EN-123

Air Quality Requirements for Pneumatic HVAC Control Systems Engineering Information

Overview

The quality of the control air used in a pneumatic HVAC control system is critical to the reliability and functional life of that system. *The air must be clean, dry, and oil free.*

The presence of moisture and contaminants—water, dirt and/or oil—will rapidly reduce the functional accuracy and dramatically shorten the life of the system.

Moisture, in concentrations greater than 0.1 PPM, present in the control air will:

- Corrode non-treated metal parts resulting in contamination that blocks passageways and reduces the physical strength of the pneumatic components.
- Block small passageways and restrictors.
- Transport dirt, causing blocked passageways.
- Freeze and block flow when mounted on outside walls in cold climates.

Oil, in concentrations greater than 0.1 PPM, should never be tolerated in a pneumatic control air system.

Caution: Synthetic or paraffin base compressor oils should NEVER be used. These oils will pass through standard oil filters, not be detected by "oil indicating" filters, and will physically destroy the materials typically used in pneumatic control devices.

Oil will block the small passageways and restrictors in pneumatic control devices.

Solid contamination, greater than 0.03 microns, will also block passageways and restrictors.

Pneumatic Control Air System Design

The following are the keys to a pneumatic control air supply system that will provide years of reliable and accurate HVAC control system performance.

Dedicated Air Supply

The supply air system should be separate and dedicated to the pneumatic HVAC control system. The requirements are more stringent than those for other air supply systems. The air from a central building or shop air system should NEVER be used for pneumatic controls. The compressors and any oil filters used with these central systems are designed for pressure and not for providing dry, clean, oil-less air.

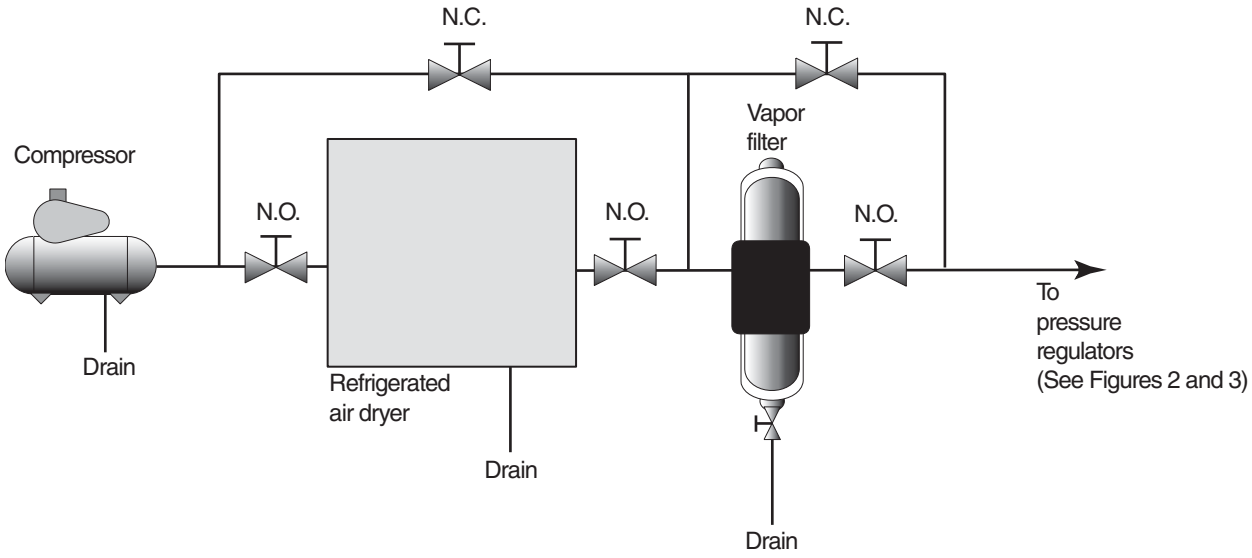

Figure-1 Recommended Air Supply System.

Air Supply System

The primary air supply (compressor, filters, and dryer) must be designed to provide the maximum degree of cleaning of the supply air. A recommended primary air supply system is shown in Figure 1. The system consists of a compressor set, pressure tank, coalescing type vapor filter, refrigerated dryer, safety release, and pressure regulators. The system also incorporates a manual bypass valve system so that the dryer and filters can be serviced without interrupting the system.

Compressor Set

The compressor set should be sized to operate 1/3 of the time during normal operation. (Refer to *EN-81, Air Equipment Sizing, F-16700*, for air compressor sizing details.) This 33% duty cycle will prolong the life of the compressor set. The use of two compressors will allow for continuous system operation should one them be off line.

Pressure Tank

The pressure tank should be sized in accordance with the system supply requirements and the compressor set capacities. The tank must have a drain trap for the removal of water and oil from the tank. Because higher pressure increases dehumidification, a tank pressure of 80 to 100 psig is recommended.

Refrigerated Dryer

A refrigerated dryer is typically required to remove moisture and oil remaining in the air. The dryer cools the air to 30 to 40° F causing the remaining vapors to condense out of the air. The dryer must have an automatic drain to expel the condensate from the air system. In some situations, a desiccant dryer is required to remove moisture.

Vapor Filter

A coalescing type vapor filter is required to remove any oil or water vapor trapped in the air. This vapor filter should be provided with an automatic drain to assure that moisture, removed by the filter, is discharged from the air system. The filter must be installed on the high pressure side of the system, i.e., between the pressure tank and the pressure regulators.

