

## SECTION 07 72 14

### ELECTRONIC ROOF MONITORING SYSTEM

#### PART 1 – GENERAL

##### 1.1 RELATED REQUIREMENTS

Uniform General Conditions, Supplementary General Conditions, Forms, Specification Sections found in Division 1 through 32 and all Drawings apply to Work specified in this Section.

##### 1.2 DESCRIPTION

- A. Work of this Section consists of supplying and installing a new live-load roof monitoring system produced by Beldon Technologies, Inc., d/b/a “Roof Monitor”, P.O. Box 100840, San Antonio, Texas 78201; (844)-4WARNING (844) 492-7646, [www.roofmonitor.com](http://www.roofmonitor.com), or approved equal.
- B. The system shall include all hardware, software, on-site servers, on-site notification devices, remote monitoring, and notification methods to the Owner via cell phone, e-mail or other approved methods.
- C. The live-load monitoring system shall have been developed and tested to operate in extreme weather conditions (-28<sup>F</sup> to 140<sup>F</sup>), and to specifically measure and continuously monitor live loads in low-slope roofs and provide timely notification to the building Owner and/or designated persons in the event of a deflection outside the established live-load limitations. The System shall provide:
  - 1. Objective metrics with actual load measurements.
  - 2. Single points of technology for real-time monitoring of live load condition.
  - 3. Alerts and alarms with protocols defined by the Owner and/or other designated end user.

##### 1.3 REFERENCES

- A. Related Sections:

*(Architect/Engineer or other Specifier: List hereafter any applicable Division 7 Sections related to the roof and its various components.)*

- B. Professional Engineering licensing laws of the State in which the project is located relative to Structural Engineers.

##### 1.4 SUBMITTALS

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- A. Provide submittals in accordance with Section 01 33 00 – Submittals (*as applicable*)
- B. Submit documentation attesting that the products proposed for installation meet the requirements of these Specifications.
  - 1. Product documentation shall include the modified bitumen roof pad for gravel surfaced roofs, primer, adhesive tape and any other roof level product required by the project.
  - 2. An accurate plan of the roof indicating all major penetrations such as HVAC equipment, exhaust fans, decks, cooling towers, raised platforms, utility lines in excess of 3” diameter, level changes, parapet walls, perimeters, and any other major penetration or feature.
  - 3. Written documentation that the Roof Monitor Authorized Service Provider is in good standing with the System Manufacturer.
- C. Provide documents certifying that all applicators having passed the 8-hour NRCA (National Roofing Contractors Association) training and testing for torching operations for modified bitumen roof systems.
- D. The Owner, in conjunction with the Roof Monitor Authorized Service Provider, shall acquire, execute and submit the following documentation to Roof Monitor at the address indicated above prior to any work beginning and prior to any materials being ordered or shipped, unless noted otherwise. Documents listed below are available at [www.roofmonitor.com](http://www.roofmonitor.com), and may not be altered or changed without written permission from Roof Monitor. These documents shall be shared equally between the Owner, System Authorized Service Provider and Roof Monitor and become part of the project permanent file.
  - 1. Owner Agreement for Roof Monitor System.
  - 2. Standard Terms and Conditions for Roof Monitor Owner Agreement.
  - 3. Landlord Consent to Installation and Maintenance. (*if applicable*)
  - 4. Roof Monitor Smart Roof Protection System Limited Warranty. (*a copy of the unsigned document will be shared as part of the submittal process then executed upon completion of the work*)
  - 5. Roof Monitor Monitoring Service Agreement (*a copy of the unsigned document will be shared as part of the submittal process then executed upon completion of the work*)
  - 6. Sensor Grid Placement Sheet (*jointly produced between Owner and Roof Monitor Authorized Service Provider*)

7. Structural Engineer's letter documenting live load.
8. Change Order Form *(if applicable)*
9. Certificate of Completion *(to be executed following installation)*
10. Customer Alert Protocol Form

## **1.5 QUALITY ASSURANCE**

- A. Roof Monitor and its technology support partners shall provide continuous monitoring (if contracted by owner) of the system during the contractual life and schedule, and perform updates to required technology and equipment as may be necessary to maintain the required performance of the system.
- B. The Authorized Service Provider shall be approved in advance of the work and be supported with resources as needed by Roof Monitor. The Authorized Service Provider shall be fully trained and equipped in the design and installation of all components of the system.
- C. Roof Monitor shall employ companies and/or individuals with demonstrated capabilities required to perform all aspects of the work including but not limited to manufacture of the hardware components, design and installation of firmware and software components relative to the system, installation of the physical components of the system, remote monitoring of the system, and all other aspects required for a properly operating system.
- D. Roof Monitor shall have tested, and shall periodically test the general system and its components, and provide updates to the software, and if required, to the hardware to ensure accurate operation of the system to meet the terms of operation and warranty.

