MACURCO
GAS DETECTION

CHILLER GUIDE

This publication is intended to serve as a guideline for the use of Macurco products. It is not to be considered all-inclusive, nor is it intended to replace the policy and procedures for any facility. If there are any doubts about the applicability of the equipment to your situation, consult an industrial hygienist or call Macurco Sales at 1-877-367-7891

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MACURCO
GAS DETECTION

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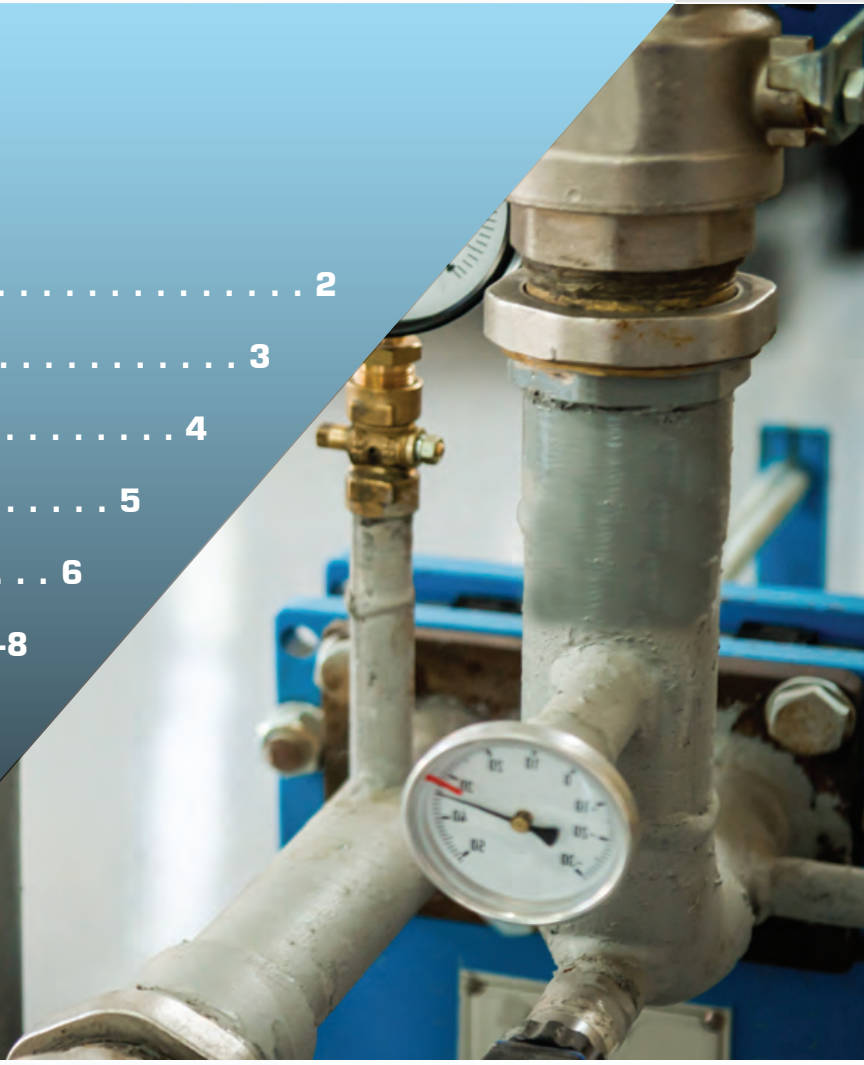


INDUSTRY OVERVIEW

Chiller systems are essential in commercial and industrial settings for temperature control, with refrigerant choice affecting efficiency and environmental impact. These systems use chemicals or gases to remove heat, cooling water or air through chillers, condensers, and air conditioners. Gas detection systems in chiller rooms are critical for safety, monitoring refrigerant leaks that could harm personnel and the environment. Early detection through sensors ensures quick responses, maintaining safe operations and reducing hazards.

