



AEROSPACE RECOMMENDED PRACTICE

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REQUISITES FOR DESIGN SPECIFICATIONS FOR ADSORPTIVE SYSTEMS

1. PURPOSE

This Aerospace Recommended Practice is intended to serve as a guide for specifying the operating parameters for an adsorptive gas Dehydrator-Purifier. The specialized nature of a Dehydrator-Purifier dictates that complete and accurate information concerning its intended use must be known to assure selection of the proper type of unit for the application. Variations in the operating parameters can significantly alter the choice of the type of Dehydrator. This practice also includes the minimum information that a prospective vendor should supply, to properly describe the type of equipment that is recommended.

2. GENERAL

Dehydrators are intended to remove water vapor from compressed gas streams. Generally, if other impurities are removed from the gas, the equipment is designated a Purifier.

2.1 Figure 1 indicates the layout of a typical, simple compressed air installation. Although many systems tend to be more complex than this, certain necessary information should be supplied to manufacturers of the dehydration equipment so that the most suitable equipment will be selected. These factors will determine the configuration of the equipment and it is extremely important to state them accurately.

3. DESIGN OPERATING CONDITIONS

3.1 Constituent to be removed: In the case of an air Dryer, water vapor is to be removed. For a Purifier, state the constituent to be removed.

3.2 Gas: Type of gas; if a mixture state the composition in volume, weight, mole or pressure percent of the constituents. This is required information, especially if a particular gas is corrosive in nature, will co-adsorb on the desiccant with the constituent being removed, or possibly destroy the desiccant.

3.3 Inlet Flow Rate: This may be stated in convenient terms of volumetric or weight flow such as: standard cubic feet per minute SCFM (the standard condition should be carefully referenced); pounds per hour. If a variation in flow rate is anticipated, state the minimum, maximum, and normal rates. Other conditions being equal, the size of the dehydrator will generally be directly proportional to the flow rate.

3.4 Inlet Pressure: This should be stated in pounds per square inch absolute (PSIA), or pounds per square inch gage (PSIG). State minimum, maximum, and normal pressures if a variation is expected. The gas pressure is vital in determining the type and size of the equipment.

3.5 Inlet Gas Temperature: This value should be stated in degrees Fahrenheit (°F), or degrees Centigrade (°C). Minimum, maximum, and normal temperatures should be presented if a range is anticipated. The water holding ability of a gas is a function of the temperature. For a 20 F increase in temperature the water holding ability of the gas approximately doubles. It is also important to note that the adsorptive capacity of a desiccant decreases with increasing temperature. The selection of the type of desiccant may be strongly dependent on the inlet gas temperature.

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- 3.6 Inlet Moisture Content: The dewpoint in degrees Fahrenheit ($^{\circ}\text{F}$), or degrees Centigrade ($^{\circ}\text{C}$) at a specified pressure is preferred. For compressed air Dehydrators, the inlet air is usually saturated if operating pressures are above 60 PSIG, because increasing pressure reduces the water holding capacity of the air. Other units may also be stated such as; parts per million (PPM) by weight or volume; relative humidity at a specified pressure and temperature.
- 3.7 Ancillary Impurities: Any convenient quantitative units may be stated. If quantitative data is not available, the existence of the impurities and any other information concerning them should be indicated. An example is compressor lubricant which will contaminate the desiccant and reduce its useful life. If a synthetic lubricant is present in the system, that fact should be pointed out.
- 3.8 Outlet Impurity Level: In the case of a Dehydrator the outlet moisture content may be presented using any convenient units as defined in section 3.6. The fact that a dewpoint must be referred to a specific pressure cannot be overemphasized. When a dewpoint is stated without a reference pressure, it may be assumed to be referred to atmospheric pressure. The designer of the system may require the specified dewpoint at operating pressure and an atmospheric dewpoint will be misleading. State the pressure at which the dewpoint will be required. For a Purifier, the maximum impurity level may be stated in identical terms to those which indicated the inlet quantity of the impurity. If the required outlet content is not known, state what is known about the application to permit the manufacturer to present his recommendations.
- 3.9 Outlet Flow Rate: Any convenient terms used in section 3.3 may be used. Some Dehydrator-Purifiers use a portion of the inlet gas, which is vented to atmosphere, for regeneration purposes. This consumption may vary from 3% to 20% of the inlet flow. Where it is impractical or uneconomical to vent this quantity of gas to the atmosphere, there are several closed-loop systems available which do not require this venting. Closed-loop systems are generally utilized when the gas stream is toxic, explosive, expensive, or the compressor is closely sized to the outlet gas flow requirements.
- 3.10 Outlet Pressure: The pressure units should be the same as used in section 3.4. In lieu of an outlet pressure, a maximum allowable pressure drop may be specified.
- 3.11 Outlet Gas Temperature: This should be specified in the same units as Section 3.5. Depending on the type of equipment selected, there may be an increase in gas temperature as the gas passes through the equipment because adsorption is essentially an exothermic process. It is important to note that the temperature of the outlet gas normally is lowered as the gas passes through the outlet piping from the Dehydrator to the end use equipment.

4. ENVIRONMENTAL AND CLIMATIC CONDITIONS

It is important to present information on environmental and climatic conditions, since such information may greatly affect the equipment selection.

- 4.1 Temperature, humidity, elevation and other environmental conditions in which the equipment will be required to operate such as:
- Indoor or outdoor location.
 - Coastal location where the equipment might be subjected to a salty atmosphere.
 - Desert location in which blowing sand and dust might be encountered.
 - Corrosive industrial vapors.
 - Explosive materials in the atmosphere such as hydrocarbon vapors or dust.
- 4.2 Shock and Vibration: Shock and vibration may destroy the desiccant because of its crystalline structure. Even if the desiccant is not destroyed completely, it may generate fines which could contaminate equipment downstream of the drying equipment.