Technical Bulletin

Instrument Air Systems

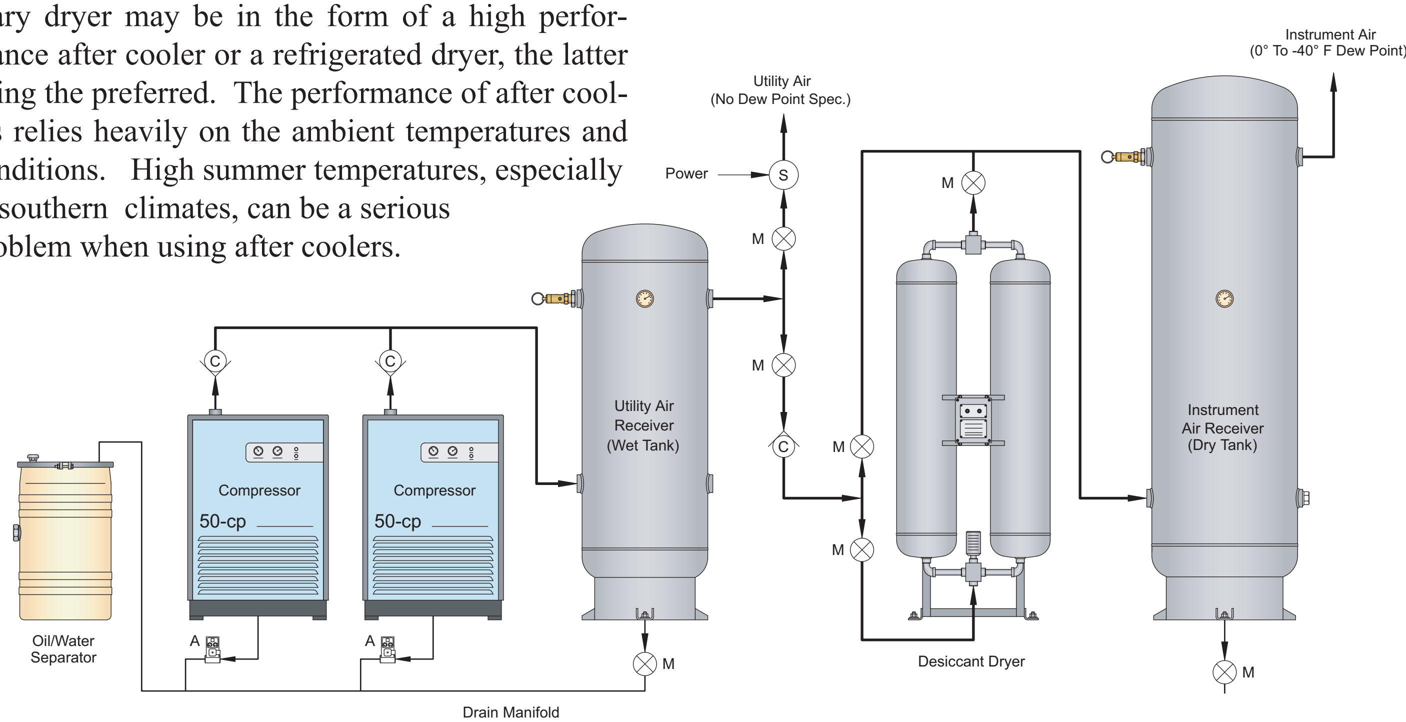
Refineries, chemical plants, semiconductor manufacturing facilities, food processing installations, etc. typically specify instrumentation quality air for their pneumatic control systems. Instrument air is generally specified at -40°F dew point. Many of these systems also incorporate a utility air output, which generally does not carry a dew point specification. The utility outputs produce notoriously poor air quality and, in many cases, even the instrument air is of poor quality due to a lack of maintenance or inadequate design of the compression package.

The illustration below shows a typical instrument air system. These systems normally consist of a compressor(s), a wet tank (*which also serves as the utility air receiver, after cooler, and water separator*), a regenerative "twin tower" desiccant dryer and a dry tank.

Systems laid out in this manner have several significant drawbacks. Because the wet receiver has very little effect on the discharge temperature of the compressor, it can only separate gross water and oil contamination, forcing the desiccant dryer to act as a primary dryer and to carry nearly the entire water and oil load from the compressor discharge. This places the desiccant charge in a situation that it is not actually designed to handle, consequently the effective life of the media is significantly reduced. Most users set up an aggressive regeneration cycle in a vain attempt to compensate for this overload condition, but this is only a Band-Aid applied to a far more significant problem.

Oil contamination is particularly detrimental to the charge. Oil-contaminated desiccant cannot be regenerated and eventually will become completely saturated, rendering the dryer ineffective and forcing the user to replace the charge. Additionally, and especially in southern climates, the temperature that the dryer receives is oftentimes too high. This has the effect of prematurely saturating the desiccant and the net result is that the output air has a water content that is significantly higher than the required specification.

To correct these and other drawbacks, the desiccant dryer should be placed as a secondary dryer only. The primary dryer may be in the form of a high performance after cooler or a refrigerated dryer, the latter being the preferred. The performance of after coolers relies heavily on the ambient temperatures and conditions. High summer temperatures, especially in southern climates, can be a serious problem when using after coolers.