Gas safety in chiller rooms centers around refrigerant leaks, which can pose health, fire, and environmental risks.

Key concerns include:
Refrigerant Leaks: Certain refrigerants, like HFCs, can harm health if inhaled.
Flammability: Some refrigerants are combustible, increasing the risk of fire or explosion.
Toxicity: Gases like ammonia are toxic and can cause respiratory issues.
Asphyxiation Risk: Refrigerants can displace oxygen, leading to oxygen-deficient environments.
Environmental Impact: Some refrigerants contribute to ozone depletion and global warming.

To address these risks, chiller rooms are equipped with gas detection systems that alert personnel to leaks, allowing for quick evacuation and response. Additional safety features like emergency shut-off switches, ventilation, and proper labeling help ensure safety. Regular maintenance is crucial to prevent accidents and protect both personnel and the environment.

REFRIGERANT GAS OVERVIEW

SAFETY

- Safety measures are essential when working with refrigerants because many can be harmful if not handled properly.
- Some refrigerants are toxic and can be deadly if inhaled, while others are flammable, posing fire or explosion risks. They are also often stored under high pressure, which can be dangerous if the system fails.
- Additionally, some refrigerants can displace oxygen, leading to asphyxiation in confined spaces.
- Proper ventilation, leak detection, and safety features help reduce these risks and ensure a safe environment around refrigeration systems.

REGULATIONS

- There are several important regulations and codes that govern the use, handling, and management of refrigerant gases, mainly to ensure environmental safety, worker safety, and proper equipment operation.
- The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) develops several standards that relate to refrigerants, including ASHRAE 34, which establishes the safety classification for refrigerants based on flammability and toxicity.
- ASHRAE 15 provides the safety standard for refrigeration systems, addressing installation, maintenance, and emergency response measures.

COSTS

- Gas detection systems for refrigerants help save money by detecting leaks early, preventing costly repairs and refrigerant loss.
- They improve energy efficiency by stopping leaks that force systems to work harder, reducing energy bills.
- These systems also ensure compliance with regulations, avoiding fines, and help extend equipment life by preventing major damage.
- By reducing downtime and enabling predictive maintenance, businesses can avoid expensive repairs and keep operations running smoothly.

REGULATIONS/CODES

ASHRAE 15 – Provides safety guidelines for the design, installation, operation, and maintenance of refrigeration systems, aiming to minimize risks related to refrigerants, particularly in commercial, industrial, and food processing environments. Key aspects include refrigerant selection, leak prevention, ventilation, leak detection, alarms, emergency procedures, signage, and regular maintenance and training.

ASHRAE 34 – classifies refrigerants based on chemical properties, safety, and environmental impact. It assigns a unique code for each refrigerant, including a safety classification for toxicity and flammability. This standard helps ensure the safe use of refrigerants, industry compliance, and protection of human health and the environment.

IMC 2024 – Section 11 outlines safety requirements for refrigeration systems, requiring refrigerants (except ammonia) to comply with IMC Section 11, ASHRAE 15, and the IFC. Ammonia systems must follow IIAR standards. Refrigerant detectors in machinery rooms must trigger alarms and activate ventilation. Emergency shutoff switches must control refrigerant equipment and ventilation, and systems must have clear emergency signs and labels.

IFC 2024 – Chapter 6 mandates audible and visible alarms for refrigerant detectors in machinery rooms. Ammonia detection follows IIAR 2 standards, while other refrigerants require detectors where leaks may occur. Alarms trigger when refrigerant levels exceed TLV-TWA values or 25% of the lower flammable limit (LFL), and equipment automatically shuts off with an emergency switch for compressors, pumps, and valves.

