Appendix M: Leak Check Report

Contents

Introduction

Technical Safety BC investigated an ammonia release from a partially disassembled refrigeration system. The Technical Safety BC investigation found that ammonia was released from a high-pressure receiver (Receiver #4). The receiver was part of a larger system and was contained within a skid that included a compressor, motor, and oil separator. (Figure 1).

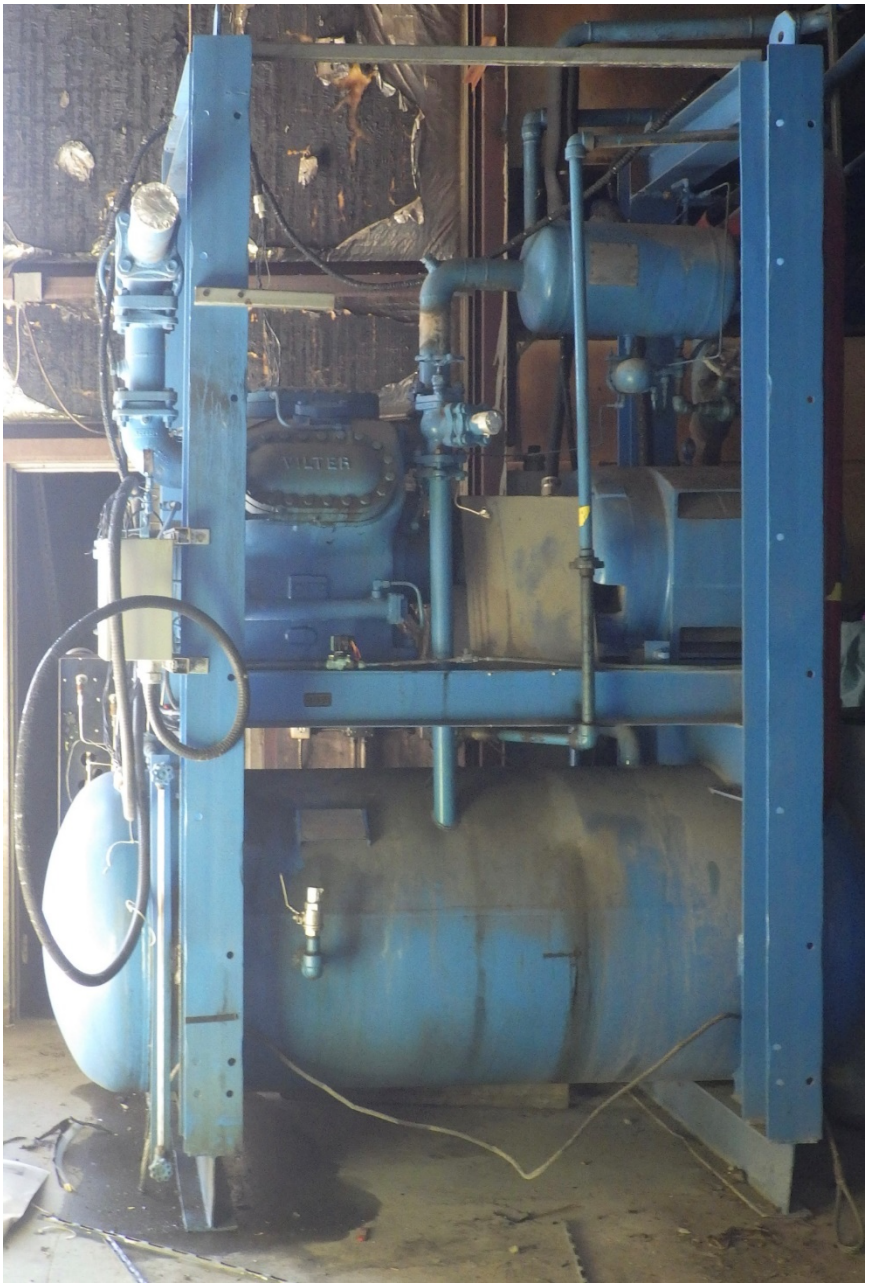

Figure 1: Refrigeration skid containing receiver, compressor, compressor motor, and oil separator

The refrigerant pipes connecting the skid to the rest of the refrigeration system had all been cut to allow for the skid to be transported off site. Figure 2 depicts the as found configuration of the system.

