

Pressurising installed systems with nitrogen to find leaks

This Good Practice guide is intended to cover the identification of leaks using Nitrogen for refrigeration systems which are already in operation and are known to have undergone a strength pressure test. This leak tightness testing procedure will sometimes be necessary to comply with the standard leakage checking requirements of the F-Gas regulations.

The majority of leaks can be found by either visual examination or use of either an electronic leak detector or a proprietary bubble solution. Where the leak cannot be identified or the gas charge has been lost, then it will be necessary to find the leak by pressurising the system with Nitrogen.

To carry out this procedure safely it is important to use the correct equipment, carry out a risk assessment and then follow the test procedure.

The test pressure

The maximum test pressure to be used should be the maximum allowable pressure, which should be stated on the equipment label. On smaller systems the suction and discharge pressures will be the same, however on larger equipment the maximum allowable suction pressure will be lower and the system will need to be tested in several sections.

If the system information is not available a general guide to pressures which could be encountered are:

Refrigerant	Suction pressure	Discharge pressure
R134a	7.1bar	13.7bar
R407C	13.2bar	23.6bar
R404A	14.1bar	24.8bar
R410A	18.8bar	33bar

These have been established assuming a maximum condensing temperature of 55°C and a maximum ambient temperature of 32°C (as

specified in EN378 – Refrigerating systems and heat pumps – Safety and environmental requirements).

Using the correct equipment

The nitrogen must be oxygen free (OFN) or High Purity. Oxygen must **never** be used as it can explode when mixed with oil, causing serious damage to equipment and injury or death to those in the vicinity.

It is essential to use a suitable regulator with the nitrogen cylinder. The regulator has an output limiting device to prevent over pressurising of systems. The rating of this must be higher than the test pressure to be used but not excessively so.

Maximum likely pressures:

Refrigerant	Maximum Pressure	Suitable regulator
R134a	13.7bar	maximum output of 26bar
R407C	23.6bar	maximum output of 33bar
R404A	24.8bar	maximum output of 33bar
R410A	33bar	maximum output of 40bar

There are now specific Nitrogen Pressure test kits on the market which use braided steel hoses. These are safer to use than a standard manifold and should be considered.

Warning - use of Manifolds with sight glasses

This guide assumes the use of Refrigerant Manifold and Gauges. It is essential that the manifold **does not** have a sight glass. These sight glasses have been known to fail and risk causing serious injury to the engineer carrying out the test. The manifold, gauges and service lines must be in good condition. Manifolds with sight glasses are only suitable for refrigerant recovery.

It is essential that appropriate personal protection equipment (PPE) is used when carrying out this test and this should include: safety goggles, gloves and a hard hat as well as normal work wear, including safety footwear.

The Risk Assessment

Before any work can take place it is mandatory to carry out a risk assessment. For guidance on carrying out risk assessments and sample generic versions for Nitrogen Pressure Leak Testing see the British Refrigeration Association Guidance.

This assessment can then be put into practice taking into account the particular site conditions. It is essential that this takes into account the safety of personnel carrying out the test as well as other personnel on site not involved in the operation.

Handling of nitrogen cylinders

When the cylinder is not being used ensure the valve is closed. Never transport or store the cylinder with the regulator fitted.

Dangers of Use of Nitrogen

You will be pressure testing at high pressures with nitrogen. The pressures are high enough to cause serious injury or death. Nitrogen is an asphyxiant – it will suffocate you in high concentrations. The following guidelines show how to minimise risk during pressure testing.

Pressure testing procedure

If there is any residual refrigerant left in the system this must be recovered prior to following this procedure.

1. Ensure the nitrogen cylinder is either secured or located in a position so that it cannot fall over.
2. Ensure the regulator valve is wound fully out (counter clockwise / anti clockwise).
3. Fit the regulator to the cylinder.
4. Fit gauges to the system and ensure there are no isolated sections within the part of the system to be pressure tested.
5. Fit the common manifold hose to the nitrogen cylinder.
6. Open the system valves and open the high side manifold valve (to avoid damaging the low side

manifold gauge do not pressurise the low side of the manifold with the test pressure).

7. Open the nitrogen cylinder valve.
8. Slowly wind the nitrogen regulator in (clockwise) to pressurise the system:
 - Pressurise the system in stages of no more than 3 bar (45 psi) at a time;
 - Ensure you only pressurise the relevant sections of the system to their maximum allowable pressure.
 - Listen for audible pressure loss at every pressure increment increase;
 - Watch the gauge for pressure loss.
 - If a leak is identified, the nitrogen should be vented, the leak repaired and the leak test procedure repeated.
9. When the maximum system allowable pressure has been reached, close the nitrogen cylinder valve and the high pressure manifold valve.
10. Note the pressure shown on the high pressure gauge.
11. Wind the nitrogen regulator valve fully out (counter clockwise / anti clockwise).
12. Carefully remove the common hose from the regulator, slowly venting the nitrogen pressure.
13. Maintain the system at the maximum allowable pressure for the duration of the test.
14. Test each joint with leak detection spray or soapy water to identify the leak point. If leaks are found, they **must not** be repaired with the system pressurised.
15. Slowly vent the remaining nitrogen.
16. Repair any leaks found and then repeat the test procedure using OFN.
17. When it is established that the system is safe and leak tight the OFN can be evacuated and the system can be recharged with refrigerant.

For more information

- HSE GN4 Safety In Pressure Testing ISBN 0717616290
- BS EN 378 (2007) - Refrigerating systems and heat pumps – Safety and environmental
- Regulation pursuant to Regulation (EC) No 842/2006 of the European Parliament and of the Council, on standard leakage checking requirements for stationary refrigeration, air conditioning and heat pump equipment containing certain fluorinated greenhouse gases
- British Refrigeration Association's Risk and Task Assessments.
- Material Safety Data Sheets for nitrogen.

The information contained in this Guide should be seen as a guide to interpretation of relevant industry standards, legislation and statutory information which should be consulted by the relevant competent person responsible for servicing refrigeration equipment. The Service Engineers' Section and the Institute of Refrigeration accept no liability for any errors or omissions.

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