

1. General

1.1. SECTION INCLUDES

1. Sensors for monitoring mass timber buildings such as Cross Laminated Timber (CLT), Dowel Laminated Timber (DLT), Nail Laminated Timber (NLT) or similar for monitoring performance comprising of moisture content, moisture detection tape, relative humidity, condensation, temperature and interior condition sensors and related data acquisition units to be installed in the pre-fabrication process or in-situ on-site.
2. **Wired OR Wireless** electronics for the data acquisition system, related low-voltage cabling to be installed in the building during the rough-in process. Select the use Wireless / Battery powered systems for use in transportation and during construction data collection. Some systems can be converted to wired monitoring solutions for long term data collection with-out the use of batteries.
3. On-line access to the data complete with installation location, data history analysis, graphical overlays showing location of the data, automated reporting and data visualization tools.

1.2. RELATED SECTIONS

1. Section 01 23 00 - Alternates.
2. Section 01 45 00 - Quality Control.
3. Section [] - [] Mass Timber Floor System.
4. Section [] - [].Mass Timber Wall System
5. Division 26 - Electrical: Electrical connection from system panel
6. Division 27 – Low Voltage Electrical: Data connection from system panel to building communications room.

1.3. REFERENCES

1. RoHS 2011/65/EU Compliant
2. Manufactured and distributed under ISO 9001:2008 guidelines
3. Low Power Wireless Network
 1. IEEE 802.15.4
4. Low voltage Cabling System
 1. Cat5E ANSI/TIA/EIA-568A/B 23awg or 24awg
 2. IEEE 802.3 minimum
 3. CAN Bus ISO 11898-2:2003
5. Gateway
 1. IEEE 802.3-2015
 2. IEEE 802.11-2016

1.4. SYSTEM DESCRIPTION

1. Installation of permanent sensors access closure with related data collection electronics facilitate detection of moisture accumulation, external environment, internal conditions, or movement with respect of the mass timber panels and at critical building details. The sensor parameters are monitored from the installation of the detection sensors by **[wired or wireless & battery powered]**, data-logging electronics and when construction completed performed by remote computer system connected by internet to the building intelligence monitoring center. Internet connection and 110v power supply by others.

1.5. ADMINISTRATIVE REQUIREMENTS

1. Section 01 31 00: Project management and coordination procedures.
2. Coordination: Coordinate with other work having a direct bearing on work of this section.

1.6. SUBMITTALS

1. Section 01 33 00: Submission procedures.
2. Product Data: Provide manufacturer's data sheets for product components and accessories.
3. Shop Drawings:

1. Indicate plans, sensor locations, location and type of data acquisition electronics in various panel types.
2. Indicate location of access closures, wiring path from sensor panels to access closures.
4. Installation Data: Manufacturer's written installation requirements.
5. Test Protocol: Manufacturer's written description of testing method and protocol at initial installation of sensors and prior to closure of wall assembly.

1.7. CLOSEOUT SUBMITTALS

1. Section 01 78 00: Submission procedures.
2. Operation and Maintenance Data: Indicate maintenance requirements for installed products.
3. Maintenance Service: Submit proposal for separate fee agreement between the Owner and the detection and monitoring system. Include Monthly standard reports with overlays on record drawings. Reports shall include name, address, date and time created, dates of initial wetting and subsequent dates of drying including trend analysis in graph format. Online graphical overlay shall enable easy viewing of the location data on building plans.

1.8. QUALITY ASSURANCE

1. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this Section with minimum five (5) years documented experience.
2. Installer Qualifications: Company specializing in performing the work of this Section with minimum three (3) years documented experience and approved by the manufacturer.

1.9. DELIVERY, STORAGE AND HANDLING

1. Section 01 60 00: Transport, handle, store, and protect products.
2. Protect electronic equipment and sensing and detection devices against potential damage from dust and moisture during installation and transportation.

1.10. WARRANTY

1. Manufacturer's Warranty: Provide a two (2) year manufacturer's warranty to include coverage for failure to meet specified requirements.

2. Products

2.1. MANUFACTURERS

1. SMT Research Ltd.: 778-373-2070 or 778-373-2071. www.smtresearch.ca

2.2. COMPONENTS

1. Sensor and data acquisition systems, which are integrated with the pre-fab panel assemblies at the manufacturers site. Sensors options include, **[Moisture Detection Tape (MDS), Point Moisture Monitoring (PMM) content, Relative Humidity (RH), Temperature (T)]** to be located in predetermined mass timber panel locations.
2. Moisture Detection Sensors (MDS): non-corrosive 316 stainless steel open low-profile conductors; laminated tape construction with two conductors and self-adhering insulating substrate for detection of water between panels, under window systems, and in specialized areas of moisture intrusion concern.
3. Point Moisture Monitoring (PMM) sensors: a set of non-corrosive probes inserted through a sensor board in which a localized moisture content and temperature can be achieved from wood, gypsum and concrete products. Provide moisture profile of mass timber moisture monitoring at **[Surface, 25mm, 50mm, 100mm, custom, from outer surface of the panel]**
4. **[Choose if the moisture is measured at surface, or at depth with-in the mass timber at the following locations]**
5. Relative Humidity (RH) sensors: a sensor element for measuring the amount of water vapor in the air. The RH sensor shall be approved for use in condensing environments when installed behind wall or roof assemblies.