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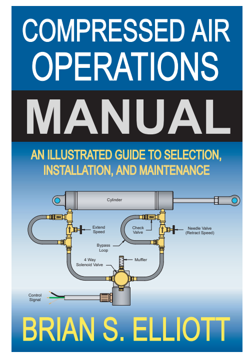
Realistically, an after cooler may produce an approach temperature of 30° to 40°F, which means that the discharge temperature is 30° to 40°F above ambient. If the ambient temperature is 95°F, then the discharge temperature of the after cooler can be as high as 135°F! This is entirely too high to effectively take full advantage of a desiccant dryer.

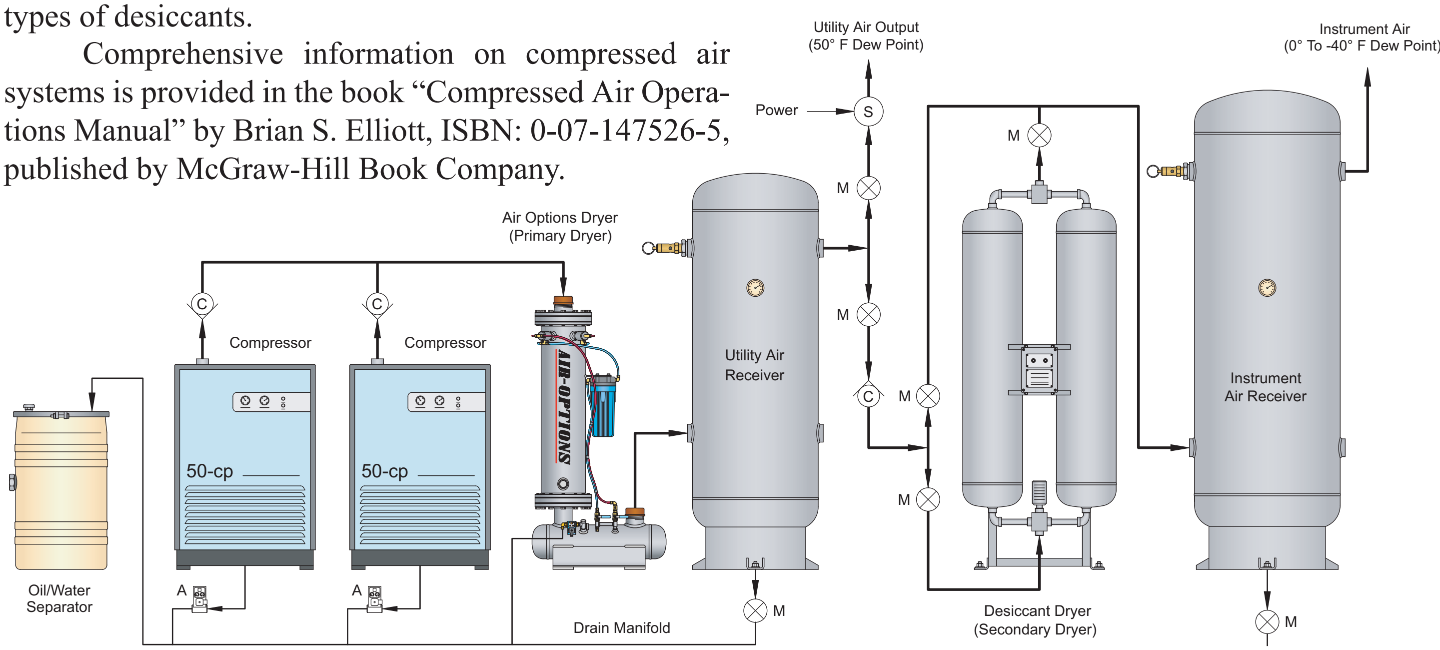
The preferred solution is to include a refrigerated dryer as a first stage. CFC-based dryers, to a lesser extent, are also dependent on ambient temperatures, but the input temperature is more important. Most CFC-based dryers require an input temperature of no greater than 100°F. There are, however, "high temperature" CFC-based dryers that will accept an input temperature of 150°F. These units are considerably more expensive than their "low temperature" counterparts. CFC-based dryers also have one other drawback, they are rather complex and delicate mechanisms with a short life expectancy, usually in the 5 to 8 year range. Additionally, they do not fare well in the type of environments where compression systems are typically installed.

The best solution is to utilize an Air Options Dry Doc Series refrigerated dryer as a first stage. Ambient temperatures have no effect on the operation of these dryers and they can accept input temperatures as high as 250°F. These dryers have the added advantage of operating between the compressor output and the utility receiver, which translates to high quality utility air as well as removing the burden on the desiccant dryer.



It should be noted that the instrument air receiver is a rather important component in systems that feed large distribution networks. Statistically, there will be times when a large percentage of the applications will operate at the same time. This will place a very high surge load on the system. The instrument air receiver is intended to deliver dry air during these peak load situations. Without the instrument air receiver, the entire surge load must be delivered through the desiccant dryer. This will force one of two situations: The dryer will deliver air at a rate that exceeds its capabilities, therefore passing wetter air, or the dryer will restrict the flow and the distribution system pressure will drop momentarily. Additionally, repeated surging of the desiccant can physically shock the charge and may lead to damage in some types of desiccants.

Comprehensive information on compressed air systems is provided in the book "Compressed Air Operations Manual" by Brian S. Elliott, ISBN: 0-07-147526-5, published by McGraw-Hill Book Company.



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