



## Institute of Refrigeration

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## Valve Failure Safety Alert

### Valve failure results in ammonia refrigerant burn injury

In a recent incident while working on a chill store plant in a food distribution depot, a refrigeration engineer received severe burn injuries when a significant amount of refrigerant was suddenly released while he was in the process of removing a valve cap from a DN 15 (1/2") charging valve. The valve was installed on the low pressure side of an ammonia system. The HSE retained the valve for examination and testing.

The injuries sustained resulted in hospitalisation and also a lengthy period off work. The engineer was wearing appropriate personal protective equipment (PPE) at the time and this undoubtedly prevented more serious injuries.

The engineer was using a check spanner to hold the body of the valve whilst undoing the cap with another spanner but even so the valve connection to the plant failed. The depot operator decided to replace other valves of the same type at the site and also at other depots they own. During planned replacement of valves on an identical plant on site the charging valve in the same position as the original plant also "fell apart". The HSE, Depot Operator and the Refrigeration Contractor agreed to carry out metallurgical examinations on both of the "failed" valves and also torque tests on these and on other valves removed from their other systems.

The valve construction included steel pipe stubs brazed into the valve body, screwed connections with nuts on the other end of the pipe stubs allow the valves to be connected to the systems or have blanking caps fitted. The valve that failed was connected to the system using a nut on the stub 90o to the valve stem; this stub came apart from the valve body. The second stub in line with the valve spindle had a blanking nut fitted as it was the refrigerant charging connection.



Valves with these types of brazed in connections are available in a range of sizes and are widely used on refrigeration systems. The photograph below shows a typical valve; in this application the blank is on the stub at 90o to the valve stem and plant connection is in line with the valve spindle.

### The conclusions drawn from the investigations are as follows:

- The failure was due to corrosion under the solder thus weakening the joint on to the valve parent metal.
- The corrosion had started externally.

- The valves were fitted on a section of plant cycling from sub zero to above zero temperatures.
- Forces used prior to the incident to fit the valves, remove caps or to fit charging lines etc may have damaged the valve.
- The paint finish on the valves had deteriorated.
- Ammonia was not considered to be a factor in the failure and it is believed that a serious incident would have occurred regardless of the type of refrigerant in the system.

### **Recommendations:**

- Before commencing work on any Refrigerating system wear PPE as required by your employers' Risk and COSHH assessments for the refrigerant within the system PLUS in the case of Ammonia have a respirator available and to hand.
- When working on any type of valve with screwed connections always use a check spanner to hold the body of the valve whilst undoing connections, caps, plugs, etc, with another spanner.
- Identify all refrigeration plants containing these types of valves installed in parts of the system susceptible to corrosion e.g. regular cycling from sub zero to above zero temperatures or frequent operation in a wet condition. Then DO NOT ATTEMPT to use the valves until an appropriate risk assessment is carried out for either the replacement or the continued operation of the valves.
- When working on refrigeration plants fitted with these types of valves installed and operating in dry conditions such as in HP discharge or liquid pipe lines etc, DO NOT ATTEMPT to work on the valves without firstly isolating upstream and downstream of the valve in order to limit potential gas loss.
- Ammonia was not considered to be a factor in the failure, so the engineer should be aware of the risk of refrigerant burn injury regardless of refrigerant type.
- Clean and apply refrigeration oil to threads before replacing screwed connections.
- Regularly (quarterly) examine valves for leakage and corrosion and repair, paint or replace as required.
- Consider if insulation is required to prevent ice from building up around the valve and exerting forces on the pipe stubs.

### **References and sources of further information**

- Information on COSHH can be found at [www.hse.gov.uk/coshh](http://www.hse.gov.uk/coshh)

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