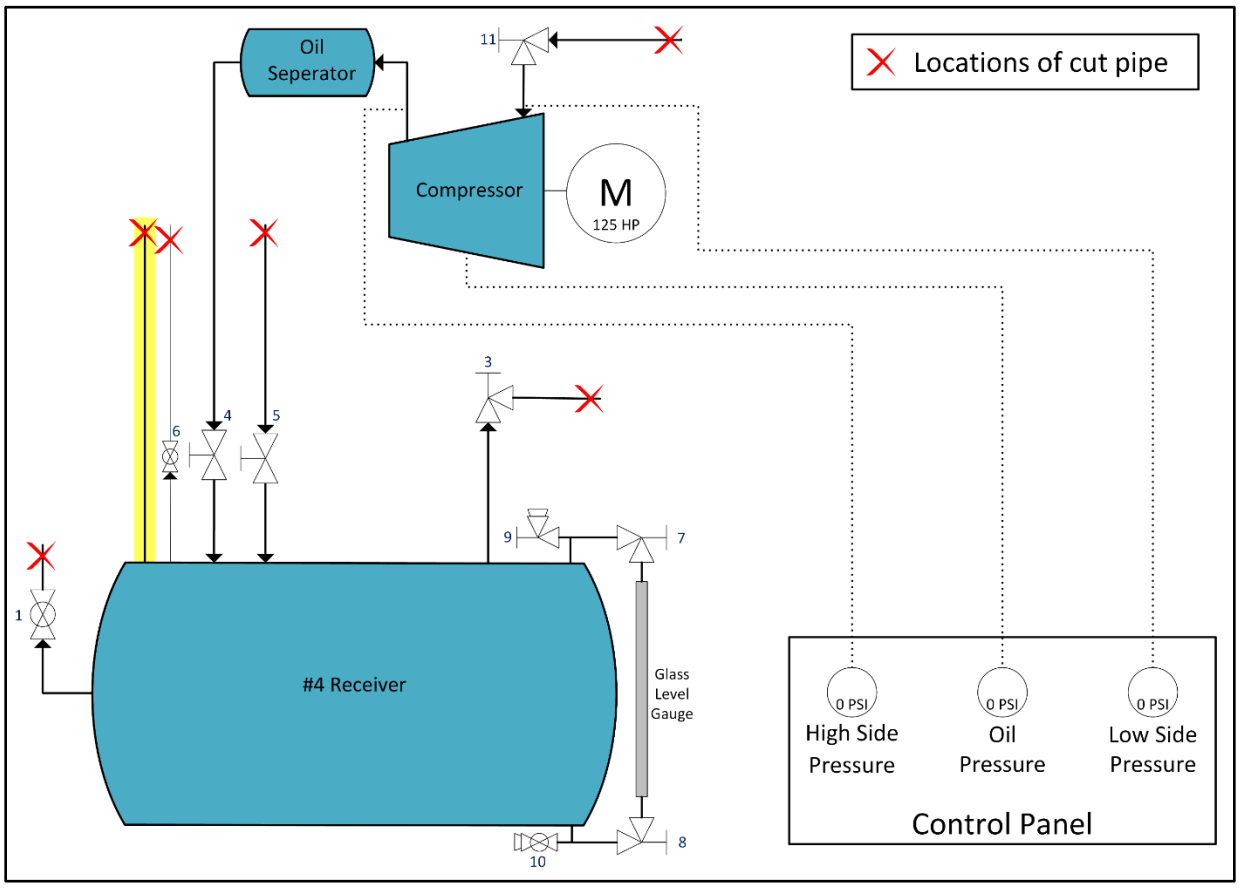

Figure 2: Configuration of refrigeration skid. Red "X" represents locations where the pipe was cut.

Note: The flow diagrams in this appendix are schematics only and are based on the observations on site. These flow diagrams are not to be used as a basis for any designs and does not serve as verifications of the existing design.

A pipe welded to the receiver was cut, with no valves between the open end and the receiver as depicted by the highlighted pipe in Figure 2. From an external visual inspection, this made it appear as though the receiver should not have been capable of holding pressure however, the process flow diagram from the manufacturer indicated that this pipe flowed through the receiver as a heat exchanger rather than being connected to it. The position of the valves and the integrity of the vessel was not known at the time. The scenario presented was that the ball valve (1) was opened, resulting in the ammonia release. To verify the scenario presented with all valves (except valve 1) left in their as found positions, a leak test was performed on the high-pressure receiver.