READ MORE ON REGULATIONS

HAZARDS

REFRIGERANT GAS CHART

Gas Type	Chemical Symbol	Safety Classifaction	RCL Values	Vapor Density (Air = 1)	LEL%	UEL%	Risks
R22	$CHClF_2$	A1	13 lbs.	3	NA	NA	Asphyxiants
R-32	CH_2F_2	A2L	4.8 lbs.	3.82	14.4	31	Asphyxiants/Flammable
R-125	C_2HF_5	A1	23 lbs.	4.2	NA	NA	Asphyxiants
R-134a	CH_2FCF_3	A1	13 lbs.	3.5	NA	NA	Asphyxiants
R-143a	$C_2H_3F_3$	A2L	4.4 lbs.	2.9	7.1	16.1	Asphyxiants/Flammable
R-227ea	C_3HF_7	A1	36 lbs.	5.9	NA	NA	Asphyxiants
R-290	C_3H_8	A3	0.59 lbs.	1.56	2.1	9.5	Flammable
R-404A	(R-125/R-143a/R-134a) 44/52/4%	A1	31 lbs.	3.34	NA	NA	Asphyxiants
R-407A	(R-32/R125/R134a) 20/40/40%	A1	19 lbs.	2.54	NA	NA	Asphyxiants
R-407C	(R-32/R-125/R-134a) 23/25/52%	A1	18 lbs.	3	NA	NA	Asphyxiants
R-407F	(R-32/R125/R124a) 30/30/40%	A1	20 lbs.	2.54	NA	NA	Asphyxiants
R-410A	(R-32/R-125) 50/50%	A1	26 lbs.	3	NA	NA	Asphyxiants
R-417A	(R-125/R-134a/R-600) 46.6/50/3.4%	A1	3.5 lbs.	3.8	NA	NA	Asphyxiants
R-422D	(R-125/R-134a/R-600) 65.1/31.5/3.4%	A1	16 lbs.	3	NA	NA	Asphyxiants
R-448A	(R-32/R-125/R-134a/R1234yf/R-1234ze) 26/26/21/20/7%	A1	22 lbs.	2.98	NA	NA	Asphyxiants
R-449A	(R32/R125/R1234yf/R134a) 24.3/24.7/25.3/25.7%	A1	23 lbs.	3.07	NA	NA	Asphyxiants
R-450A	(R-134a/R1234ze) 42/58%	A1	20 lbs.	NA	NA	NA	Asphyxiants
R-452B	(HFC-32/C3H2F4) 30-50/50-70%	A2L	4.8 lbs.	NA	11.9	23.3	Asphyxiants/Flammable
R-454A	(HFC-32/R-1234yf) 35/65%	A2L	4.4 lbs.	2.83	6.3	15	Asphyxiants/Flammable
R-454B	(HFC-32/R-1234yf) 68.9/31.1%	A2L	4.6 lbs.	2.2	7.7	22	Asphyxiants/Flammable
R-454C	(HFC-32/R-1234yf) 21.5/78.5%	A2L	4.6 lbs.	3.1	6.2	15	Asphyxiants/Flammable
R-455A	(CO2/R32/R-1234yf) 3/21.5/75.5%	A2L	6.8 lbs.	NA	11.8	12.9	Asphyxiants/Flammable
R-507	(R-125/R-143a) 50/50%	A1	32 lbs.	NA	NA	NA	Asphyxiants
R-513A	(R-134a/R-1234yf) 30-50/50-70%	A1	20 lbs.	NA	NA	NA	Asphyxiants
R-600	C_4H_{10}	A3	0.15 lbs.	2.0	1.8	8.4	Flammable
R-717	NH_3	B2L	0.014 lbs.	0.6	15	28	Toxic/Flammable
R-744	CO_2	A1	4.5 lbs.	1.52	NA	NA	Asphyxiants/Toxic
R-1233zd	$C_3H_2ClF_3$	A1	5.3 lbs.	NA	NA	NA	Asphyxiants
R-1234yf	$C_3H_2F_4$	A2L	4.5 lbs.	4	6.2	12.3	Asphyxiants/Flammable
R-1234ze	$C_3F_4H_2$	A2L	4.7 lbs.	4	6.5	15	Asphyxiants/Flammable

Color - Colorless **Smell -** Faint Ethereal Odor **Sensor Type -** NDIR **% in Atmosphere -** NA **Mounting Height -** ~12" Above Floor

RCL & LEL (LFL) values are based on ASHRAE 34 Standard

Purpose of Detection:

Safety: Refrigerant leaks can lead to the formation of harmful and potentially lethal concentrations in enclosed spaces. Detection systems help to identify and mitigate these risks.

