Part 1 General

1.1 SYSTEM DESCRIPTION

Inverted membrane leak location system shall be designed and locate membrane breaches in the roofing or waterproofing system where the roofing membrane is installed on concrete and then covered with various overburdens. A network of excitation grid and sensor elements are installed **above** the roofing membrane, beneath the overburden of typical drainage mat and insulation layer, to detect the presence of membrane breach. Electric leak detection system (ELDS) including a membrane electronic leak detection scan (ELD Scan) and installed electronics-based leak detection system. (ELD System)

Electronic Leak Detection (ELD) Scan completed by digital multi-vector detection scan (DigiSCAN) of membrane areas indicated and scheduled to verify waterproof integrity prior to installation of electronic leak detection system components.

Installation of left in place electronic leak detection system including stainless steel Electronic Field Tape (EFT) grid and measurement sensor elements element (DigiStar) connected via direct burial cable to termination in junction boxes.

SELECT PARAGRAPH 1.1.1 for FUTURECAST Passive: Periodic measurement of passive installed sensors.
OR
SELECT PARAGRAPH 1.1.2 for FUTURECAST Active: Automated Leak Detection for cloud based active monitoring system.

.1 Passive inverted Roof Leak Detection: The installation of the passive sensor elements of electronic field tape (EFT) and measurement sensor elements (DigiStars) in the roof and water proofing assembly terminated at an accessible junction box location for technician use of electronics measuring apparatus for periodic testing.

.2 Active Inverted Roof Leak Detection: Additional to the passive inverted leak detection system, provide automated, permanently installed electronics for continued monitoring by remote gateway and associated switching and measurement equipment.

1.2 RELATED SECTIONS

Section 01 23 00 - Alternates.

Section 01 45 00 - Quality Control.

Section 07 33 63 - Vegetated Roofing.

Section [_____] - [_____] Roofing.

Section 07 55 52 - Modified Bituminous Protected Membrane Roofing.

Section [_____] - [_____].

Section 11 24 23 - Window Washing Equipment and Fall Protection.

Division 22 - Plumbing: Drains and scuppers.

Division 26 - Electrical: Data connection from system panel to building communications room.

1.3 ALTERNATES

SELECT PARAGRAPH 1.5.1 for FUTURECAST Passive: Periodic measurement of passive installed sensors.
OR
SELECT PARAGRAPH 1.5.2 for FUTURECAST Active: Automated Leak Detection for cloud based active monitoring system.

1.4 REFERENCES

RCABC (Roofing Contractors Association of British Columbia) Guarantee Corp. - RCABC Roofing Practices Manual.

Journal of ASTM International (Vol.8, No. 9) Paper ID- JAI 103772 - Electrical Conductance Methods for Locating Leaks in Roofing and Waterproof Membranes.

4th International Conference on New Horizons in Green Civil Engineering Paper ID-70 Understanding Low-Slope Extensive Automated Leak Detection Systems

ASTM D 7877-14- Standard Guide for Electronic Methods of Detecting and Locating Leaks in Waterproofing Membranes.

1.5 SYSTEM DESCRIPTION

SELECT PARAGRAPH 1.5.1 for FUTURECAST Passive: Periodic measurement of passive installed sensors.
OR
SELECT PARAGRAPH 1.5.2 for FUTURECAST Active: Automated Leak Detection for cloud based active monitoring system.

.1 Installation of permanent electronic field grid, location sensors and access enclosure with related testing and measuring apparatus to facilitate detection of membrane leak locations.

The leak locate function is performed at the roof access enclosure by the manufacturer personnel on-site

[OR]

.2 Installation of permanent electronic field grid, location sensors and access enclosure with related testing and measuring apparatus to facilitate detection of membrane leak locations.

The leak locate function is performed at the roof access performed by remote computer system and monitoring electronics connected by internet to the online building intelligence monitoring center.

1.6 ADMINISTRATIVE REQUIREMENTS

Section 01 31 00: Project management and coordination procedures.

Coordination: Coordinate with other work having a direct bearing on work of this section.

Pre-installation Meeting: At the contractor’s request convene four (4) weeks before starting work of membrane roofing.

.1 Review preparation and installation procedures and coordinating and scheduling required with related work.

1.7 SUBMITTALS

Section 01 33 00: Submission procedures.

Product Data: Provide manufacturer’s data sheets for product components and accessories.