Leak test

The leak test was performed by a licensed refrigeration contractor at the request of Technical Safety BC. The purpose of the leak test was to validate the pressure retaining capabilities of the High-Pressure Receiver, in its as-found configuration.

To perform the leak test, a 2-inch ball valve (valve #1) was removed and sent to a lab for separate analysis. The nitrogen tank was connected to the 2-inch pipe where the valve had been removed. This 2-inch pipe was chosen as the fill point because it is the location where ammonia was released. By adding pressure at this point, the pressure boundary of the chamber that previously held ammonia was being directly tested.

A pressure gauge was then connected to the vent valve (Valve #9) located above the glass level gauge. This gauge was used to monitor pressure during the test.

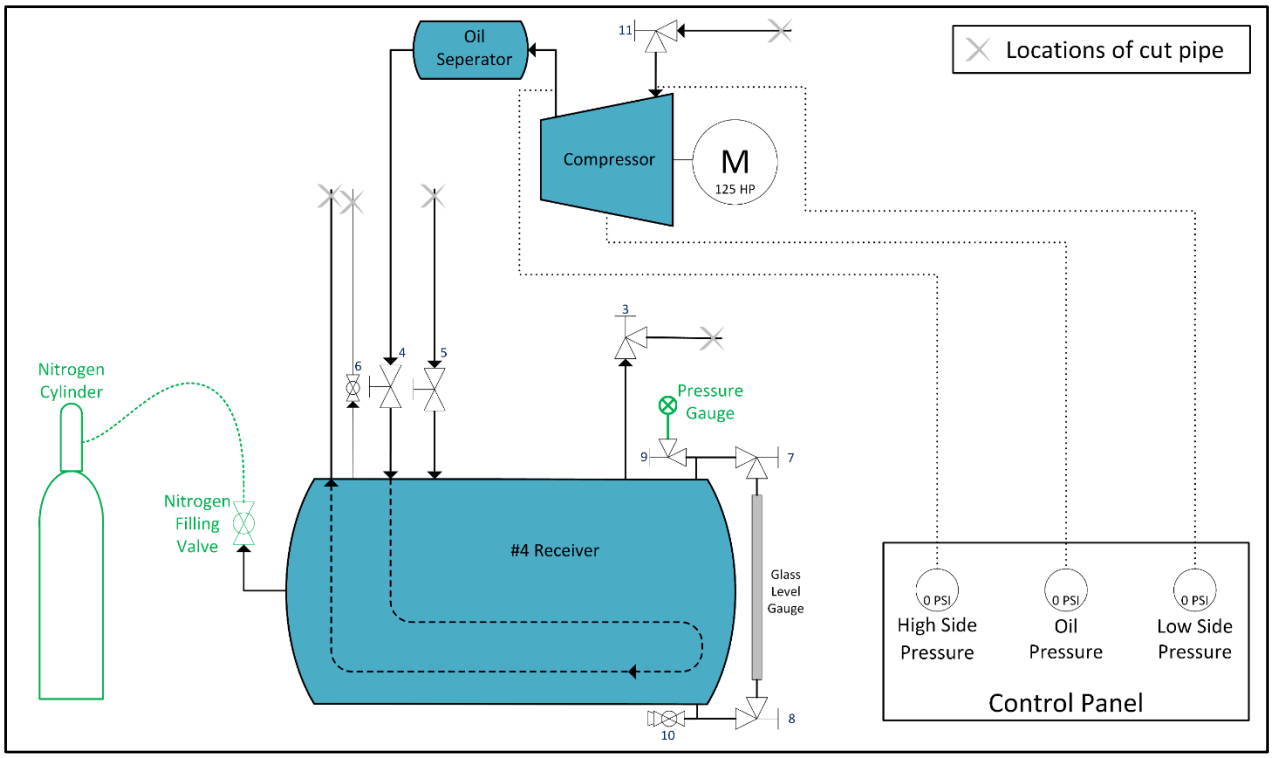

Figure 3: Leak check configuration with nitrogen cylinder connected to 2-inch liquid feed line.

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The high-pressure receiver was brought up to a test pressure of 15PSI. The Nitrogen cylinder was isolated from the receiver and the receiver pressure was monitored for a duration of 10 minutes. During this time, no changes in pressure were observed. After 10 minutes the pressure had not changed and a final pressure of 15PSI was recorded (Table 1). It was also noted the gauges on the system control panel did not register pressure during the duration of this test. The refrigeration mechanic safely released the pressure from the receiver and disconnected the pressure gauge.