## **1.6 JOB CONDITIONS**

- A. The Owner shall execute the required documents listed above and further explained below prior to the work commencing.
- B. The Owner shall designate locations for Controllers and other interior components.
- C. The Owner shall provide Roof Monitor approved electrical and internet resources for interface with the new system.
- D. The Owner shall provide the live load capabilities of the building in conjunction with a State-registered and licensed Professional Engineer whose expertise is Structural Engineering. If the Owner so designates, Roof Monitor will employ a registered and licensed Professional Engineer

who will structurally evaluate the building and provide the live load(s) required for the specific building. The retained Professional Engineer provided by Roof Monitor shall be currently registered in the State in which the building is located.

- E. Live loads may vary depending on the roof and conditions thereon.
- F. The Roof Monitor Authorized Service Provider is not a Professional Engineer, but may assist the Owner and (*Owner's or Roof Monitor's*) Professional Engineer in determining specifics related to roof systems, current penetrations, and other conditions which may contribute to the live load determination (such as ponding water conditions), but may not under any conditions speculate on or establish the live load designation.

## **PART 2 – PRODUCTS**

### **2.1 SENSORS**

- A. Sensors shall be designed for exposure to all natural elements and comply with the following:
  - 1. Sensors shall be injection-molded U-V stabilized polycarbonate in shape(s) designed by Roof Monitor. Sensor shall have locator pole with height indications and ability to hold external antenna to allow for less interference.

### **2.2 DOUBLE-SIDED ADHESIVE TAPE AND PRIMER**

- A. Sensors shall be adhered to new or existing TPO or modified bitumen prepared roof membranes with double-sided tape. Sensors shall be attached to PVC roof membranes with three (3) 1” wide crossing pieces of PVC membrane heat welded to the existing PVC roof membrane.
- B. Double-sided tape shall equal “EternaBond DoubleStick MicroSealant Putty Tape” produced by EternaBond, Inc., Mundelein, Illinois, USA; 888-336-2263, [www.eternabond.com](http://www.eternabond.com), or other adhesive tape approved in advance by Roof Monitor. Note that double-sided tape will not bond to PVC membranes where the plasticizers have been marginalized. The double-sided tape shall meet the following.
  - 1. Adhesion 19 lbs/in width
  - 2. Application Temperature 150 deg F. to -20 deg F.
  - 3. Sizes Pre-cut to conform to the shape of the sensor
  - 4. Dielectric Strengths Exceeds 12 kV

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|-----|----------------------------------|---|
| 5.  | Elongation                       | > 500%  |
| 6.  | Insulation Resistance<br>megohms | 10 to the 6 <sup>th</sup> power               |
| 7.  | Low Temperature Flexibility      | 1/2" radius at -30 deg F.                     |
| 8.  | Permanence                       | .001 perms maximum                            |
| 9.  | Pliability                       | No cracks in membrane                         |
| 10. | Shelf Life                       | Up to 5 years                                 |
| 11. | Standard Box Quantity            | Six (6) pieces per box                        |
| 12. | Temperature Flexibility Range    | -70 deg F. - > 200 deg F.                     |
| 13. | Total Thickness                  | 60 mils                                       |
| 14. | Water Vapor Test (ASTM E 96B)    | .005 gm / 100" sq. / 24<br>hrs per 100 deg F. |

C. Primer shall equal "EternaPrime" produced by EternaBond, Inc., Mundeleie, Illinois, USA; 888-336-2263, [www.eterabond.com](http://www.eterabond.com), or other primer approved in advance by Roof Monitor. The primer shall meet the following.

