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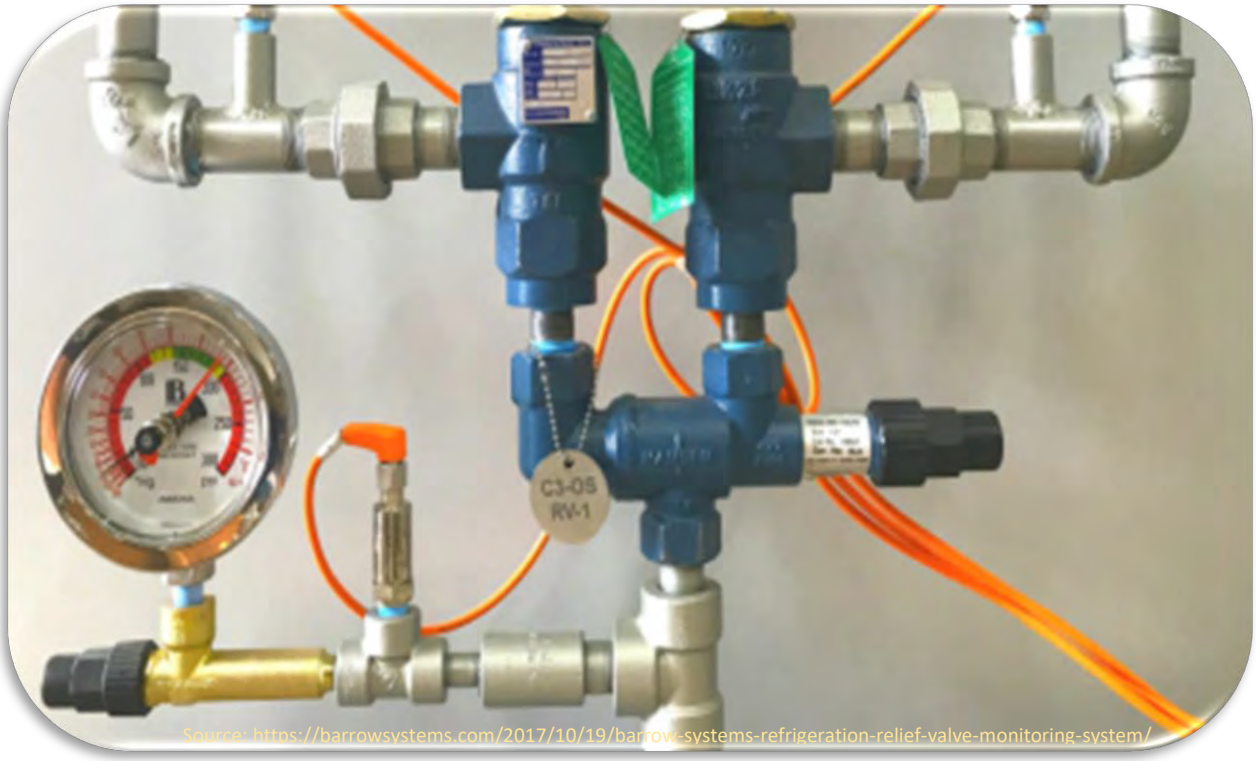
ENGINEERING BULLETIN NO. 5

DTC ENGINEERING

10 BEST PRACTICES OF DESIGN & OPERATION OF AMMONIA RELIEF VALVES SYSTEM FOR DTC EMPLOYEES



Source: https://barrowsystems.com/2017/10/19/barrow-systems-refrigeration-relief-valve-monitoring-system/

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DUALTEMP CLAUGER

4301 S. PACKERS AVE, CHICAGO, IL 60609

www.dualtempclauger.com

10 BEST PRACTICES OF DESIGN & OPERATION OF AMMONIA RELIEF VALVES SYSTEM FOR DTC EMPLOYEES

1. Follow Industry's & Company's Best Safety Practices. Safety is always our FIRST PRIORITY. Follow job Hazard Analysis prior to performing any work and ensure you have the proper training.

2. Do not design any relief valves for equipment & piping unless it is required by codes and DTC or client's best practices.