Environmental Compliance: Many refrigerants contribute to ozone depletion or global warming. Detecting and repairing leaks is essential to comply with environmental regulations.

AIRESHIELD FEATURES

COLORED NOTIFICATION LED

IP65 RATING

USER SELECTABLE SETTINGS

SOUNDER / BUZZER

NDIR SMART SENSOR

BTL CONNECTIVITY TO MACURCO CONNECT APP

EQUIPMENT SELECTION & LOCATION

DETECTION SYSTEM

Since each application and installation may differ, you will want to determine the refrigerant type and appropriate measurement units, such as PPM and %LEL.

MACURCO AIRESHIELD (24V) REFRIGERANT DETECTOR

- **Easy installation to the wall or 4x4 electrical box**
- **NEMA4X/IP65 enclosure**
- **Field replaceable smart sensor**
- **Single or Dual Sensor Option**
- **Remote Sensor Option**
- **Optional buzzer**
- **Event Logging**
- **User-selectable settings via a four-button interface or Bluetooth App**
- **Analog/digital output options**
- **5 A SPDT and 0.5A relays to control fans,**
- **valves, louvers, horns and strobes**
- **Colored notification LED – (alarm, warning, trouble, calibration)**

AIRESHIELD PLACEMENT

- **Coverage Area up to 1,257 sq. ft (centrally mounted, the radius is 15-20ft)**
- **Recommended mounting height (target gas-dependent, see chart):**
- **Centrally mounted where air movement is generally good**
- **Do not mount in a corner**
- **Do not mount where ambient temperature is below -4°F or exceeds 122°F (-20°C to 50°C)**

REFRIGERANT APPLICATION PAGE

AIRESHIELD PRODUCT PAGE

EQUIPMENT SELECTION & LOCATION

MACURCO CONTROL PANELS

- Can connect from 12-192 sensors based on the model
- 3 to 8+ relays based on model
- Local audible/visual notification
- Optional external audible/visual notification

MACURCO NOTIFICATION SERIES

The Macurco Notification is recommended for areas needing distinctive visual or audible signal inside and outside the chiller room to provide additional advance notification in the event of an alarm condition.

