

# ภาคผนวก ข-26

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การตรวจสอบอุปกรณ์และเครื่องจักร

**Work Order Shop Paper**

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<b>Order</b>	83567742	<b>Order type</b>	0C20 0C20 Planned Maintenance
<b>Description</b>	RECIPROCATING COMPRESSOR		
<b>Reported By</b>	IP1020220225		
<b>Start date</b>	07.03.2022		
<b>End date</b>	07.03.2022		
<b>Priority</b>	5	0C-Installation down	
<b>Status</b>	REL PRT NMAT PRC SETC		
<b>Funct. location</b>	9149-14-93-07	NATURAL GAS PIPELINE	
<b>Equipment</b>	TH-HCO1MT-00002288	COMPRESSOR NG FEED C10502	
<b>Main work center</b>	MECH 9149	Mechanical Group	
<b>Maintenance plan</b>	333661		

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<b>Operation</b>	<b>Description</b>	<b>Activity Type</b>	<b>Est Hours/ Qty</b>	<b>Act Hours/ Qty</b>
0010	Reciprocating Compressor 1M	ENGR	0.5	

## 1 Month C10502 Reciprocating Compressor

### Reciprocating Compressor C10502 - 1 Month

PM Category: RECPCOMP

Tasklist: T0118227

PRT Document: GT016526

10

Review compressor variable data if available. Compare against historical and allowable values.

**\*\*Normal condition.**

Some compressor operating parameters are captured in the PLC / HMI. Where possible, review parameters such as bearing vibrations and temperatures, suction/discharge pressure and temperature. Compare against historical and allowable values. If the compressor has a local control panel then check all parameters for any deviation from the norm or for any alarms. Raise a notification for corrective measures in the event of significant deviation.

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Record / trend interstage pressures and temperatures for multiple stage units (if applicable).

multiple stage units. (if applicable)

**\*\*OK Pressure Suction** PT10536 = 27.53 Barg.

**Pressure Discharge** PT10537 = 39.19 Barg.

**\*\*OK Temp Suction** TI10532 = 33.0 °C.

**Temp inlet before Inter Cooler** TT10540 = 63.13°C.

**Temp Discharge /After Cooler** TT10544 = 37.49°C.

A change in interstage pressures or rise in temperatures can be an indication of valve malfunction, ring bypassing, or unloader malfunction.

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Record and trend suction and discharge valve temperatures (infrared gun or RTDs if equipped).

**\*\*OK Temp Suction** TI10532 = 32.0 °C.

**Temp inlet before Inter Cooler** TT10540 = 63.13°C.

**Temp Discharge /After Cooler** TT10544 = 37.49°C.

35% of all reciprocating compressor unscheduled shutdowns are due to valves so correct valve maintenance and planning for valve maintenance is essential. Valve bypassing due to failure of springs, plates, poppet's, etc. will cause higher valve temperature due to gas recirculation. High valve temperatures indicate a valve failure. Create a notification for valve replacement.

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Check machine train for loose/missing bolts and cracked foundations.

**\*\* Normal not have loose or missing bolts not have cracked foundations.**

Foundation deterioration is very serious and can lead to compressor failure due to increased piping stresses, distortion of casing and loss of internal machine clearances. Minor looseness on reciprocating machine frames or components can quickly deteriorate and result in failures of fasteners, mechanical impact of fixed components and/or fatigue cracking or ultimate failure. Visually inspect holding down bolts and foundation shim/shim packs. Place hands on the lower corners of the frame and feel for any signs of movement. Any deficiencies must have a corrective maintenance notification created. Any oil leaks must be mitigated and then corrected when possible.

50

Check all pipework, pulsation vessels and coolers for damage, corrosion, and mechanical integrity.

**\*\*Normal.**

Check for excessive vibration, cracking, and looseness of any component. Tightness of compressor cases and compressor

distance pieces, cylinders, and pulsation bottles is important as any looseness can lead to stress on bolting and cracking flanges, pipework and large cast components. In addition, pulsation in bottles or pipework can adversely affect the smooth operation of the valves resulting in machine inefficiencies.

60

If the machine is fitted with valve unloaders or cylinder clearance unloaders then ensure that no leaks exist and that they are functioning correctly.

**\*\*Normal.**

Valve unloaders function by forcing open the valve seat such that compressed gas is passed back into the suction as well as the discharge. As indicated they unload the machine reducing power consumption and production. Cylinder unloaders function by changing the volume clearance in the cylinder. Cylinder unloaders do something similar but have greater volume control. Unloaders can be manually actuated or use actuators. Ensure that the valves move / function and that no leaks exist. Ensure that the loader is in the position required. When the machine is loaded, no air pressure is placed on the unloader and no air should exist in the tubing. If possible, remove a dead-end tubing connection to the unloader and check for gas. If an unloader solenoid valve or diaphragm is leaking, then air, CO2 or ammonia will be detected in the tubing.

70

Check for loose/missing covers and guards. Rectify as required.

**\*\*Normal not has loose or missing covers, guards**

Guards and covers for personnel protection must remain securely in place. Any deficiencies can result in increased risk to safety.

80

Check for unusual noise or vibrations on the complete machine train. If possible, place hands on machine to detect any unusual vibrations or pulsations.

**\*\*Normal** not have unusual noise or vibration.

It is possible to have noise and vibration around the compressor that is not detected by the machinery protection system. Investigate any abnormal noises or vibrations for the source. Serious compressor problems have been detected by technicians with a good ear or feel for audible changes in the machine.