Shop Drawings: Indicate plans, EFT grid layout, sensor element locations, dimensions, construction details, location and type of roof penetrations and roof drains.

.1 Indicate location of electrical enclosures, and access enclosures.

.2 Indicate location where EFT grid cables will be terminated and area where monitoring electronics or future monitoring electronics will be installed.

.3 Indicate location of EFT electrical guard circuits around perimeters, penetrations and drains.

.4 Indicate the electrical enclosure location where electrical and data are required.

Test Reports: Test reports from approved testing agency certifying that leak detection system conforms to performance characteristics and testing requirements specified.

Installation Data: Manufacturer's written installation requirements.

Test Protocol: Manufacturer's written description of testing method and protocol.

1.8 CLOSEOUT SUBMITTALS

Section 01 78 00: Submission procedures.

Operation and maintenance data: Indicate maintenance requirements for installed products.

Maintenance Service:

.1 Submit proposal to perform additional membrane integrity scans when the membrane is still exposed during the construction process.

.2 Submit proposal to perform passive: periodic measurement of installed sensors of the electronic leak detection system every year (12) months, reports and

.3 Submit proposal for active leak detection system maintenance, access to automated leak detection system data and reporting options.

1.9 QUALITY ASSURANCE

Products to be listed as Accepted Materials in the RCABC Roofing Practices Manual.

Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten (ten) years documented experience.

Installer Qualifications: Company specializing in performing the work of this section documented experience and approved by the manufacturer.

Testing Agency Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by the manufacturer.

1.10 DELIVERY, STORAGE AND HANDLING

Section 01 60 00: Transport, handle, store and protect products.

Protect electronic equipment and sensing/detection devices against potential damage from dust and moisture.

1.11 ENVIRONMENTAL REQUIREMENTS

Automated measurement of installed sensors shall occur over a season, access to nearest weather station for data for correlation may be required.

1.12 WARRANTY

Manufacturer's Warranty: Provide a two (2) year manufacturer's warranty to include coverage for premature equipment failure.

Part 2 Products

2.1 MANUFACTURERS

SMT Research Ltd.: 778-373-2070 info@smtresearch.ca www.smtresearch.ca

2.2 EQUIPMENT

Electronic Leak Detection (ELD) Scan completed by digital multi-vector detection scan (DigiSCAN) of membrane areas indicated and scheduled to verify waterproof integrity prior to installation of electronic leak detection system components

.1 DigiSCAN Power Supply: Voltage supply to induce electrical potential to the light layer of water on top of membrane relative to the roof deck below.

.2 DigiSCAN Membrane Scanner: Digital Multi-vector 16 probe membrane scanning device which outputs the voltage magnitude and vector direction to the operator. Use of related head attachment for vertical scanning, and corners.

Electronic Leak Detection System (ELDS) Installation of left in place electronic leak detection system including stainless steel Electronic Field Tape (EFT) grid and measurement sensor elements element (DigiStar) connected via direct burial cable to termination in junction boxes.

MultiSCAN board: Automated switching and measurement unit that facilitates the rapid connection to and testing of the monitoring grid installed on the top surface of waterproof membranes.

Gateway: (TiG) Automated gateway solid state computer for local building data collection, connection to site supplied internet and power.

Online Monitoring: Data collected, stored and available through ELDS manufacturers online portal

2.3 COMPONENTS

Electronic Field Tape Grid: Type 316 stainless steel conductor; laminated tape construction and self-adhering insulating substrate. Connection shall be by gas tight connector and water tight heat shrink.

Star measurement sensor elements: (DigiStar) connected via direct burial cable to termination in junction boxes.

Access Enclosure: Supply enclosure with adequate space for cable terminations on terminal blocks, monitoring electronics and terminal barrier blocks for connecting grid cable, to enable field test access. Access enclosure to be watertight in exterior locations.

.1 Provide 400 x 350 x 150 mm deep (16 x 14 x 6 inches) box per 500 sq.m (5,400 sq.ft).

Electrical Cable and Accessories: Direct burial cable for exposed wet environment as recommended by system manufacturer.

2.4 COMPONENTS (ALTERNATE PRICE)

DELETE PARAGRAPH 2.4 for FUTURE CAST Passive: Periodic measurement of passive installed sensors.
OR
ADD PARAGRAPH 2.4 for FUTURECAST ACTIVE: Automated Leak Detection for cloud based active monitoring system.