3. Do not attempt to service a system under ammonia charge unless it has been directed by DTC management. We occasionally cut into ammonia system under the practices of 'Hot Tap Welding.' We should always perform the required safety checks prior to conducting the hot tap.

4. Do NOT install a relief valve that opens to the atmosphere on a vessel that is full of liquid ammonia or has a large quantity of liquid ammonia. Design for the RV to be piped back to the system as required by codes and IIAR Standards. As a Standard Practice, we do not install dual relief valves on oil pots. Furthermore, we require the relief valve to be piped back to the vessel.

5. We mandate the use of IRC software for design and sizing of RV and RV piping. All DTC engineers must go through IRC training for the use and design of ammonia RV design.

6. Additional **'Do's and Don'ts'** of relief valve system:

6.1 Relief Valve Requirements

6.1.1 Valve inlet connection cannot be larger than relief connection on vessel.

6.1.2 For vessels larger than 6-inch inner diameter (ID) but less than 10-ft^3, relief device connection on vessel shall not be less than ¾-inch or ½-inch coupling. Only 1 relief is required. 2 reliefs with manifold is also OK.

6.1.3 For vessels larger than 10-ft^3, relief device connection shall not be less than 1-inch or ¾-inch coupling. 2 reliefs with manifold is required.

6.1.4 Relief valves are required for vessels, compressors, heat exchangers, APP and NEAP purgers, and even condensers sometimes.

6.1.5 Relief valves discharging to the atmosphere are subject to a 5-year replacement.

6.1.6 Atmospheric reliefs must be installed above the liquid level and liquid rated reliefs below the liquid level.

6.1.7 A2BK and A2CK, though adjustable, are not ASME rated, and therefore should not be used on refrigerant/tube side of oil coolers. Rather, the valve should be incorporated into a system where it is installed to relieve a section of liquid line which could inadvertently be isolated by service valves or automatic control valves. The regulator should be installed to relieve back to a low pressure (suction) side of the system.

6.2 Relief Valve Installation

6.2.1 Mount relief valves in upright position, so the spindle is vertical. A valve not installed in this position will not open at the specified set pressure and may not perform correctly.

6.2.2 For flanged valves, be sure to draw the bolts down evenly. If you tighten one side all the way and then the other, not only will you not be able to tighten it completely, but you could crack the valve.

6.2.3 Do not over tighten the valves. This can damage both the inlet and outlet threads and cause leakage.

6.2.4 Apply pipe dope to male threads only. Pipe dope is a compound that prevents valves from leaking, applying it to female threads could contaminate your system.

6.3 Relief Inlet Piping

6.3.1 Inlet piping must be at least Schedule 80 for inlet connections.

6.3.2 Inlet connections can reduce going into the manifold OR relief but cannot increase. See Figure 1 below.

Figure 1: Inlet Piping Requirements

6.4 Relief Outlet Piping

6.4.1 Outlet piping can be Schedule 80, 40, and even 10 for outlet piping. We typically use Schedule 40. **If you would like to use Schedule 80, call and verify with the Engineering department.**

6.4.2 Outlet piping can increase out of the relief valve outlet, but never reduce. See Figure 2.

6.4.3 Some reliefs made prior to new code may not effectively work for their given outlet size. Therefore, we sometimes need expansion fittings very close to the outlet of the reliefs. This is accomplished with the aid of swage fitting. See Figure 3.

6.4.4 Expanding at relief valve outlet may cause relief arrangement to change (you may have to turn one of the reliefs 90° and add extra fittings and

outlet piping. See Figure 4. **Always sketch up and send to the Engineering department if what you would like to do is different from the drawing you have received.**

6.4.5 Isolation valves may be installed downstream of the relief, but they must have a suitable means for locking them in the open position and closed only for replacement or maintenance of the PRV.

