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Lessons Learnt: Compressor Hot Gas By-Pass Valve

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Lessons Learnt: Compressor Hot Gas By-Pass Valve

Disadvantages:

1) Valve unlikely to be completely tight shut-off => constant leak of hot gas, reduces efficiency

2) Valve parts break and enter compressor

3) Hot gas can cause internal mechanical damage to the blades and seals.

Please feel free to comment/share your experiences on the same.

Best,
Mojtaba

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3 comments

Stuart

Stuart Williamson
Dynamic Simulation Consultant at CB&I

Mojtaba
The title states "lessons learned" - but are these problems you have experienced on past projects or is it just a list of things that you consider might be potential problems with this option?

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Mojtaba

Mojtaba Habibi
Process Engineer at Wood Group

Dear Stuart,

Actually these are problems that have been experienced on past projects and if not addressed properly might be potential problems with this option. Personally I have not faced with these problems directly but found them useful to share with others for more discussion and experience sharing.

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Stuart

Stuart Williamson
Dynamic Simulation Consultant at CB&I

Mojtaba
The first consideration is why you need to install such a device. It is invariably required to prevent surge on rundown after a compressor trip when the discharge volume is large and the anti-surge valve alone cannot depressurise the head across the compressor sufficiently quickly. Once you have confirmed the need for one then you have limited options:
- Install a hot gas bypass valve
- Install a cold gas bypass valve
- Increase the size of the anti-surge valve

The third item is usually not considered as it will probably lead to a significantly oversized anti-surge valve which is then not controllable for “normal” compressor operation.
This leaves the options of a cold or hot gas bypass valve. Invariably the cold gas bypass valve (in parallel with the anti-surge valve is a better option for various reasons:
- It can use the ant-surge recycle loop so less piping mods are required
- It recirculates cold gas back to upstream of the suction scrubber (and hence removes any concerns about valve parts breaking off)
- If it fails open then whilst it will push the compressor into stonewall but the compressor suction temperature should not become excessively hot
The only drawback of a cold gas bypass valve is that it will be larger than the equivalent hot gas bypass valve as it has to depressure a large volume.
With respect to the “disadvantages”, I have less experience of such issues although would comment:
- Surely (1) is just specifying a tight shut off type valve for the application
- If (2) was a worry you could pipe the hot gas bypass loop back to upstream of the suction scrubber. This is typically how it is done on large LNG applications
- Pipe the hot gas bypass into the compressor suction line as far upstream as possible from the compressor suction nozzle to minimize the temperature rise when the compressor trips.
Of course the other disadvantage is if the hot gas bypass valve fails open when the compressor is running this could result in very high temperatures at the compressor suction and the potential for mechanical damage. Limit switches and discharge TSHH trips are usually also part of a typical hot gas bypass valve installation but due to temperature sensor lags and limit switch reliability these may not provide adequate machinery protection for the fail open scenario. Hence the cold gas bypass should always be considered as a potentially better alternative

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