material not higher than top of flange ring.

### **3.6 INSTALLATION: GROUND TEMPERATURE MONITORING EQUIPMENT IN INSET BASE UNIT**

- .1 Install thermistor string in borehole and data collection equipment inside inset base unit.
- .2 Connect data collection equipment to bottom inset base unit clamps using wire cable and connectors.
- .3 Remove foreign material from base:
  - .1 Clean rust or other foreign material from gasket groove and matching machined flange surfaces of both base and top.
  - .2 Clean and dry bolt holes to ensure that bolts can be positioned so that top assembly is tightened evenly.
- .4 After cleaning, apply coating of lubricant supplied with top assembly to gasket.
- .5 Set top assembly on base receptacle with bolt holes aligned.
- .6 After alignment:
  - .1 Install and tighten in sequence until all bolts are tightened to recommended torque.

### **3.7 FIELD QUALITY CONTROL**

- .1 Site Test, Inspections:
  - .1 Perform tests to ensure ground temperature monitoring systems are functional at each location.
  - .2 Complete sub surface borehole logs, laboratory test reports, ground temperature monitoring verification test data and submit to Departmental Representative.

**3.8 CLEANING**

- .1 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

**3.9 PROTECTION**

- .1 Protect installed products and components from damage during construction.

**END OF SECTION**