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|----|---------------------------|----------------------------|
| 1. | Application Temperature   | -20 deg F. to 205 deg F.   |
| 2. | Coverage                  | 1 can adheres 15 sensors   |
| 3. | Drying Time at 60 deg. F. | 15 minutes                 |
| 4. | Film Thickness            | +/- 4 mils when wet        |
| 5. | Flash Point               | 110 deg F. (43 deg C.)     |
| 6. | Standard Can Size         | 14-oz spray; 1 can per box |
| 7. | Viscosity                 | 135 – 152 cps              |
| 8. | Weight                    | 6 lbs per gallon           |

## 2.4 SOFTWARE, HARDWARE AND CONNECTIVITY

- A. Firmware and software shall be as provided by Roof Monitor.
- B. Controllers and cloud-based servers shall be selected and provided solely by Roof Monitor for operation of the Roof Monitor system.

- C. Roof Monitor, and/or its agents, will provide the interior Controller, exterior Communication Box, roof top sensors, and pole locators for the Roof Monitor system to operate as intended.

## **2.5 MISCELLANEOUS MATERIALS**

- A. Cabling shall be CAT-5 or 6 plenum-rated cabling for all above-ceiling and riser installations. Shielded cable shall be provided where required for Code or as otherwise directed by the Owner. Plenum-rated cabling may be used for riser cabling when passing between floors, but cabling manufactured specifically as riser cabling may not be used in the place of plenum-rated cabling. Plenum-rated cabling shall comply with NFPA 90A.
  - i. Cable needs to run from interior Controller to exterior remote control box; and,
  - ii. If cable exceeds 300', a booster will need to be added to extend the run requirements; and,
  - iii. Cat-5 or 6 cable must be tested prior to installation of Roof Monitor equipment
  - iv. Penetration through roof needs to be flashed per the manufacturer's recommendations and/or specifications so as to provide a water-tight and warrantable penetration.
- B. J-hooks for cabling shall be produced from galvanized steel, be minimum 1" in width and designed for horizontal and/or vertical attachment. Edges shall be slightly rolled to provide smooth edges for cable contact.
- C. Fire sealant shall be used to caulk around cable penetrations through walls and floors. Sealant shall be an intumescent latex-silicone compound in gun-grade with a red-brown coloring. Acceptable manufacturers are 3M and Dow-Corning, or approved equal.
- D. Fishing line shall equal "Ultracast Invisi-Braid" as manufactured by Spiderwire shall be used for removal of sensors from existing roof surfaces. Gloves must be worn when removing the sensors.
- E. Intermatic electrical receptacle for remote control box power supply.
  - i. Model #WP1250MXD
  - ii. [http://www.intermatic.com/en/products/weatherproof/inusecovers/extra\\_duty\\_die\\_cast\\_covers/wp1250mxd](http://www.intermatic.com/en/products/weatherproof/inusecovers/extra_duty_die_cast_covers/wp1250mxd)

## **PART 3 – EXECUTION**

### **3.1 INSPECTION AND PREPARATION**

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- A. Following execution of the contracts and required forms the Roof Monitor Authorized Service Provider / Roof Monitor Team shall meet with the Owner and the Owner's designated IT or other personnel to outline the specific requirements of each party for the installation and operation of the Roof Monitor system.
- B. During the meetings and subsequent inspection of the building(s) the Authorized Service Provider / Roof Monitor Team will confirm with the Owner locations for Controllers, cable routing (if any), electrical connections, internet interface, and roof plan development.
  - 1. The interior Controller shall be located as close to the roof top Communication Box as possible.
  - 2. Plenum-rated Cabling:
    - a. Cabling shall be minimum CAT-5 or 6 cable. Shielded cable shall be used where required.
    - b. Cables shall be set in cable trays where existing. Where cable trays do not exist or are inconvenient cabling shall be hung from existing structural elements by steel j-hooks suspended. Tying cables with plastic ties, wire, tape or rope is unacceptable.
    - c. Where cable penetrates walls above ceilings or penetrations between floors the cable shall be sealed per UL requirements for smoke and fire penetration using sleeves and/or fire-resistant caulking complying with local code requirements. Holes for penetrations shall be as small as possible and drilled neatly through the wall surfaces.
- C. The Authorized Service Provider / Roof Monitor Team shall survey the roof to determine any roof repairs or modifications necessary for the Roof Monitor system to function as intended. In some cases the Owner may be required to furnish recommended repairs to the roof. The Authorized Service Provider shall be provided with skilled support by Roof Monitor to address these issues as needed.
- D. If requested, the Authorized Service Provider / Roof Monitor Team will provide the Professional Engineer and Owner with data specific to the existing roof system such as roof assembly type and weights of components. The Authorized Service Provider / Roof Monitor Team will, to the best of its ability, advise the Owner of any ponding water or other issues of immediate concern for the existing or new roof and provide recommendations for alleviating the identified issues.