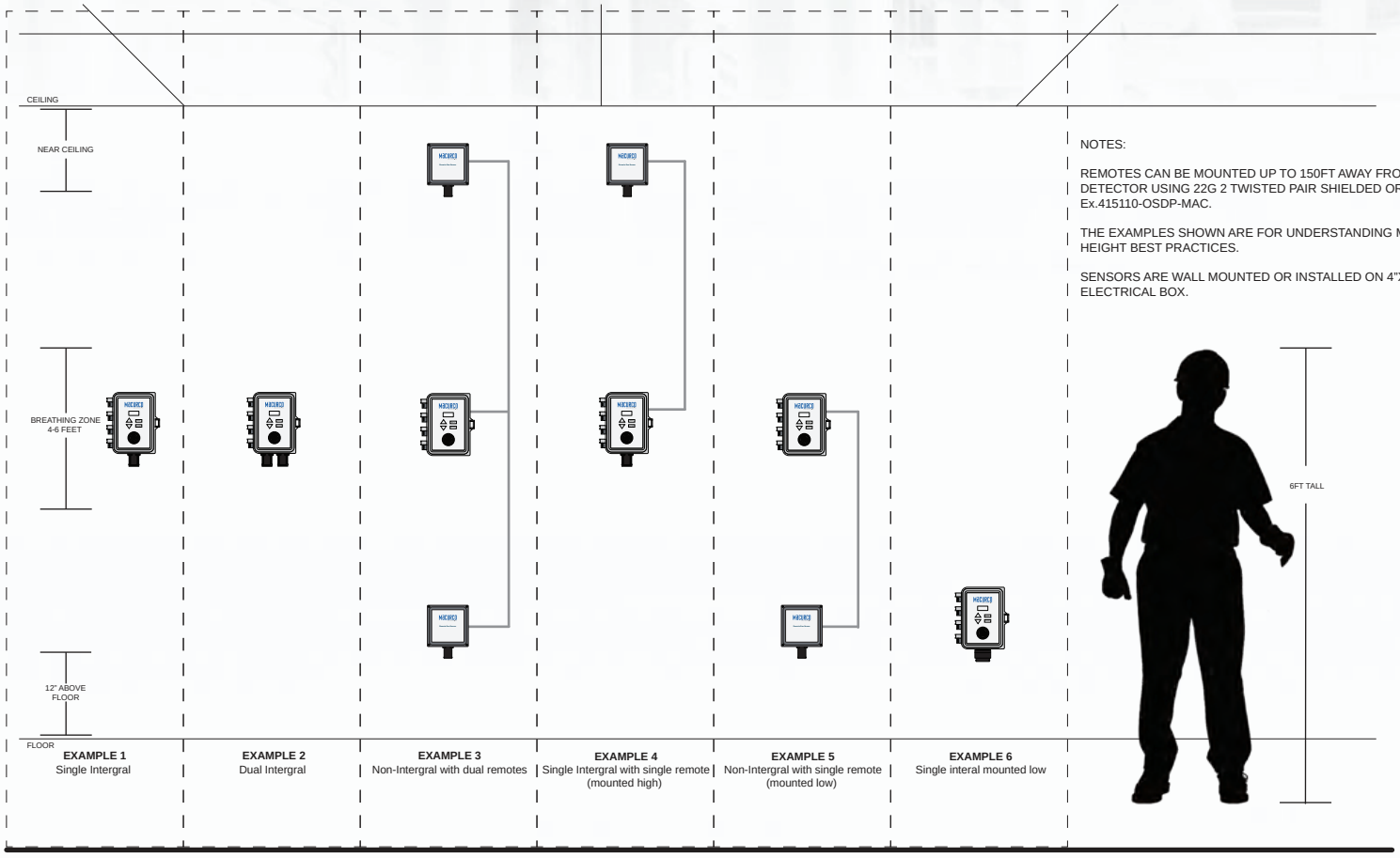
EMERGENCY POWER OFF

The Macurco E-Stop button is a remote button used to disengage power in the event of an emergency. This shutdown can be used to shut down gas valves or chiller systems.

VENTILATION SWITCH

The Macurco On / Auto Switch is a remote manual switch used to manually engage ventilation in the event of an emergency, during maintenance, or to add additional ventilation in a non-emergency situation. This switch is to be wired in parallel to the gas detection system.