6. Displacement sensors for measurement of the movement from floor to floor compression shall utilize string potentiometers with a system of reference points mounted to the corresponding Mass Timber elements. Utilize a sensor measurement range of **[50mm, 250mm]** within a specification of resolutions of 0.1mm. Ensure complete system including NEMA rated enclosure with ½" conduit, draw wire extensions available up to 300 ft, and related mounted hooks.

[Choose a WIRED or a WIRELESS SYSTEM for collection of sensor data to access the cloud server for real-time data analytics]

7. **WIRED SYSTEM:**

1. Provide required WiDAQ electronics to measure the sensors installed per panel: Automated switching and data logging measurement unit that facilitates the monitoring sensor installed.
2. Access Closure: low voltage electrical enclosure with space for cable terminations on terminal blocks and monitoring electronics and for connecting sensor cable and to provide field test access. Access closure to be watertight in exterior locations.
3. Low voltage cabling: route cable from panel to panel location for collection of sensor cable harness to central communication options. Each cable run shall be less than 500 meters (500 yards) and collect 10 panels each.

8. **WIRELESS SYSTEM:**

1. Provide required A3 boards to measure the required sensors installed per panel: Automated switching and data logging measurement unit that facilitates the monitoring sensor installed
2. Access Closure: low voltage electrical enclosure with space for cable terminations on terminal blocks and monitoring electronics and for connecting sensor cable and to provide field test access. Access closure to be watertight in exterior locations.
3. Low voltage cabling: route cable from central monitoring location to the relative area of the A3 locations – with-in 100 ft of the electronics. Route the cable along standard low-voltage pathway with-in the building.

9. Tactical Intelligence Gateway (TiG) Automated monitoring system for permanent installation to the master access closure for real-time monitoring of the pre-fab panel sensor system., on-site gateway and connection to internet system. The TiG shall be installed in a wall access enclosure in a communications, electrical or mechanical area. Coordinate for others to provide 110v power and Internet connection at location of main access enclosure.

10. Building Analytics On-line Monitoring Centre: Interior Conditions, Water intrusion, moisture accumulation, condensation, conditions of each monitored area shall be sensed and reported. Reports shall include text descriptions and two dimensional graphs relating zone-specific moisture accumulations and dissipations over specified time ranges. Event Report including system identification, location of moisture event. Send reports to Contractor and Owner-designated targets.

11. Electrical Cable and Accessories: As recommended by system manufacturer.

2.3. COMPONENTS (ALTERNATE PRICE)

1. Permanently Installed SMT Building Intelligence Gateway BACnet connection to owners Building Management system (BMS) (Alternate): Automated monitoring system output to the overall Building Management System. Provide on-site gateway and connection to internet system. Others to provide 110v power and internet connection at location of main access enclosure. Others to provide programming of building BMS system.
2. BIM model overlay and roof moisture status interface with virtual and Augmented Reality interface. Design team or general contractor shall provide BIM model for use in application related to the display of data on 3D model with live and historic data from SMT Online monitoring center

3. Execution

3.1. EXAMINATION

1. Section 01 71 00: Verify existing conditions before starting work.
2. Verify that the mass timber panel is sufficiently dry and clean prior to installation of the two conductor stainless steel moisture detection sensor (MDS) tape.
3. Verify that each Moisture Detection tape is electrically isolated from conduit, or building materials by applying applications of additional layers of non-conductive waterproof material or other electrically insulating materials.
4. Coordinate with responsible entity to correct unsatisfactory conditions.
5. Commencement of work by surveyor is acceptance of installation conditions.

3.2. PREPARATION

1. Installation of sensor shall be completed to surfaces that are, dry, clean, free of construction materials and debris.

3.3. INSTALLATION - SENSORS

1. Install sensors and related wire harness to manufacturer's written instructions and approved shop drawings in each panel at place of pre-fab panel manufacturing.
2. Place sensor cabling, related device boxes routing clear of electrical and low voltage services. conductor
3. Provide specific detection tape zones around drains and penetrations

3.4. INSTALLATION – DATA ACQUISITION UNITS

1. Install Data Acquisition Units to manufacturer's written instructions.
2. Install and terminate electrical cables from grid on approved screw terminal blocks or IDC connection blocks in access closure. Record each sensor location and type to each electronic input.

3.5. INSTALLATION - CABLING

1. Install access closure to manufacturer's written instructions.
2. Install and terminate electrical cables from grid on approved screw terminal blocks or IDC connection blocks in access closure.

3.6. INSTALLATION PROCEDURE

1. Perform initial measurements to establish baseline conditions to equipment manufacturer's written requirements.
2. Install sensors [**with-in the mass timber panel facility OR on construction site**] as per manufacturers details and shop drawings. Verify wiring sequence, electrical continuity and the absence of shorts or grounds.
3. Upon installation of the mass timber panel in the Perform test of moisture monitoring system prior to installation of insulation and interior wall components.
4. Record location and photo of sensors and data acquisition on sketch or drawings for communication with contractor and/or inspector.
5. Perform recording of sensor data immediately after installation and set up for real-time data collection as electrical and data connections become available in the building.

3.7. FIELD QUALITY CONTROL

1. Section 01 45 00: Field inspection and testing.
2. Correct identified defects or irregularities.
3. Field Reports: Identify date, time, and weather conditions when monitoring system are conducted.
 1. Provide general description of installation equipment and process.
 2. Document survey with photographs and plan view scale drawings with location of detection system.

3. Provide system report with sensor data, project photos and graphical display of sensor locations.

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