TB08:
Leak Checking in Changing Ambient Conditions

1 PROCEDURE FOR TESTING WITH OFN

Before any work takes place, it is essential that a risk assessment is carried out. The refrigerant type for the system should be known and from that a maximum allowable pressure in the system and a leak test pressure can be determined.

The manual handling and use of compressed gases must be considered in the risk assessment, and the usual PPE (personal protective equipment) with this type of work shall be used: safety gloves, safety goggles, safety footwear, plus any site considerations required under local conditions.

NOTE: *Nitrogen gas is an asphyxiant – it will suffocate in high concentrations. Pressure testing with OFN shall only be carried out in well-ventilated areas, and consideration shall be given to evacuating any area where there is a potential for high volumes of OFN to enter an occupied space which is not well ventilated.*

Refrigerant manifold sets with sight glasses have been known to fail and cause injury under high pressure. The use of these manifolds shall only be used downline of an approved regulator set and the procedure for pressure testing shall ensure that the pressure is slowly increased into the system with no sudden rise in pressure in any part of the system.

- Ensure the nitrogen cylinder is secured or located in a position that it cannot fall.
- Ensure the regulator valve is fully wound out (anti-clockwise) before fitting to the cylinder.
- Connect gauges to the system to be tested and fit the common manifold hose to the OFN regulator.
- Use the high side valve and gauge of the manifold for testing to avoid damaging the low side gauge (if using compound gauges).
- Open the OFN cylinder valve and start slowly winding the regulator in (clockwise) using steps of no more than 45psi (3 bar) at a time.
- At each step listen for audible leakage and check for pressure drop on the gauge.
- When the pressure test level has been reached, the OFN cylinder valve shall be closed and a note taken of the time, temperature and pressure in the system.
- The regulator valve should be fully wound out again (anti-clockwise) and the common hose removed from the cylinder.
- A new system should be leak tested overnight, at least, and on checking the next day the pressure and temperature shall again be noted.

There should be no difference between the pressure test levels recorded at the start and end of the test.

NOTE: The pressure in the system may however have changed due to temperature change rather than a leak (see section 2).

2 LEAK CHECKING IN LOW OR CHANGING AMBIENT CONDITIONS

Gay-Lussac's Gas Law

This gas law states that if you change the temperature of a gas in a container with a fixed volume (such as an RACHP system, for example), the pressure inside the fixed volume will change in direct proportion to the temperature change.

$(P_1/T_1) = (P_2/T_2)$ where: **P** is the gas's pressure in bar absolute (bar gauge pressure +1)

T is the gas's temperature in Kelvin (°C + 273)

P_1 **and T1** are the pressure and temperature at the start of the test,

and P_2 **and** T_2 are the pressure and temperature at the end of the test.

This law then tells us that when we are testing with OFN, if the temperature of the test gas changes over the time during the test period, then so will the pressure. We can predict what the pressure should be by using the following equation:

$$P_2 = (P_1 \times T_2) / T_1$$

For example:

You are pressure testing an R410A system at a design test pressure of 33 bar gauge (34 abs) and the temperature at the outset is 20°C, but when you return the following day to check on the test the temperature has dropped to 10°C then the expected pressure would be 31.8 bar gauge (32.8 bar abs): **[(34 X 283)/293] = 32.8**

This drop in pressure of 1.2 bar gauge (approx. 17.4 psi) may have occurred due to the drop in temperature NOT a leak. If time permits then an extended test period is wise.

Any drop in test pressure exceeding this calculated allowable deviation must be treated as a suspected leak and dealt with accordingly.

Similarly, for the same scenario in the example above, if the ambient temperature rose from 10 to 20°C then the calculation would be: **[(34 X 293)/283] = 35.2 bar abs (34.2 bar gauge) =** 1.2 bar(g) (approx. 17.4 psi) higher than it was at the start of the test period.

Therefore the test pressure not rising when the ambient has increased significantly may indicate a small leak and should be investigated further.