AIRESHIELD MOUNTING OPTIONS



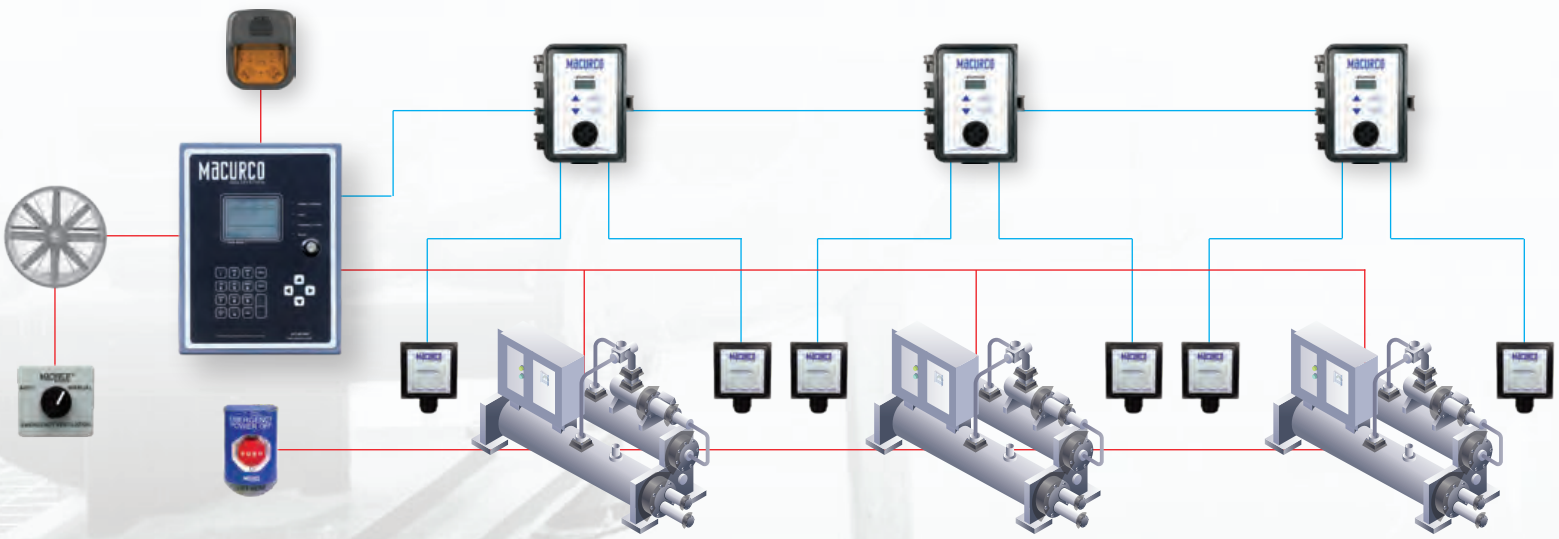
NOTES:

REMOTES CAN BE MOUNTED UP TO 150FT AWAY FROM THE DETECTOR USING 22G 2 TWISTED PAIR SHIELDED OR SIMILAR. Ex.415110-OSDP-MAC.