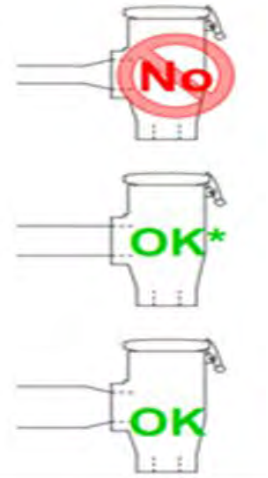

Figure 2: Outlet Piping Requirements

Figure 3: Sample of Swage Fitting

Figure 4: Typical Relief Valve Piping

6.5 Relief Vent Termination

6.5.1 The termination of pressure relief device discharge piping relieving to the atmosphere shall be not less than 15-ft above grade and not less than 20-ft from windows, ventilation intakes, or exits.

6.5.2 The discharge termination from pressure relief devices relieving to atmosphere shall not be less than 7¼-ft above a roof that is occupied solely during service and inspection.

6.5.3 Where a higher adjacent roof level is within 20-ft horizontal distance from relief discharge, the termination shall not be less than 7¼-ft above the height of the adjacent roof.

6.5.4 Discharge piping shall be permitted to terminate not less than 7¼-ft above platform surfaces, such as upper condenser catwalks, that are occupied solely during service and inspection.

6.5.5 The termination shall be directed upward. We typically use a gooseneck with 2 45's attached. See Figure 5 for typical weep hole points.

6.5.6 For single vent reliefs on roof, like surge drums, we install yellow weather caps (see Figure 6). When installing, make sure the retaining collar is close enough to the weather cap to allow it to pop.

6.5.7 Weather caps are not applicable with an inline vent sensor.

6.5.8 Discharge piping from pressure relief devices should have provision for draining moisture from the piping. Lines that terminate vertically upward and are subject to moisture entry shall be provided with a drip pocket having a minimum 24-inch length and having the size of the vent discharge pipe. The drip pocket shall be installed to extend below the 1st change in vent pipe direction and shall be fitted with a valve or drain plug to permit removal of accumulated moisture.

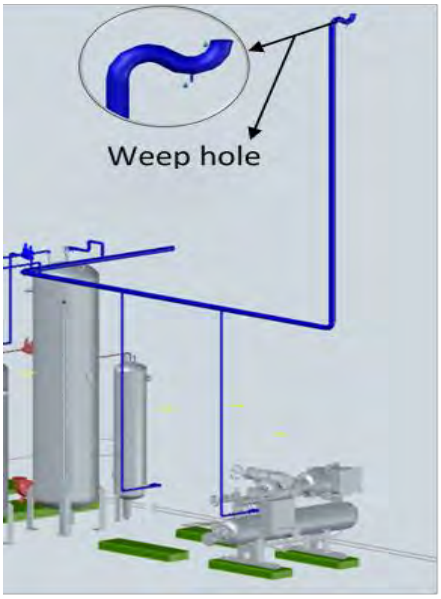

Figure 5: Typical Weep Hole Point

Figure 6: Typical Weather Cap

6.6 Oil Pots and Internal Relief

6.6.1 Oil pots should have vapor rated reliefs if the relief connection is above the liquid level and liquid rated reliefs if the connection is below the liquid level.

6.6.2 For internal relief, use a vapor rated relief with the differential pressure less than or equal to the MAWP difference (e.g. 300-psig oil pot connected to 250-psig LPR would have a relief with a set pressure of 50-psig).

6.6.3 50 -150 psig Internal relief will be with a Shank 800 OP and piping will be like Figure 7.

6.6.4 A relief installed internally is NOT subject to the 5-year replacement.

6.6.5 The relief needs to have an isolation valve on the outlet that would be car-sealed open and should be open during draining as well. The isolation is available for relief replacement should there ever be a need to.

