REFRIGERATION REVIEW

OIL POTS

Draining of oil in ammonia refrigeration systems is one of the most challenging processes. Ever since I was a green engineer and an old timer took me out back and showed me what the stiff coagulation of drained oil, water and air looked like, I have garnered an appreciation for the oil draining process. While lubricating oil is heavier than liquid ammonia, at low temperatures it can be as stuff as molasses.

Draining oil manually or through an automated process using an oil still can be a challenge, and needless to say can be one of the most hazardous processes in maintaining an ammonia refrigeration system. Generally, the process involves using an oil pot (a separate small vessel which is connected to recirculators, accumulators, surge drums, and other points that oil tends to settle out), and on a quasi-continuous basis lets the heavier oil "migrate" out of the larger vessels or surge drums into the oil pot.

When manual drain systems are employed the normal practice is to let ammonia and oil flow by gravity into the oil pot. The oil pot remains uninsulated so it will heat up, and normally ice will form around the oil pot, indicating that is is slowly boiling off ammonia. As the oil pot fills with oil, the ice will disappear off the lower portion of the oil pot, and normally when it's half full of oil, it would be time to drain the oil out. One of the connections to the oil pot is a downleg to the bottom of the oil pot. On manual drain systems, there would be only one. When draining is required, the drain line from the bigger vessel is closed, as well as the vent line that passes gas up above the liquid level in the vessel. Assuming the oil pot is in a machinery room where it would have warmer temperatures, the little bit of ammonia remaining in the oil pot will provide pressure to push the oil out of the oil drain valve into an appropriate container. Some designers like to use a dead man's valve for drain valves. I prefer a manual valve rather than have a man hold the valve open while he's experiencing a lot of discomfort with the ammonia/oil mixture bubbling, regurgitating and sometimes spewing out of the drain valve.

When someone didn't know better, there have been cases where a hose was connected to a drain valve and a worst-case scenario was what to do with a hose full of ammonia and oil squirting out of a hose that is flopping around in the air -- and there are several sad cases and near misses of hazardous incidents relating to just that. A hose should NEVER be attached to a drain valve, and the valve should only be cracked open so that once all the oil is out, the valve can be closed to stop the ammonia gas from coming out.

Oil pots are usually designed such that the gas return line protrudes 1 1/4" into the top of the oil pot. This will leave a pocket of ammonia gas in the top of the oil pot and prevent locking up liquid in such a was that its expansion can cause unexpected occurrences. Oil pots are designed for higher than normal system pressures -- 300 to 400 psig -- and they are equipped with relief valves, either to the outside relief valve system and diffusion tank, or they can be relieved to the vessel to which they are attached, with an appropriate lockout globe valve.

For large refrigeration systems, quite often a semi-automatic oil draining system can be provided. The oil pot for this system normally has two downlegs -- one for manual draining and one for the automatic still drain system. Generally, these oil pots are larger than the manual oil pots. As illustrated below, it can basically be piped in the same manner as the manual oil pot. Some designers will set the oil drain relief valve as low as 50 psig, while we normally prescribe to setting the relief valve on the oil pot in keeping with the design pressure of the oil pot, generally 300 psig.

The primary objective is to have an understanding of how the oil pot will be used and a pretty good idea of how often the oil will be drained from the different components of the system. It usually takes from 6 months to 1-1/2 years to accumulate enough oil to start an oil draining program. The key is to not let the oil accumulate more than the oil pots will retrieve, and depending on the type and efficiency of the oil separators and the type of compressors will greatly influence the frequency of oil draining. The use of coalescent filters on both screw and reciprocating compressors greatly extends the frequency necessary to drain oil, but it will eventually need to be drained.

There are several stories about vertical risers that in time totally congealed and sealed off the suction line to the point that a vacuum pump could not relieve the oil. The line had to be uninsulated and heated to get the oil out of the riser. There are numerous stories of vessels that gradually build up oil to the point that the oil would enter the ammonia circulating pumps and jam the pump or cause cavitation.