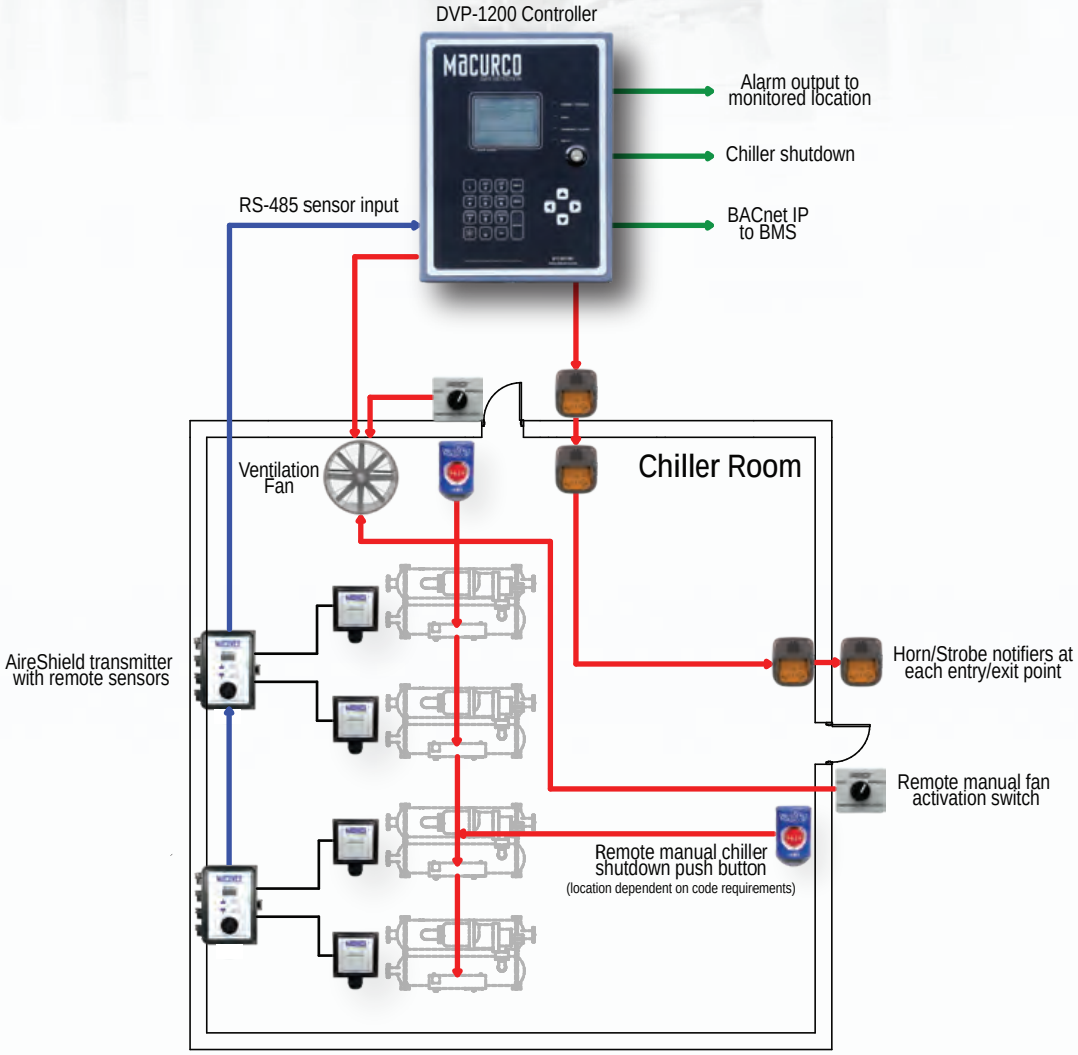
THE EXAMPLES SHOWN ARE FOR UNDERSTANDING MOUNTING HEIGHT BEST PRACTICES.

SENSORS ARE WALL MOUNTED OR INSTALLED ON 4"X4" ELECTRICAL BOX.

MACURCO CHILLER SOLUTION



CHILLER ROOM LAYOUT



MAINTENANCE

DEMONSTRATION AND TRAINING

Inspect the components, equipment installation, and electrical connections for compliance with requirements. Test the alarm setpoints of the gas detection system with calibration, and test gases, and verify the sequence of operation. Performdemonstrations and train maintenance personnel to adjust, operate, troubleshoot, calibrate, and maintain the gas detection and control systems. **Calibration and test kits should be provided with the gas detection system.** Calibration and test intervals must comply with the manufacturer's recommendations. If required, prepare a written report to record test procedures, results, and corrective actions. The information should also cover the requirements for accessories like the acceptability of alarm types, signs, and protective equipment. **Macurco should perform any repair or replacement of malfunctioning units.**

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GAS DETECTION

Celebrating over 50 years of gas detection, the Macurco product line offers equipment for residential, commercial, and industrial applications. Since 1972 Macurco has been providing detection options for a number of different gases including carbon monoxide (CO), nitrogen dioxide (NO_2), hydrogen (H_2), propane (LP), methane (natural gas), hydrogen sulfide (H_2S), ammonia (NH_3), oxygen (O_2), carbon dioxide (CO_2), and refrigerants.

Headquartered in Sioux Falls, South Dakota, Macurco strives to provide the highest quality detection, safety and security solutions to customers worldwide. Whether you are looking for gas detection for a security system, building automation, or HVAC system, for personal safety or for monitoring specific gases in potentially hazardous environments, Macurco has a gas detector to meet your needs.

GAS DETECTION IS ALL WE DO, AND WE DO IT BEST.

Visit **www.macurco.com** for additional product information and training.

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Manufactured by Macurco Inc. Sioux Falls, SD
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