Refcom is a BESA Group Company

TB017 v2

PRESSURE TESTING IN CHANGING AMBIENT CONDITIONS

1 OBJECTIVE

The objective of this technical bulletin is to inform members of the safe method of pressure leak testing of RACHP pipework using oxygen free nitrogen (OFN) at high pressure, with particular emphasis on the change in pressure caused by changes to ambient temperatures during the leak test period.

It is a requirement of the F gas Regulation (EC517/2014 Art.3) that installers of RACHP systems, and the associated pipework and components, "shall take precautionary measures to prevent leakage" of the refrigerants to be contained within the systems.

It is also a requirement that regular leak checks that have identified leakage "shall be repaired without undue delay" and the point of leak be tested again "within one month".

In practice this means:

- For new systems, this means being tested again immediately to ensure the system is leak free prior to the system being put into service or any refrigerant introduced to the pipework.
- For existing equipment being tested as part of a planned routine leak check required under the regulation, it means the system is leak checked again after the repair has been carried out, no later than one calendar month after the repair, but ideally as soon as possible after the repair has been carried out, to ensure the repair was successful.

2 RISK ASSESSMENT AND SAFETY CONSIDERATIONS

Before any work takes place it is essential that a risk assessment is carried out. The manual handling and use of compressed gases shall be considered in the risk assessment, as well as adherence to the usual use of PPE (personal protection equipment) with this type of work: safety gloves, shoes and goggles, plus any site considerations necessary under local conditions. The refrigerant type should be known and from that a maximum allowable pressure in the system and a leak test pressure determined.

Refrigerant manifolds with sight glasses have been known to fail and cause injury after being badly handled and the glass casing damaged. The use of standard manifold sets 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.

Nitrogen gas is an asphyxiant – it will suffocate in high concentrations. Pressure testing with OFN shall only be carried out in well ventilated areas.

NB: At all times the manufacturer's recommendations and instructions for pressure testing procedures must be observed.

3 PROCEDURE FOR TESTING

- 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.

NB: The pressure in the system may have changed due to temperature change rather than a leak (see section 4).

4 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 T_1 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, then so will the pressure. We can predict what the pressure should be by using the following equation:

$$P_2 = (P_1 X T_2) / T_1$$

For example: if 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 15°C then the expected pressure would be 32.4 bar gauge (33.4 bar abs):
[(34 X 288)/293] = 33.4

The drop in pressure of 0.6 bar gauge (approx. 8 psi) has occurred due to the drop in temperature NOT a leak.