Also be aware that any time a system is modified and opened up to the atmosphere, there is a tendency for old oil, carbonized oil, water, and air to coagulate, stop up the filters, and require changing (i.e., compressor filters) the same as when the compressors were initially installed and started.

Just be aware that although the oil separates, it tends to separate in the coldest places that it has been distilled out of, and on rare occasions requires a temporary hot gas connection to melt the coagulated mess to the point where the oil can be drained.

So all this to say, while new systems run unattended, in time they are going to need attention and primarily from the oil, which is a very necessary part of lubricating the compressor.

NOZZLE SCHEDULE						
MARK	SIZE	TYPE	RATING	QTY	SERVICE	REINFORCEMENT
A	1"	CPLG	3000#	1	OIL & REFRIG. INLET	----
B	1/2"	CPLG	3000#	1	SAFETY RELIEF	----
C	1"	CPLG	3000#	1	GAS OUTLET (VENT)	----
D	3/4"	PIPE	SCH. 80	1	OIL OUT TO ATMOS.	----
E	3/4"	PIPE	SCH. 80	1	OIL OUT TO RESERVOIR	----

NOTES:

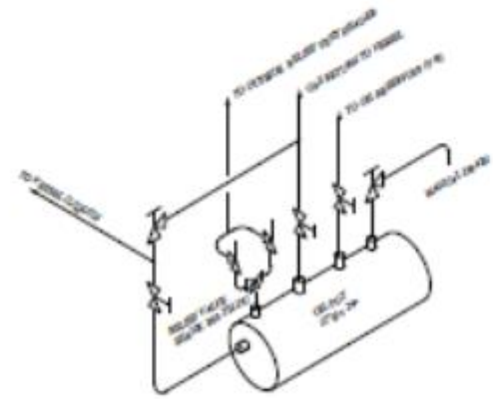
1. DESIGN AND CONSTRUCTION CONFORM WITH SECTION VIII, DIVISION 1, LATEST REVISED EDITION. ASME CODE FOR UNFIRED PRESSURE VESSELS.

2. ASME AND NATIONAL BOARD INSPECT AND STAMP FOR [illegible] PSIG @ [illegible] TO [illegible]°F.

3. THREE (3) OIL POTS REQUIRED FOR V-2A, V-3A & V-5A.

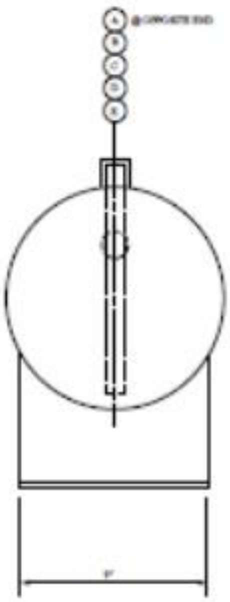
4. OPENINGS TO BE MARKED AS SHOWN.

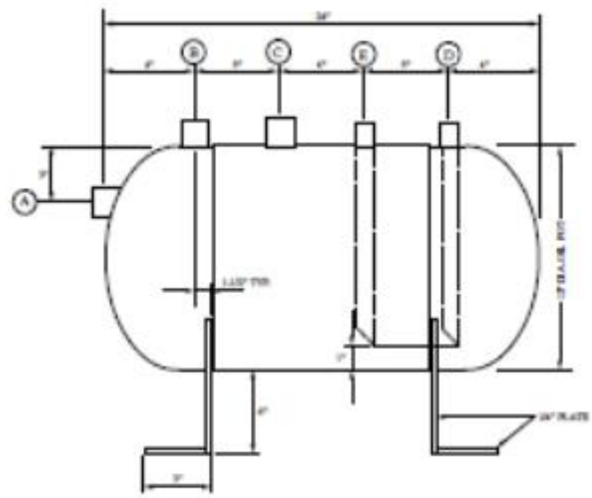
5. ALL MANUAL VALVE STEMS TO BE INSTALLED IN HORIZONTAL POSITION.



