Gas Field Policy 16: Carbon Dioxide Service (with H2O)

GENERAL:

Carbon dioxide is a colorless, odorless gas which is normally obtained by combustion of carbon (in any form) with an excess of oxygen. It is also obtained from the heating of limestone or from the action of acids on carbonate materials, or as a by-product of fermentation. Carbon dioxide is soluble in water, alcohol and alkalies. Its water solution is carbonic acid which is very corrosive.

Although carbon dioxide is not poisonous, it induces asphyxia by excluding oxygen. CO_2 does not react with air or oxygen and is therefore neither explosive nor combustible.

MATERIALS OF CONSTRUCTION:

CO_2 is substantially non-corrosive. Synthetic rubbers have commercial resistance to this gas.

In the presence of water, however, CO_2 will cause severe corrosion of unprotected iron and steel, which could be significant during idle periods with low cylinder wall temperatures.

Please refer to Section 15.4 (Carbon Dioxide) of API 11P Second edition, dated November 1, 1989.

1. If the concentration of CO_2 (in a wet gas phase), at the suction pressure of any stage, falls into the "A" range (see curve page 2), Siemens Energy recommends its standard materials of construction.

2. If the concentration of CO_2 (in a wet gas phase), at the suction pressure of any stage, falls into the "B" range (see curve page 2), Siemens Energy requires the following construction for maximum resistance to corrosion.

    1. Age Hardened 17-4 PH stainless steel piston rods with Siemens Energy "TC3" coating in the area of packing travel.

    2. Stainless steel internal bolting in "clamshell" type cylinders.

    3. Suction port oilers located in cylinder or suction piping.

    4. Stainless steel or pickled and oiled frame lube oil piping.

    5. Frequent bore inspections to determine proper cylinder lubrication rate (See “Commissioning” Section below).

    6. Valve cover "O" rings can be 90 durometer Viton or AFLAS.

    7. Valve cover o-rings may also be made from Virgin Teflon® material. This has proven successful in reducing/eliminating explosive decompression (ED) in standard o-rings.

    8. Oil slingers are required due to oil compatibility and longer distance pieces may be required.

    Note: Please refer Siemens Energy HSRC Group for any other special requirements.

3. In all cases, the distributor and operator must insure that liquids are not allowed to form or accumulate in any compressor cylinder.

CYLINDER LUBRICATION:

1. CO_2 is soluble in mineral oils, thereby reducing the oil / gas mixture viscosity. Mineral oils are complete miscible into CO_2 which can have a major effect on an oil's ability to lubricate. PAG (poly-alkaline-glycol) synthetic lubricants are commonly used where there is a specified level of CO_2 concentration associated with a given operational CO_2 gas pressure (see following graph).

2. If the concentration of CO_2 and suction pressures are greater than prescribed values in the following graph, a pure synthetic PAG (poly-alkaline-glycol) with a viscosity index of 150 or greater is recommended.

3. Again, in all cases, the distributor and operator must insure that liquids are not allowed to form or accumulate in any compressor cylinder.

4. Cylinder pre-lube can be employed if you have an off-mounted lubrication system. As CO_2 has an affinity to sweep away oil, a pre-lube will ensure that there will not be a dry start on the cylinder bore. A suggested time for pre-lube would be 10-15 minutes. Adjust pre-lube time as dictated by cylinder bore inspections.

COMMISSIONING:

1. Verifying proper lubrication rates is critical to the successful operational life of compressor cylinders and pressure packing, especially within the first days and weeks of operation.

2. After establishing and making preparations for the correct oil to lubricate the cylinder bore and pressure packing, a stepped procedure for periodic cylinder bore inspections is to be carried out.

3. During "break-in", initial cylinder bore lube oil rates should be established as per the unit Operation and Maintenance Manual. Note that the compressors leave the factory with their lube pumps set at the maximum flow rate which typically exceeds the recommended break-in rate by 10-20%.

4. Cylinder bores should be inspected for proper lubrication after the first three days of operation and once a week thereafter for the next three weeks of operation. All inspections should use the "Cigarette Paper" test (see manual for details).

5. After the first three weeks of operation, if the cylinders are showing adequate lubrication using the "Cigarette Paper" test, the lubrication rates may be adjusted down assuming more than adequate lubrication is present during the inspections above.

6. Lubrication rates should be adjusted down in increments of 5-10% maximum.

7. Once the lubrication rate is turned down, all cylinder bores should be inspected weekly using the "Cigarette Paper" test. Assuming this inspection passes the "Cigarette Paper" test, it is recommended the unit be ran for three weeks before turning down the lubrication rates again.

8. There should always be enough oil present to wet the "Cigarette Paper". If the paper doesn't wet, then the lubricator rates should be increased.

NOTE

The "Cigarette Paper" test only gives indication of oil film quantity. It does not give an indication of viscosity quality. Oils diluted with water, hydrocarbons or other constituents may produce what appears to be an adequate film but the oil may not have the required load-carrying capability due to dilution.