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Tracing Compressor Suction Line



S M Kumar
Process Design Consultant
Top Contributor

Query:

Compressor suction lines between the knockout drum and the compressor shall be heat traced and insulated if ambient temperature is below the dew point of the gas at compressor suction or if handling hydrocarbon gas components heavier than ethane.

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Please let me know for which maintenance temperature the electrical heat tracing system should be designed? How much design margin should be considered? and how to set the maintenance temperature?

For example is this good enough to keep the gas temperature 10C higher than dew point?

My response

Yes, it is goods enough to keep the metal (not gas) 5 deg C higher than gas dew point.

Why do you trace?: Not to allow heavy ends condense in the pipe between suction KOD and compressor inlet flange. The heavy ends condense due to cooling introduced by pressure drop in the line – that you can not avoid and heat loss to atmosphere, which you can minimize by tracing and the insulation that comes with it.

If heavy ends condense, then (1) they hit the compressor blades at high velocity and may cause damage in the long run (2) they coke on the compressor blades; coke deposits cause unbalanced loads on the compressor shaft and lead to failure/ trip/ damage.

Extra 1 This heat tracing approach is good with clean gases and for the second and further stages of an oil & gas field production compressor. For the first stage, field observations indicate coking regularly occurs due to liquid carry over from HP or Production Separator. Simulation does not predict minute amounts of heavy ends; it does not mean they are not there in the gas to compressor. In this case, an additional coalescer filter ahead of compressor is preferred by a few operators. Go by field experience. This heavy ends not predicted in Simulation is a cause for concern in (1) Compressor Seal gas damage and (2) Liquid carry over to Gas Turbine burners.

Extra 2. Compressor Discharge Aircoolers cool the gas to a few degrees above ambient. Pressure drop and cooling in the line causes heavy ends to Glycol contactor – cause of foaming. Electrical tracing; filter-coalescer and locating compressor discharge KOD below Glycol Contactor helps.

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4 comments



Mojtaba Habibi
Process Engineer at Petroleum Engineering and Development Company (PEDEC)
Top Contributor

Mojtaba

Dear Mr.Kumar,

About this part of your viewpoints:

"For the first stage, field observations indicate coking regularly occurs due to liquid carry over from HP or Production Separator. Simulation does not predict minute amounts of heavy ends; it does not mean they are not there in the gas to compressor. In this case, an additional coalescer filter ahead of compressor is preferred by a few operators. Go by field experience."

Which process specification and inlet feed stream conditions should be specified for this additional coalescer filter to enable vendor to size this filter?

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Wilfredo

Wilfredo Garcia
Process Specialist at Ecopetrol

From my point of view, the introduction of a filter or coalescer at the compressor suction may create another problem: filter/coalescer clogging leading to surge conditions at the compressor, what I have seen in a refrigeration plant using C2/C3 as refrigerant is the installation of boots at the low point of the compressor suction lines, these boots include a level transmitter to alarm the operator for high liquid level in the boots and allow the operator to manual drain the liquid to LP flare

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S M

S M Kumar
Process Design Consultant
Top Contributor

Specification: More or less the same as the suction KOD

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Saeid R. Mofrad
Principal Process Engineer at Petrofac (P.E.)
Top Contributor

In my opinion and based on what we did in a project handling a nasty gas containing heavy ends, asphaltene, etc. as a most conservative design we can maintain the suction line at operating temperature (which is definitely higher than dew point) by heat tracing. Though it may increase power consumption but ensures that temperature won't drop in any condition.

You don't need to trace entire line, first of all compressor suction line shall be no pocket (so I take the scheme proposed by Wilfredo Garcia as pitfall mitigation, not correct design, as liquid accumulated in boot does not guarantee that there is no carry over to compressor. In contrast, it shows that something is wrong). It is preferred to make this line free draining back to suction KOD, if not possible (because compressor inlet nozzle is usually lower than KOD outlet nozzle) heat tracing can be applied from high point of this line to compressor suction nozzle (not whole line).

About using filter at suction, I don't see any problem provided filter is equipped with adequate instrumentation (differential pressure alarm). We put a filter after suction KOD to remove particles above 1micron and it works fine. To have some margin on pressure and reduce the frequency of cleaning you can specify filter pressure drop not be more than 20% of dirty pressure drop. (You have to specify filter pressure drop at dirty condition depending on the system hydraulic and available pressure).

If you are going to add a vessel upstream of filter to remove bulk liquid (due to condensation in upstream line) and concerned about plugging of wire mesh, vane pack can be used which offers higher opening and less (almost no) plugging possibility.

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