90

Listen for any sign of noise / knocking from the cylinder heads.

**\*\*Normal**

There can be tight clearances between the pistons and the cylinder head, especially if the machine is fitted with unloaders. Listen for any unusual signs of knocking which might indicate a loose piston, a foreign object inside the cylinder (ie damaged valve parts) or the pistons are hitting the cylinder heads

100

Inspect distance piece for evidence of oil leakage past oil scrapers, excessive gas packing leaks, and piston rod surface condition (where possible).

**\*\*Normal.**

The distance piece is a structural member connecting the cylinder to the compressor frame. Any process gas leakage past the seals is typically vented at the distance piece. Gas packing leaks should be small but must be monitored. Any increase in leakage indicates gas wiper seal wear. Oil scrapers are designed to prevent oil migration to the process gas and again, any leak should be negligible. Some compressors have a drain valve located underneath the distance piece. Open and check for presence of any oil. Measure and record any oil drained out. Significant amounts of oil suggest that the oil scrapers may need replacing. Any carryover must be investigated. The piston rod surface should be clean and undamaged. Any damage to the rod will increase oil and gas leakage. Rod damage also may indicate wear on the piston rider bands.

110

Visually inspect cross heads if possible (where applicable).

**\*\*Normal.**

This is generally applicable to horizontally opposed compressors. Look for any obvious signs of wear on the cross head or bearing pad. Listen for any clunking noises which may indicate that something is loose.

120

Check, record, and trend rod drop indication values (if equipped).

**\*\*N/A.**

Rod drop indicators measure the position between the piston rod and the cylinder surface. Any changes in measurement indicate wear in the rings and / or rider bands. Rod drop indicators, if fitted with a trip circuit, may also provide protection against running the piston into the cylinder in the event of a compressor trip.

130

Check for proper distance piece purge flow (if equipped).

**\*\*Normal.**

Distance piece purges are typical with compression of hydrocarbon gases, oxidizers, toxic gases, or others that may pose risk if vented to atmosphere or mixed with oil in the motion works of the compressor.

140

Check cooling water system for leaks.

**\*\*Normal Cooling water not has leak.**

Cooling water volume flow and quality is critical to the efficiency of the machine. Visually check to ensure that all cylinders, coolers etc. receive water. Check sight glasses and

ensure that they are clean. Ensure water quality is maintained, controlled and monitored. If cooling water is supplied by the customer it is still required to be monitored. If unsure, review with the Plant Manager, RBU Support Team, or water treatment engineer.

150

Inspect the lube oil system. Check for correct oil levels in the tank and for leaks. Check all oil filter differential pressures ( $\Delta P$ s).

**\*\*Normal filter  $\Delta P$ s = 0, Lube oil level = 50%,but tank oil slowly leaks.**

If any leak exists in the lube oil system then first identify the source of the leak. It must be mitigated and then corrected. Ensure the  $\Delta P$  gauge is functioning correctly. Note that the absence of a  $\Delta P$  may indicate a bypassing or failed filter which can result in machine failure. Low  $\Delta P$  situations must be immediately investigated and corrected. If  $\Delta P$  starts to rise then switch filters immediately because the contamination rate is exponential and they will fail quickly. Change cartridge as necessary. Note that when changing cartridges on either a single system or dual system all air must be purged. Any loss of oil in the system can result in machine damage.

160

Check lube oil return sight glass for oil colour/flow/excessive gas entrapment (if equipped).

**\*\* oil colour normal.**

Degradation of oil can be an indicator of machine wear or contamination from water, thermal breakdown, etc.

170

Check oil flow, pressure, and temperature are within limits.

**\*\*Normal**

Review process data trending where available.

180

Check operation of lubricator system (if applicable).

**\*\*Normal**

Cylinders with lubrication rely on drip lubricators to regulate oil flow via drip rate for proper lubrication. Insufficient lubrication will lead to greater ring wear. Over lubrication can lead to valve failures and carry over to downstream equipment.

190

Check water return sight glasses for evidence of gas bubbles.

**\*\*Normal** cooler water not has gas bubbles.

Gas bubbles are an indication of leakage in intercoolers or head gaskets.

200

Check all bearings (motor and compressor) for abnormal temperature (if equipped).

\*Normal, Temp. motor DE=45.4 °C, NDE=42.1°C / Comp. DE=44.8 °C, NDE=46.1°C

Many machines are fitted with bearing temperature indicators. If not and the plant has a thermographic gun the temperatures should be taken and recorded. Compare to historical values and proximity to alarm setpoints. It is difficult to generalize on bearing temperatures for plain bearings but typically if it is not possible to put a hand on a bearing surface for ten seconds then the temperatures are high and should be investigated. A rule of thumb is that 90C (195F) is acceptable, 100C (212F) a cause for concern, and 115C (240F) a potential problem.

210

Check all relief devices are free from obstruction and ice, and are not passing.

**\*\*Normal**

Check that discharge pipes are securely clamped, drain holes are clear and bird meshes are in place (where required).

220

Check condition of any filters. Change / clean as necessary.

**\*\*Normal**

## Fault Finding Report

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### Observation and Action Taken

Failure component

Damage description

Root cause



Work Done

Actual  
Duration

Activity  
Type

Start date  
& Time

End date  
& Time

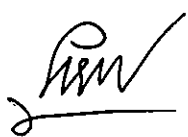


### Work Order Close-Out Authorisation

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Work Done by:

Name & Signature



Date

Mar 14, 22

Work Approved by:

Name & Signature



Date

21/3/22

End of report