SECTION 28 35 00 – REFRIGERANT DETECTION AND ALARM SYSTEMS

PART 1 - GENERAL

1.1. SUMMARY:

A. This Standard is intended to provide guidance regarding the installation of refrigerant leak detection systems to comply with applicable National and State Ordinances as well as other applicable University Design Criteria.

B. Related Sections:

1. Section 01 17 01 – Building Systems Identification & Labeling
2. Section 23 00 10 – HVAC Design Criteria
3. Section 23 09 01 - Building Automation Systems Point Names, Descriptions, Graphics and Alarming

1.2. SUBMITTALS:

A. Submit the following documents for reference and/or approval:

1. Refrigerant leak detection Control Panel and sensors
2. Audible and Visual Signaling Devices
3. Interconnection Wiring Diagrams
4. Installation and operating instructions for all equipment
5. Equipment testing procedures.

1.3. REFRIGERANT LEAK DETECTION SYSTEM DESIGN CRITERIA:

A. Provide a refrigerant leak detection system where required by Code and these Standards. Areas include but are not limited to the following:

1. Mechanical rooms where refrigerants are used for refrigeration equipment and within piping between equipment components,
2. Occupied spaces that do not have mechanical ventilation, where refrigerant piping is installed in greater than exempt quantities per ASHRAE 15.

B. Refrigerant leak detection system shall generally:

1. Be capable of detecting the presence of the refrigerants(s) utilized within the chiller system(s), providing various stages of alarming, and capable of continuously displaying the specific gas (refrigerant used) concentration.
2. Be capable of continuously transmitting alarm and trouble conditions, and gas concentration levels to the Building Automation System (BAS).
3. Control the chiller room (or other protected areas) mechanical ventilation system.

C. Refrigerant gas leak detection to be provided with the following basic features:

1. Common system trouble alarm.
2. Each monitored alarm zone to include three levels of individual adjustable-setpoint alarm relays, each capable of being manually reset.
3. 0-10 volt, or 4-20mAmp programmable refrigerant gas concentration signal output, for connection to the BAS, for each monitored alarm zone.

D. Refrigerant monitors and alarm indicators shall be connected to building Standby Power system where available. In locations where chiller system is connected to
Standby power system, chiller room ventilation system shall also be connected to Standby Power.

E. Monitoring shall be employed to provide a minimum of two (2) points of area sampling and (1) point of relief vent monitoring for each chiller. Provide additional monitoring zones for any pit areas within the chiller mechanical room.

F. Where multiple refrigerant types are used, it is the system supplier’s responsibility to properly select the quantity and type of refrigerant detectors and monitoring systems required to safely monitor the equipment room.

G. Operation of the chiller room Emergency ventilation system shall be initiated from the refrigerant gas leak monitor panel and from manual switches located outside the mechanical room entrance door(s).

H. Refrigerant monitoring system(s) installed shall be completely installed and operational prior to bringing refrigerant onsite to fill new systems.

I. BAS Refrigerant alarm and alarm message nomenclature shall be coordinated per Section 23 09 01 - Building Automation Systems Point Names, Descriptions, Graphics and Alarming.

1.4. LEAK DETECTION ALARM LEVELS:

A. Guidance on refrigerant leak alarm actions and alarm levels for select refrigerants is noted below. If other refrigerants are proposed, contact the Project Manager for guidance.

<table>
<thead>
<tr>
<th>Alarm</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trouble</td>
<td>* BAS alarm</td>
</tr>
<tr>
<td>Level 1</td>
<td>Not Used</td>
</tr>
<tr>
<td>Level 2</td>
<td>*Activate emergency ventilation system;</td>
</tr>
<tr>
<td></td>
<td>*BAS alarm</td>
</tr>
<tr>
<td>Level 3</td>
<td>*Activate emergency ventilation system;</td>
</tr>
<tr>
<td></td>
<td>*Activate local Alert Horns / Lights;</td>
</tr>
<tr>
<td></td>
<td>*BAS alarm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Refrigerant</th>
<th>“Caution” Level 1</th>
<th>“Caution” Level 2</th>
<th>“Alarm” Level 3</th>
<th>Referenced Maximum Exposure Limits</th>
<th>“Trouble”</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-11</td>
<td>Not Used</td>
<td>50PPM</td>
<td>700PPM</td>
<td>OSHA PEL: 1000 ppm</td>
<td>Sensor/Controller Fault</td>
</tr>
<tr>
<td>R-22</td>
<td>Not Used</td>
<td>50PPM</td>
<td>700PPM</td>
<td>NIOSH TWA: 1000 ppm STEL: 1250 ppm</td>
<td>Sensor/Controller Fault</td>
</tr>
</tbody>
</table>
PART 2 - PRODUCTS

