DS DRYER OPERATION

Compressed air circuit

Saturated compressed air enters the dryer's air-to-air heat exchanger, where it is pre-cooled by the (cold) compressed air exiting the dryer. From here it passes to the evaporator, where it is further cooled by the cold evaporating refrigerant.

The cold air and condensed liquids flow to the demister separator, where the liquids are separated out of the air-stream by the demister's mesh filter. The liquids are then drained away by a mechanical zero loss condensate drain .

The now dry but still cold compressed air exits the dryer via the air-to-air heat-exchanger; as it cools the incoming air so it is itself warmed up, with the benefit of both ensuring the compressed air temperature is brought to a level which is well above the dew point, as well as avoiding sweating in the compressed air piping just after the dryer.

Refrigeration circuit

The refrigeration circuit functions as a closed loop.

Beginning at the discharge of the refrigerant compressor, the hot high-pressure gas flows through towards the air-cooled condenser. Here the refrigerant is cooled by ambient air flowing across the condenser coil, causing the gas to condense into a liquid state.

On exiting the condenser the liquid refrigerant passes through the filter/dryer, where any moisture and impurities within the refrigerant (which may have entered the circuit during servicing) are removed.

Next the refrigerant passes through the automatic expansion valve. The automatic expansion valve expands the high-pressure refrigerant before entering the evaporator.

The cold liquid refrigerant then enters the evaporator, where it exchanges with the hot compressed air. As the refrigerant flows through the evaporator it changes from a cold liquid to a warm (and superheated) gas, thus adsorbing heat from the compressed air and cooling the compressed air to the required dew point.

The warm refrigerant gas then exits the evaporator and returns back to the refrigerant compressor, where it repeats the whole above cycle again.

The above process operates as a closed circuit, which would work perfectly if the load on the refrigeration circuit were to be constant. However, this is not the case. The load on the refrigeration circuit varies according to variations in 1) airflow, 2) ambient temperature, 3) compressed air inlet temperature and 4) required dew point.

As a result a pilot system is required which perfectly balances the whole refrigeration circuit irrespective of changes in any or all of these four variables, thereby ensuring that there is no risk of freezing within the evaporator.

In order to achieve this balancing function, the automatic expansion valve features a modulating control, thereby acting as the controller for the whole refrigeration circuit. The automatic expansion valve operates according to the refrigerant pressure within the evaporator, and reacts by reducing the refrigerant percentage (which can vary from 0 to 100% depending upon the conditions) flowing across the evaporator. In this way the automatic expansion valve can ensure that the pressure of the refrigerant entering the evaporator is always constant, thereby ensuring a stable refrigeration circuit regardless of changes in the above 4 variables.