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ESG Service Information

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Equipment Affected: OM Titan Chillers

Purging Inert Gases / Noncondensables

General

This letter describes the best practice for purging inert gases/noncondensibles from Titan OM water chilling systems with subcooling chambers in the condenser.

A best case scenario is to avoid the introduction of inerts/noncondensible contaminants into any medium/high pressure system. This can be achieved by following industry and/or manufacturers' recommendations for evacuation and dehydration processes during commissioning and service activities, as well as knowing the refrigerant quality being added to the system.

Purging

Either fully automatic or manual methods can be used to purge inert gases from these systems. This best practice outlines the manual method for purging a system contaminated with inerts/noncondensible gases that result in more than 2° F measured differential between the saturated condensing temperature and the measured temperature of condensed liquid. Note the condensed liquid temperature must be taken ahead of any subcooler installed in the system.

With incorporation of subcooling chambers, we must reexamine the best practice for purging since historically, any inerts/noncondensibles typically would have accumulated in the coolest, dormant flow areas of the system. On units without subcooling it's assumed the top of the condenser would be a reasonable sampling location. Equipment with automatic purge systems may still be successful utilizing sampling location(s) the top of the condenser since the vapor travel is a very dynamic during operation of the system. While the amount of inert gas in the sample taken from this location may be reduced in units with subcoolers, this may still provide the means over time to collect and expel them from the system.

Typically, manual purging has involved operating the unit for the purpose of collecting inerts/noncondensibles in the condenser, then shutting the unit down and while static, sampling vapor off the top condenser connection to remove the inerts/noncondensibles. Operating data from a unit with a subcooler indicates the majority of inerts/noncondensibles do not actually remain in the condenser at shut down. Removing contaminants by this method will be a very long drawn, tedious and unproductive task because the contaminants are most likely in the evaporator shell.

The table on page two shows sample data from an OM Titian water chiller operating with R-22, which was suspected of having inerts/noncondensible contamination. The data was recorded after the system had been shut down and a manual purge performed as described above. The data shows how the small difference performance of the cooler improves and the condenser degrades over 3 hours. The system was eventually purged of contaminants by using the means outlined in this letter.

When the contaminants must be removed by manual means, perform the following steps.

1. Remove all possible liquid from the system and place into suitable container(s)
2. Reclaim all vapor into a container(s) in accordance with industry standards and guidelines.

! NOTE

This refrigerant vapor will be considered potentially contaminated and should not be reused until reclaimed to industry standards.

3. Evacuate/dehydrate the system to manufacturer's recommended levels, or 2mm Hg as an alternative
4. "Break" the system vacuum using refrigerant vapor of known "good" condition (conforming to ARI 700) and of the appropriate designation for the system to a safe pressure above freezing. Then proceed with the liquid charging process using the original refrigerant which can be effected with minimal danger of freezing, Note: it is recommended that water flow be established through the unit to further reduce the risk of freeze hazard. DO NOT allow

any refrigerant vapor to be charged from the refrigerant containers storing the original charge. This will assure that any contaminants in the vapor form will remain in the storage container and not be returned to the system.

5. Recommission the system and validate that condensed liquid temperature and the saturated condensing temperature are within prescribed limits.
6. Recycle, reclaim or dispose of the remaining refrigerant vapor charge left in the container(s) after the liquid has been removed from the containers and returned to the system. All purging, reclaiming, recycling or disposal must be done in accordance with EPA guidelines currently in effect.

NOTE

A comparison of the actual pressure measured in the storage container compared to the saturated pressure corresponding to the ambient temperature of the container may be a means to verify whether contaminants are present. It is suggested the temperature be normalized for several hours before making this comparison.

Time	03:30:11	03:31:44	03:45:00	04:32:22	05:31:20	06:15:00
Evaporator						
Water Inlet Temp	49.66	49.47	48.80	48.57	49.72	50.19
Water Outlet Temp	45.30	43.34	39.45	39.45	40.19	40.57
Water Flow	19200.00	19200.00	19200.00	19200.00	18800.00	19000.00
Water Press Drop	11.06	10.64	10.39	10.74	10.83	11.23
Refrigerant Pressure (PSIA)	74.14	75.19	72.72	75.03	78.80	79.53
Sat.Ref.Temp from Press (° F)	33.49	34.28	32.42	34.16	36.91	37.43
Refrig Liq to Evap Temp (° F)	35.74	37.55	36.84	38.05	39.57	39.82
Small Difference	***11.81***	***9.07***	***7.03***	***5.29***	***3.28***	***3.14***
Intercooler						
Liq Temp to Intercooler	69.63	71.15	80.66	86.57	86.68	86.33
Intercooler Press	112.33	111.85	112.84	121.31	125.15	124.97
Condenser						
Water Inlet Temp	70.26	71.32	76.89	83.00	82.69	82.48
Water Outlet Temp	74.18	76.63	84.86	90.62	90.87	90.22
Water Flow	26000.00	26000.00	26000.00	27000.00	27000.00	28000.00
Water Press Drop	13.17	12.77	12.51	12.89	12.12	12.08
Refrigerant Press (PSIA)	150.72	156.59	182.16	199.40	203.75	202.86
Sat.Ref.Temp from Press (° F)	76.70	79.26	89.64	96.05	97.60	97.29
Small Difference	***2.52***	***2.63***	***4.78***	***5.43***	***6.73***	***7.07***
Sideload into Compr Temp	69.75	65.38	67.57	62.97	60.54	59.22
Turbine						
Steam Flow	39271.53	41625.68	68733.43	75939.38	71996.72	72451.54
Inlet Press	191.05	187.87	183.28	187.56	190.38	190.90
Inlet Temp	478.98	481.39	482.91	499.97	494.27	499.30
Exhaust Press	0.96	0.92	1.77	2.10	2.16	2.17
Compressor						
Shaft Horsepower	4419.54	4708.03	7137.04	7806.08	7359.14	7425.00
Torque From meter	5516.95	5733.00	9036.32	9076.15	9186.87	9224.59
Discharge Temp	121.78	126.30	142.10	146.79	144.42	143.55
Discharge Superheat	45.08	47.04	52.46	50.74	46.82	46.26
Surface Condenser						
Water Outlet Temp	76.25	78.23	89.40	95.34	95.50	94.97
Condensate Temp	85.60	86.83	102.08	107.73	107.79	107.47
Performance						
Chiller Capacity	3488.91	4906.83	7495.33	7309.87	7478.48	7630.93