Permanently installed MultiSCAN Board and Tactical Intelligence Gateway or Building Intelligence Gateway (Alternate): Automated monitoring system for permanent installation to access closure for real-time monitoring of protected membrane grid system.

Provide required MuiltSCAN boards, on-site gateway and connection to internet as a complete system.

Site to provide 110v power and internet connection at location of main access enclosure.

Part 3 Execution

3.1 EXAMINATION

Section 01 71 00: Verify existing conditions before starting work.

Verify that membrane penetrations are of a non-conductive material or are electrically isolated by applying additional layers of non-conductive waterproof material or other electrically insulating materials to above overburden level.

Verify that the waterproof membrane extends above all overburden to avoid unintended electrical paths to ground.

Verify that a suitable liquid-applied or weatherproof insulating material or a cap sheet may be applied to insulate exposed concrete. Metal flashings and other metal elements should be clear of overburden and soil to achieve the electrical insulation and avoid unintended grounds.

Verify availability of hose and water supply of sufficient length to reach all points on surfaces to be surveyed.

Coordinate with responsible entity to correct unsatisfactory conditions.

Commencement of work by surveyor is acceptance of installation conditions.

3.2 PREPARATION

Membranes to be scanned shall be broom clean (except for follow-up surveys on vegetated waterproofing) and are free of overburden, construction materials, equipment and debris.

3.3 INSTALLATION –ELECTRIC FIELD GRID AND SENSOR ELEMENTS

Install monitoring sensors and field grid to manufacturer's written instructions and approved shop drawings.

Place a conductor with Type 316 stainless steel conductor in the specified pattern on top of waterproof membrane. Space conductor wires in accordance with shop drawing and selected granularity of the leak detection system.

The granularity of the leak detection shall directly affect the amount of overburden to be removed to find leak. Table below is an estimate for wet side monitoring sensor and electric field grid layouts.

Environment	Granularity	Grid Spacing
Concrete Pavers on pedestals	400 sq ft, 40 sq meters	20'x 20' 6 x 6 meters
Extensive Green Roof (up to 200 mm deep)	100 sq ft 10 sq meters	10' x 10' 3 x 3 meters
Intensive Green Roof	100 sq ft 10 sq meters	10' x 10' 3 x 3 meters
Concrete Topping	36 sq ft 3.6 sq meters	6' x 6' 1.8 x 1.8 meters

Provide specific electronic field tape guard around drains, roof anchors and penetrations.

3.4 INSTALLATION - ACCESS CLOSURE

Install access enclosure to manufacturer's written instructions.

Install and terminate electrical cables from grid on approved screw terminal blocks or IDC connection blocks in access closure.

Utilize fiberglass waterproof enclosure for outdoor above ground applications. Utilize plastic waterproof enclosures for installation in planters.

3.5 SURVEY PROCEDURE

Perform initial digital multi-vector membrane scan to establish baseline conditions to equipment manufacturer's written requirements.

Mark breach locations on membrane with a wax crayon approved by the waterproof membrane contractor and/or inspector.

Record location of membrane breach on sketch or drawings for communication with contractor and/or inspector.

Electronic leak detection system:
Verify wiring sequence, electrical continuity and the absence of shorts or grounds on electric field grid system.

Perform test of leak detection system prior to installation of protection boards, drainage panels and other overburden.

Record location of membrane breach on sketch or drawings for communication with contractor and/or inspector.

Perform final sensor readings and report immediately following installation of final layer of inverted or vegetated roof with grid system.

3.6 FIELD QUALITY CONTROL

Section 01 45 00: Field inspection and testing.

Request site attendance of roofing manufacturer representative during installation of the work.

Correct identified defects or irregularities.

Field Reports: Identify date, time, and weather conditions when surveys are conducted.

.1 Provide general description of scan/survey equipment and process.

.2 Describe typical membrane breaches located and areas not accessible by scanning equipment.

.3 Document survey with photographs and plan view scale drawings with approximate location of breaches noted.

System Reports: Identify date, time, and weather conditions when system measurements6 are conducted for passive or automated reports.

.1 Provide general description of survey / passive electronics and equipment and process.

.2 Provide data visualization on plan view scale drawings with approximate location of EFT, sensor elements and conditions report of the membrane, with breaches noted.

END OF SECTION 07 01 73