2.1. **REFRIGERANT LEAK DETECTION SYSTEM:**

   A. All equipment and components shall be new, and the manufacturer’s current model.

   B. Acceptable Manufacturers:

       1. Mine Safety Appliance (MSA)
       2. Bacharach

PART 3 – EXECUTION

3.1. **INSTALLATION - GENERAL:**

   A. Locate control panel outside the mechanical room where the chiller equipment is located, near the most frequently accessed door to the chiller room for emergency responders. If the location is not secured from public access, provide adequate tamper protection for the control panel yet allowing responders to view the display without opening.

   B. Install equipment and components in compliance with manufacturers’ recommendations. Consult manufacturer’s installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.

   C. The contractor shall clean all dirt and debris from the inside and the outside of the equipment and sample lines after completion of the installation.

3.2. **ALARMS AND SIGNAGE:**

   A. Provide audio and visual alarms both inside the mechanical space (or other protected space) and outside each entrance, positioned ~ 96 inches AFF. Visual alarms shall be colored yellow. Audio horn shall be distinct tone separate from Carbon Monoxide and fire alarm systems. Each device shall be labeled “REFRIGERANT LEAK ALARM” to indicate its purpose.

   B. Place warning signs inside the mechanical room and outside each door to the refrigeration equipment room; The warning sign shall read as follows:

       WARNING
       Authorized Personnel Only - Stay Out When Refrigerant Alarm Sounds;
       Call Facilities Management Immediately at 401-863-7800 and
       EHS Emergency Response Team at 863-4111
       If Police, Fire or Medical is Required, Call Public Safety at 401-863-4111

<table>
<thead>
<tr>
<th>Refrigerant</th>
<th>Concentration</th>
<th>AIHA TWA</th>
<th>Sensor/Controller Fault</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-123</td>
<td>Not Used</td>
<td>30PPM</td>
<td>50PPM</td>
</tr>
<tr>
<td>R-134a, R-407c, R-410A, R-507</td>
<td>Not Used</td>
<td>50PPM</td>
<td>700PPM</td>
</tr>
</tbody>
</table>
3.3. WIRING AND CIRCUIT IDENTIFICATION:
   A. System wiring shall conform to Division 26 requirements of the Brown Standards, and the requirements noted herein.
   B. System wiring, circuits, and conductors shall be color coded and identified by number and/or function, in coordination with the system wiring diagrams, at all termination points (i.e., control panels, sensors, etc.) and terminal cabinets.

3.4. REFRIGERANT MONITORING SYSTEM IDENTIFICATION/LABELING:
   A. All refrigerant monitoring and gas leak detection system labeling and component designations shall match Brown labeling requirements. See Section 01701CPPR – Building Systems Identification & Labeling, in addition to this section.
   B. Provide engraved nameplates for leak detection Monitor Panels. The plate shall contain the equipment identification and the control power circuit source panel name and breaker number.
   C. Provide machine-labeled directories for all equipment controls and indicators.
   D. Junction and splice boxes containing refrigerant leak detection system wiring, circuits, and conductors: provide with yellow covers and marked “refrigerant leak detection” in ¾” (three-quarter inch) white letters.
   E. All sample tubing shall be marked “refrigerant leak detection”.

3.5. STARTUP AND TRAINING:
   A. Prior to project completion, manufacturer’s factory trained representative shall program, start up, thoroughly test and calibrate, set alarm threshold levels, and verify that system is in compliance with operational sequence.
   B. Provide Training for University staff in the operation, use and maintenance of the system.
   C. Provide Safety Certification documentation including: Air Flow Profile Report for each sample point location, Calibration Report with before and after results of each analyzer, Alarm / Interface Report stating all threshold levels, alarm and interface action at each level of alarm with field verification report, BAS alarm Report for each alarm threshold, and Safety Training Checklist.

END OF SECTION