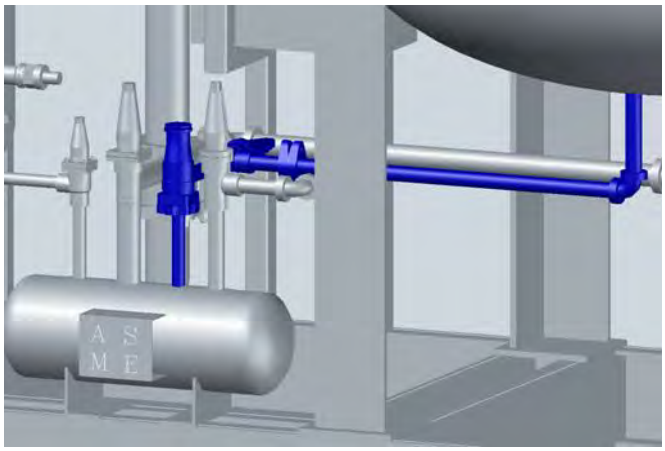

Figure 7: 50-150-psig Pressure Setting
Valve Manufactured by Shank

6.7 Hydrostatic Protection

6.7.1 Hydrostatics are located around the Thermosyphon Return (TSR) stop valve for compressors. Condensers will have a check valve around the Condenser Drain (CD) stop valve for condensers. See Figures 8 & 9.

6.7.2 The set pressure for hydrostatic reliefs should be the difference between the MAWP of the component and the downstream design pressure.

6.7.3 For oil coolers, it is the difference between the oil cooler's MAWP (typically 400-psig) and the oil separator's MAWP (typically 300-psig). This would be a 100-psig relief regulator.

6.7.4 Since condensers are not usually ASME rated, they do not require relief protection. Therefore, it is better to have a check valve installed around the stop valve.

6.7.5 Compressor hydrostatics are typically a Shank 75-psig 803LQ and condenser hydrostatics are typically an A2CK set at 100-psig.

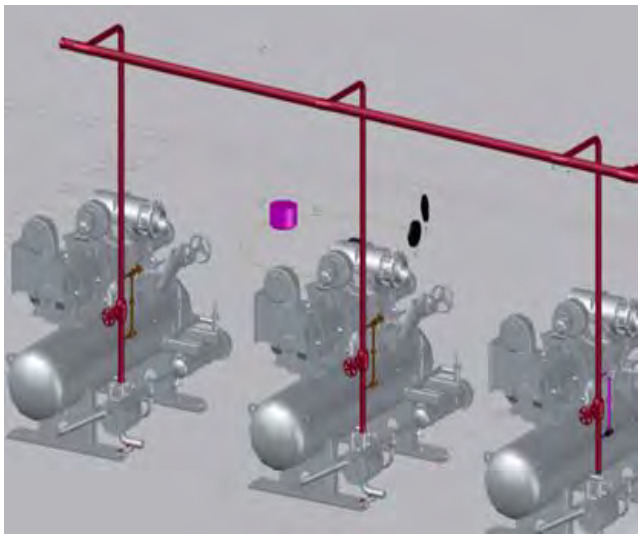

Figure 8: Typical Compressor Hydrostatic on a TSR line (C1-17 is Shank 75-psig 803LQ)

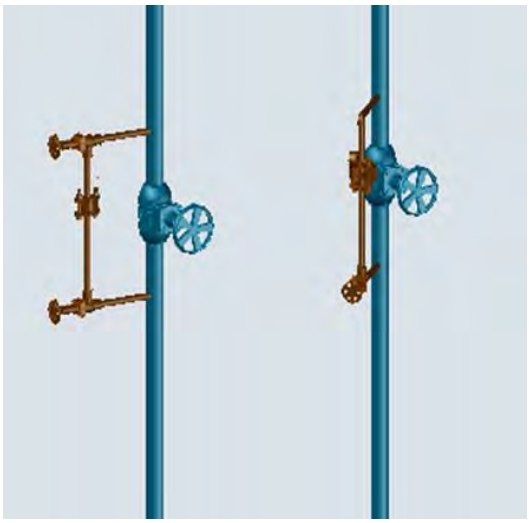

Figure 9: Typical Condenser Check Valve on a CD line (EC1-17 & 18)

7. Ensure there is an updated relief valve list with all the data, such as manufacture, model, capacity rating, pressure setting, location, etc.

8. Perform a Pre-startup construction check list with an updated relief valve list to ensure the correct RV is installed at the right location prior to charging the system with ammonia.

9. Prepare an action item plan for every relief valve for an unlikely opening of relief valve to ensure the valve is accessible with SCBA.

10. Finally, none of the above provisions will offer any safeguard without training of our refrigeration personnel. Remember, no organization or program will

ever succeed without a training and performance validation. **Without it, none of the above matters**.