**OFF-GAS GAS DETECTION SYSTEM FOR LITHIUM-ION BATTERIES**

1. **GENERAL**
2. The off-gas monitoring system is a system comprised off a distributed sensing network that is designed to monitor lithium-ion batteries that have vented gas. The off-gas detection system should be installed in accordance with the manufacturer’s recommendations.
3. The system includes the following components:

* Sensor
* Controller
* Cable
* Adapter (optional)

1. **COMPONENTS**

**2.01 SENSORS**

**Monitoring Sensor, Reference Sensor**

1. Monitoring Sensors should be distributed in the application to monitor for lithium-ion battery cell venting.
2. Reference Sensors should be distributed in the application to monitor air contaminants.
3. Sensors will have power supply rated at 3 – 16 VDC.
4. Sensors can communicate status of error, warm-up, normal, and alarm.
5. Sensor can operate within relative humidity ranges 5 – 95% and temperature ranges of 14oF to 140oF (-10oC to 60oC). The maximum allowable temperature change is 8.6oC
6. The unit will be certified to UL/IEC 61010 for product safety, EN60326-1 for EU Directive (2014/30/EU), RoHS 3 EU 2015/863 and REACH compliant.
7. The sensor and controller must be manufactured in an ISO 9001:2015 production environment.
8. The sensor shall be capable of self-diagnosing error states.
9. The sensor should be checked with yearly maintenance checks to continue sensor performance. The validation of sensor operation shall be done in accordance with the manufacturer’s recommendations.

**2.02 CONTROLLER**

**Monitoring & Reference Controller**

1. The Controller distributes power to the sensors, aggregates and processes sensor signals, and provides communication of sensor status.
2. The Controller aggregates 12 Monitoring Sensors and 3 Reference Sensors
3. Multiple Controllers can be used when Controllers are properly daisy chained together by c
4. The Controller processes the sensor signal status and communicates if a lithium-ion battery cell venting has occurred.
5. The Controller will have a power supply rated at 8 – 28 VDC.
6. The Controller has a power consumption detailed in the table below:

|  |  |
| --- | --- |
| **Detail** | **Specification** |
| Controller (no sensors) | 2.4 W (at 24 Vdc) |
| 1.4 W (at 12 Vdc) |
| Sensor | 275 mW (at 5 Vdc) |
| Controller (fully populated, 15 sensors) | 6.6 W (at 24 Vdc) |
| 5.6 W (at 12 Vdc) |

1. The Controller will be protected by a 3.5 A replaceable fuse.
2. The Controller will communicate individual and aggregated sensor status’ through two digital output ports and/or MODBUS RTU RS232.
3. The Controller will communicate aggregated sensor error status’ through digital output and MODBUS RTU
4. The Controller will communicate individual sensor error status locally through LED indicators.

**2.01 CABLES**

**Sensor Cable, Power Cable, Communication Cable, Daisy Chain Cable**

1. Monitoring Sensor Cables are black 8P8C RJ45 shielded 24-28 AWG cable.
2. Reference Sensor Cables are blue 8P8C RJ45 shielded 24-28 AWG cable.
3. Daisy Chain Cables are grey 8P8C RJ45 shielded 24-28 AWG cable.
4. Power Cables are 3-pin Molex connectors that include earth ground and terminate in bare wire leads.
5. Digital Output Cables are 10-pin Molex connectors that terminate in bare wire leads.
6. Serial Cables are female-to-female RS232 cables.

**2.01 ADAPTERS**

**MODBUS adapter, Relay**

1. The MODBUS TCP/IP adapter has the ability to convert the Controller’s native MODBUS RTU communication protocol to MODBUS TCP/IP.
2. The Relay will turn the digital output signal into a dry contact signal.

**3.00** **EXECUTION**

* 1. **INSTALLATION**

1. The installation should be done in accordance with the manufacturer’s recommendations.
   1. MAINTENANCE
2. The maintenance procedure should be done in accordance with the manufacturer’s recommendations.

**END OF SECTION**