- E. Following the inspections and investigations a plan will be developed by the Roof Monitor Team for installation of the sensors on the roof and locations for various components of on-site hardware as required. The Owner shall review the plan with the Authorized Service Provider / Roof Monitor Team, and upon approval of the Owner, installation will be scheduled. The plan shall conform to the minimum "Recommended Sensor Placement on Roof" criteria developed and published by Roof Monitor based on the following criteria per geographic location of the building.
1. For Installations North of the Mason Dixon Line:
    - a. 2 Sensors at every Roof Drain. Locate within 24" of the drain in a location that will not block water flow.
    - b. 2 Sensors at every Scupper. Locate within 24" of the scupper in a location that will not block water flow.
    - c. 1 Sensor every 25 ft. around the perimeter of the roof
    - d. 1 Sensor every 25 ft. at any high wall. Locate within 24" of the wall.
    - e. 1 Sensor every 50 ft. on center each way throughout the interior of the roof in order to form a grid pattern.
  2. For Installations South of the Mason Dixon Line:
    - a. 2 Sensors at every Roof Drain. Locate within 24" of the drain in a location that will not block water flow.
    - b. 2 Sensors at every Scupper. Locate within 24" of the scupper in a location that will not block water flow.
    - c. 1 Sensor every 50 ft. on center each way throughout the interior of the roof in order to form a grid pattern.
- F. A schedule shall be developed with the Owner / Building Users for installation of the system components. The schedule will take the Owner / Building Users' on-going operations into account and avoid disruptions to the greatest extent possible.
- G. Installation of the Roof Monitor System shall not begin until all required construction, repairs, modifications, etc., on the roof is totally complete in order to avoid possible damage to the new sensors. The sensors are pressure sensitive so all foot traffic on the roof surface shall be restricted after installation begins.

## **3.2 INSTALLATION**

- A. Installation of hardware and software components shall be in strict adherence to the requirements of Beldon Technologies and Roof Monitor and be performed by qualified technicians.
- B. Best roofing practices shall be performed in the installation of the rooftop sensors. Sensors shall be located where determined by the advance plan and be fully adhered to the existing or new roof surfaces. Further, the sensor itself shall (black circle) shall not be pressed on at any time. Any testing of the gauge must be done with a calibrated device approved by Roof Monitor.
  - 1. Sensors shall be installed on the various roof surfaces using the double-stick tape specified above and primer as required.
  - 2. Preparation for gravel-surfaced asphalt and coal tar roofs:
    - a. Gravel and flood coat shall be spudded to bare felt in a 12" x 12" pattern and swept clean.
    - b. A 12" x 12" piece of granule-surfaced SBS modified bitumen membrane shall be torch applied over the exposed felt. Any exposed felt at the perimeter will be touched-up with asphalt flashing cement neatly applied by tube or trowel.
    - c. The modified bitumen surface shall be primed in the outline of the new double-stick tape.
    - d. Note, fully adhere a sacrificial layer of membrane, per manufacturer's recommendations and/or specifications, prior to installing sensor if required to maintain roofing warranty.
  - 3. Preparation for granule-surface modified bitumen membrane roofs:
    - a. The existing roof membrane shall be swept free of granules, dirt and debris in the location of each sensor.
    - b. The exposed membrane shall be primed to the outline of the double-stick tape.
    - c. Note, fully adhere a sacrificial layer of membrane, per manufacturer's recommendations and/or specifications, prior to installing sensor if required to maintain roofing warranty.
  - 4. Preparation for single-ply (TPO or EPDM) membrane roofs:
    - a. The existing roof membrane shall be swept free of all dirt and debris in the location of each sensor.