Table 1: Leak Check Results

	Time (24 hr)	Pressure (PSI)
Start	21:16	15
End	21:26	15

Conclusions

The high-pressure receiver was able to hold a pressure of 15PSI for 10 minutes. This indicates that:

1. Valves #3, #5, #6, #9, and #10 were all closed.
2. The pipe with no valve was part of an internal cooling loop independent of the receiver's primary volume and did not release pressure.
3. The gauges on the control panel were not reading the pressure inside the high-pressure receiver.

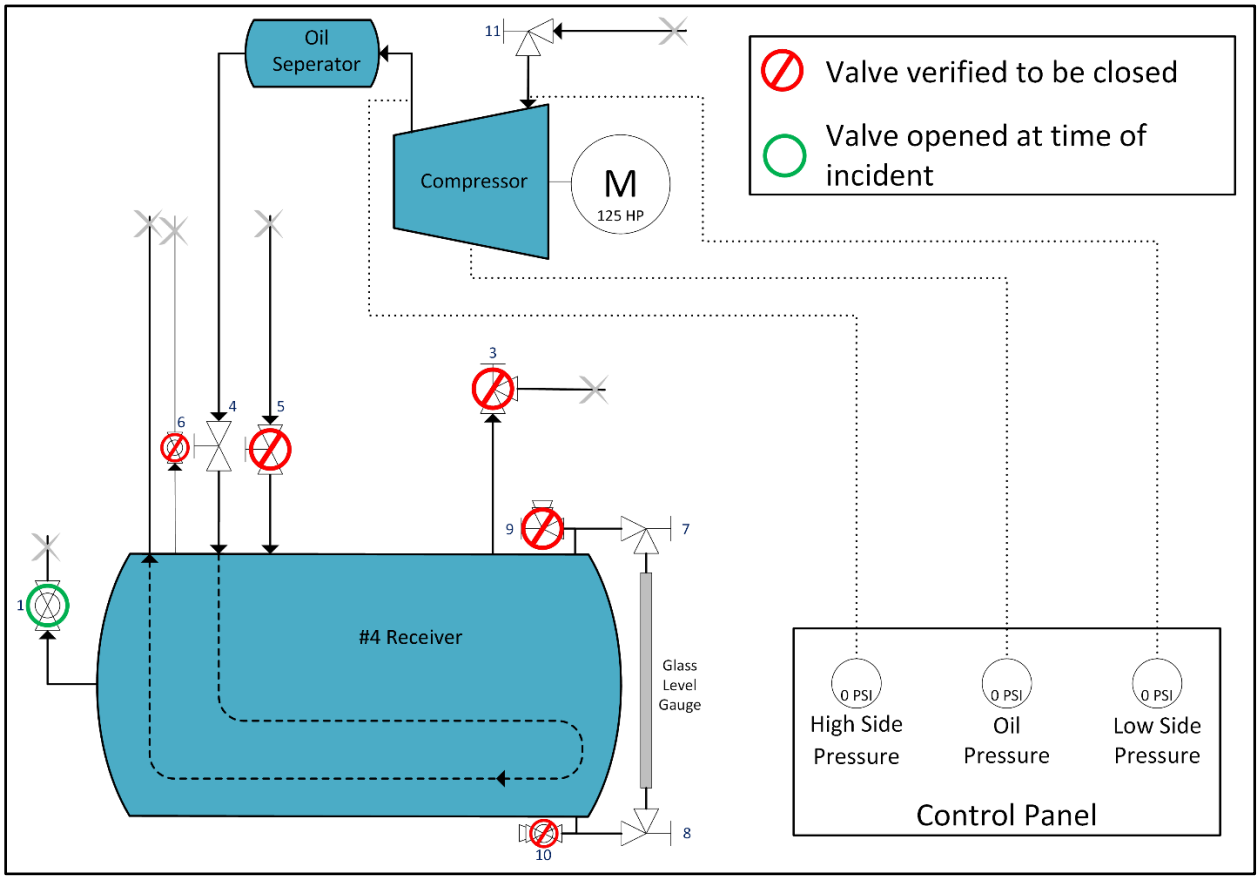

Figure 4: Known valve positions on the high-pressure receiver (Receiver #4) based on leak check findings.

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TECHNICAL SAFETY BC

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