Pressure Regulator(s)

A pressure regulator is required to maintain an operating pressure of 15 to 25 psig for the system. The regulator is placed down stream of the coalescing filter. An optional second pressure regulator can be placed prior to the main pressure regulator for safety. The first in line is normally set at 30 psig and the second is set at 15 to 25 psig. A safety relief valve should be placed downstream of the pressure regulator(s) set at 30 psig to ensure that pressure does not exceed a safe operating pressure. Figure 2 shows the configuration of a single pressure system and Figure 3 shows a dual pressure system.

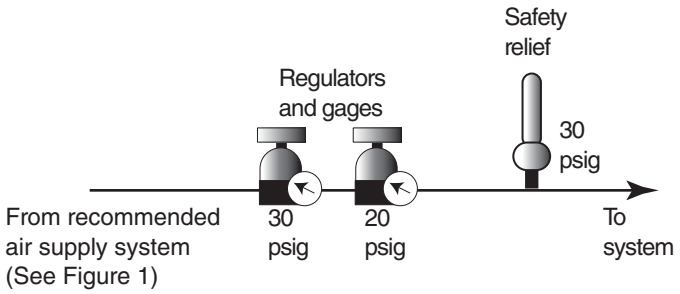

Figure-2 Single Pressure System.

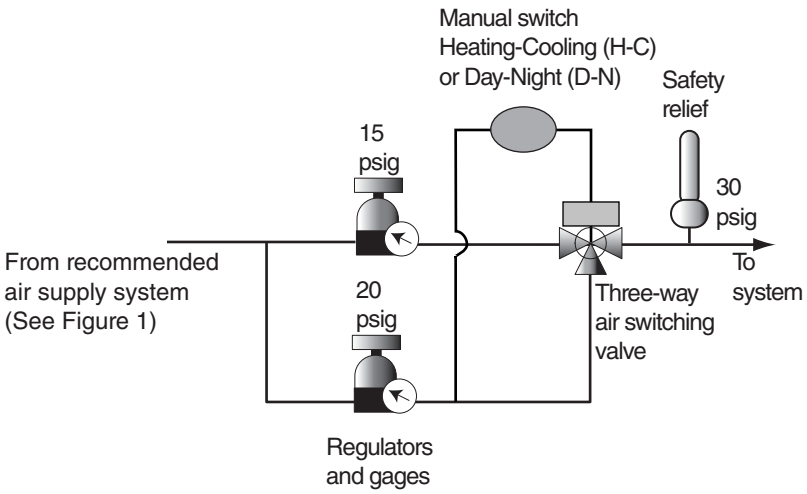

Figure-3 Dual Pressure System.

Oil Indicating Filter

It is strongly recommended that an oil indicating in-line filter be installed at the main air inlet to all critical and sensitive pneumatic devices. The greater the accuracy requirements of a commercial grade pneumatic control device, the greater is its susceptibility to moisture, oil, and dirt, i.e., it has smaller passageways and restrictors. The filter should be installed in the main air supply just before the main input port to the device.

Routine Preventative Maintenance

Routine preventative maintenance is a must in order to keep a pneumatic control system accurate and reliable.

Compressor Set

The oil levels of the compressor set must be checked on a schedule according to the compressor manufacturer's recommendations.

Excessive oil usage usually indicates that the cylinder rings are worn and should be replaced. Excessive oil usage also means that the downstream filters and dryers have more than likely been overloaded and that oil could have contaminated the complete pneumatic air distribution system. The filters and dryer should be checked for functionality. The end pneumatic devices should also be checked for signs of oil, water, and dirt. See "Cleaning A Contaminated Supply Air System" in this document for information on cleaning the system.

Pressure Tank

The drain on the pressure tank, even if it is an automatic type, should be checked according to the manufacturer's recommended schedule and repaired or replaced as necessary.

Refrigerated Dryer

The refrigerated dryer must also be checked according to the manufacturer's recommendations. The drain on the dryer must be checked. If defective, the dryer and/or drain should be repaired or replaced. If the dryer is defective, the complete system must be checked for contamination.

Vapor Filter

The vapor filter must also be checked according to the manufacturer's recommendations. If the filter is inoperative, the filter must be repaired or replaced and the complete system must be checked for contamination.

Oil Indicating In-line Filters

The oil indicating in-line filters should be checked on a routine basis and, anytime oil is indicated, the device should be replaced and the entire primary air system should be checked for the presence of oil or other contamination.

Cleaning A Contaminated Supply Air System

Whenever a system is contaminated with oil, moisture, and/or dirt, the source of the contamination should be corrected and the entire distribution system replaced or cleaned.

Oil Contamination

If the contamination is oil, the best solution may be replacement of the system. In some cases, the system can be cleaned. However, use caution when selecting a method of cleaning an oil contaminated system. Ensure that the method complies with all environmental regulations.

Moisture or Dirt contamination

If the contamination is moisture or dirt, replacement of the system, though the best solution, is not always practical. Therefore, cleaning of the system *may* remove the contamination. In this case, the devices should be disconnected from the main air supply and then the main lines blown out with clean, dry air or dry nitrogen. However, this does not always remove all contaminants from the main air supply. Even with this attempt at cleaning, the devices may be contaminated and will need to be replaced. Every device in the pneumatic HVAC control system should be checked to ensure reliable accuracy.

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