OIL POT PIPING SCHEMATIC
SCALE: NONE

NOTE: DO NOT INSULATE OIL POT.
INSULATE PIPING TO AND FROM OIL POT.





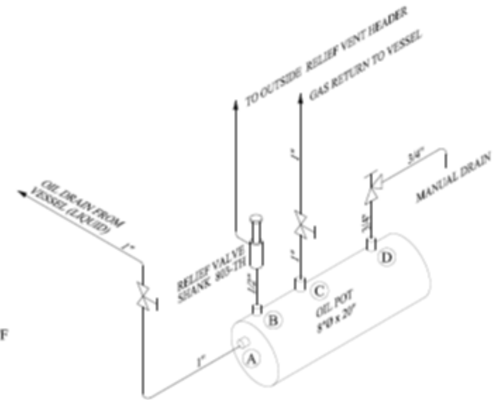
12" DIA. x 24" OIL POT
SCALE: NONE

NOTE - DO NOT INSULATE OIL POT

NOZZLE SCHEDULE						
MARK	SIZE	TYPE	RATING	QTY.	SERVICE	REINFORCEMENT
A	1"	CPLG	3000#	1	OIL & REFRIG. INLET	---
B	1/2"	CPLG	3000#	1	SAFETY RELIEF	---
C	1"	CPLG	3000#	1	GAS OUTLET (VENT)	---
D	3/4"	PIPE	SCH. 80	1	OIL OUT TO ATMOS.	---

NOTES:

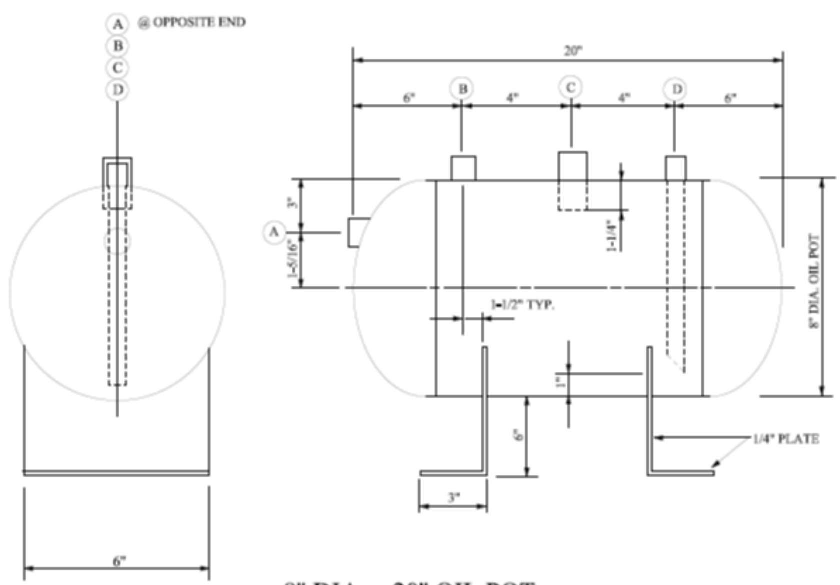
1. DESIGN AND CONSTRUCTION CONFORM WITH SECTION VIII, DIVISION 1, LATEST REVISED EDITION. ASME CODE FOR UNFIRED PRESSURE VESSELS.
2. ASME AND NATIONAL BOARD INSPECT AND STAMP FOR 300 PSIG @ -50°F / +450°F
3. FOUR (4) OIL POTS REQUIRED. ONE EACH FOR V-2, V-3, V-4 & V-5.
4. OPENINGS TO BE MARKED AS SHOWN.
5. ALL MANUAL VALVE STEMS TO BE INSTALLED IN HORIZONTAL POSITION.



OIL POT PIPING SCHEMATIC

SCALE : NONE

NOTE : DO NOT INSULATE OIL POT.
INSULATE PIPING TO AND FROM OIL POT.



8" DIA. x 20" OIL POT

SCALE: NONE

NOTE : DO NOT INSULATE OIL POT

OIL STILL