- b. The membrane shall be thoroughly cleaned with a water-based detergent then rinsed or wiped clean. More stringent detergents may be required, but prior to use these shall be confirmed as acceptable by the membrane manufacturer.
  - c. Primer may be required depending on the membrane and adhesion of the tape. The installer shall test a piece of tape to determine the need for primer before installing the final tape for the sensors.
  - d. Note, fully adhere a sacrificial layer of membrane, per manufacturer's recommendations and/or specifications, prior to installing sensor if required to maintain roofing warranty.
5. Preparation for single-ply (PVC) membrane roofs:
- a. The existing membrane shall be swept free of all dirt and debris in the location of each sensor.
  - b. The membrane shall be thoroughly cleaned with a water-based detergent then rinsed or wiped clean. More stringent detergents may be required, but prior to use these shall be confirmed as acceptable by the membrane manufacturer.
  - c. The manufacturer of the existing membrane shall be identified if possible. Membrane materials employed for attaching the sensors shall match the existing membrane or be those recommended by the membrane manufacturer.
  - d. Three (3) 1" wide straps of PVC membrane shall be laid in a cross pattern to attach the sensor to the existing membrane per Roof Monitor directions. The straps shall be heat welded to the existing membrane. Heat shall not be applied directly to the new sensor. Prior to installing the strips, the PVC manufacturer's approved water-block sealant shall be placed, in 1/2" beads, along the entire bottom plate.
  - e. Note, fully adhere a sacrificial layer of membrane, per manufacturer's recommendations and/or specifications, prior to installing sensor if required to maintain roofing warranty.
6. Tape and sensor installation (non-PVC roofs):
- a. One (1) ply of double-stick tape shall be applied by first removing the backer film from one side and pressing it into place making sure no bubbles or debris is trapped beneath. The tape shall be tightly rolled until fully adhered.

- b. The top film shall be removed from the tape and the sensor firmly pressed into the new tape adhesive.
- C. Owner to provide electrical and Cat 5 or 6 cabling by a licensed electrician.
- D. Hardware Installation: Beldon Technologies, Inc., Roof Monitor personnel, and/or the Authorized Service Representative shall install all Controllers and other required hardware in locations previously approved, including all required connections. Hardware will be mounted securely on walls or other surfaces utilizing industry-accepted methods and materials. A bubble level, included in the kit with the hardware, shall be used to ensure the interior Controller is set and secured in a level position. The exterior Communication Box shall be anchored to a parapet wall, penthouse, and/or approved din-rail.
- E. For the internal Controller, a back-up power supply shall be installed by the Owner, or through the Authorized Service Representative, to provide uninterrupted and continuous power to the Roof Monitor equipment in the event of a primary power failure. For the external Communication Box, it is the owner's prerogative on whether or not to install a back-up power supply. One is recommended.
- F. If the sensor requires removal fishing line as specified previously shall be used to cut the bond between the sensor and double-sided tape. The line shall be used to saw through the bond and removed the sensor without damage to the existing roof system. In the event the roof system is damaged repairs shall be required to restore the roof to a water tight condition.

### **3.3 OPERATIONS AND TESTING**

- A. Upon completion of the sensors, hardware and software components Roof Monitor technicians will activate the wireless features of the system and all required components.
- B. The system shall be fully tested and interconnected with the 24/7 365 day remote monitoring services of the system.

### **3.4 TRAINING**

- A. Roof Monitor technicians will meet with the Owner / Building Users and provide training in use of the system.
- B. Roof Monitor technicians will assist the system users who are specified to receive alerts in activating the program on mobile phones, tablet computers, laptop computers and/or desktop computers.

### **3.5 WARRANTY**

- A. Following installation of the system the Authorized Service Provider shall assist the Owner as required in submitting the completed Certificate of Completion. The Certificate of Completion confirms that the system has been completed and is operational as intended and notifies Roof Monitor to release the warranty and begin remote monitoring of the system.
- B. Roof Monitor shall deliver to the Owner the completed Roof Monitor Smart Roof Protection System Limited Warranty and continue remote monitoring for the duration of the agreed-upon contract period.
- C. The Roof Monitor System is not an alarm system and shall not be construed or interpreted as such. The expected performance of the system along with the Owner's and Roof Monitor's obligations is contained within the executed documents listed above under Article 1.4.D.

**END OF SECTION**