Olin Lake Charles

Mechanical Maintenance Instructions

Rotoflow Expander (HYCO I) Overhaul

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Rotoflow Expander (HYCO I) Overhaul	
Purpose:	To restore all clearances and expander functions to vendor specifications.
When:	Whenever the bearings are rough and noisy, after vibration analysis, or leaking shaft seals, or when there is a work order.

Tools/Materials	
• Inside and Outside Micrometers	• Snap Gauges
• Dial Indicator and Attachments	• Allen Wrenches
• Scribe	• Scale
• Socket Set	• Screw Drivers
• Allen Wrenches	• Combination Wrenches
• Channel Locks	• Crescent Wrenches
• 1/2 Ton Come-Along	• 1/2 Ton Chain Fall
• Impact Wrench (Pneumatic)	• Replacement Gaskets and O-Rings
• Lubricant	• Parts Washer
• Loctite	• Seal Tight
• LCC 1013 Safe Work Permit Procedure	• LCC 1005 Hazardous Energy Tag & Lockout Procedure
• LCC 1005B Line Breaking, Vessel & Equipment Opening Procedure	• Rotoflow Vendor Manual

Safety Equipment
• Safety Glasses
• Cotton Gloves
• Nomex Coveralls
• Rubber Boots
• Ear Plugs

Do These Steps:

1. Obtain Safe Work Permit.
2. Interview the Operator for additional information.
3. Lock, tag out, & disconnect all connected energy sources.

4. Sign on the Safe Work Permit with the assigned unit Operator.

5. Inspect the expander assembly and surrounding area for abnormal conditions.

6. Record all inspection or measurement data on the tear down report (see attachment)

7. Remove the expander assembly covers.

8. Notify the appropriate personnel for expander insulation removal.

9. Remove the bottom insulation retaining plates.

10. Drain the seal oil

11. Bleed any CO pressure from the lines

12. Disconnect the tubing

13. Disconnect the expander assembly flanges/piping.

> **Note:** Use a rope over neighboring piping to lift the discharge flex pipe and provide the clearance for the north end expander assembly.

14. Remove the expander assembly from the base plate.

> **Note 1:** Bolt angle iron to the inlet/discharge flange to attach the rigging.

> **Note 2:** Lift the expander assembly to remove the last bolt

15. Transport expander assembly to the shop.

16. Secure the expander assembly to a work bench.

If:	Then:
A replacement expander is available in the warehouse	Remove the fittings from the defective expander. Install the fittings on the new/rebuilt expander. Proceed to Step 101.
A replacement expander is not available in the warehouse	Proceed to the next step for rebuild/overhaul instructions.

Note 1: The two major components of the expander assembly is the actuator and the expander. During disassembly/reassembly, the steps listed may be performed out of sequence.

Note 2: Use Loctite or stake all bolts during reassembly.

17. Remove the dynamometer impeller cover

18. Remove the o-ring

19. Remove the expander assembly

20. Remove the actuator assembly bolts.

21. Remove the actuator assembly

22. Mount the expander in the vertical position.

Note: A TDA reactor sleeve makes a good mounting frame. The vertical position prevents the shaft from flopping around during the final disassembly.

23. Clean the actuator assembly.

Note: When cleaning any actuator or expander component, use a plant approved solvent. Never use the bead blaster

24. Measure from the top of the labyrinth seal housing and nozzle fix ring (depth micrometer).

25. Remove the labyrinth and nozzle fixed ring.

26. Remove the actuator shaft bolts (4)

27. Remove the actuator pin and the nozzle adjusting ring.

28. Remove the nine nozzle segments.

29. Remove the nozzle fixed ring gasket
30. Remove the Teflon expander seal
31. Inspect for any shims located under the nozzle fixed ring.
32. Clean the nozzle fixed ring components.
33. Inspect the nozzle fixed ring components for surface defects.
34. Polish any pitted segments with 400 emery (if required).
35. Install the labyrinth seal housing into the actuator assembly.
36. Inspect for excessive labyrinth seal housing movement (need interference fit).
37. Install the nine nozzle segments and pin.
38. Inspect the segments for free movement.
39. Install the nozzle adjusting ring and pin.
40. Measure the labyrinth I.D.
41. Measure the expander rotor O.D.
42. Measure the expander rotor TIR
43. Install two new gaskets in the nozzle fixed ring flange.
44. Install a new labyrinth and nozzle fixed ring.
45. Install a new gasket in the actuator shaft mounting plate.
46. Stroke the actuator to the closed position.
47. Install the actuator shaft. (4 bolts)
48. Remove the impeller cover and O-ring.
49. Inspect the dynamometer inlet for wear.
50. Measure the rotor end shaft thrust (.005” to .009”).
51. Measure expander rotor for TIR (labyrinth area) rim check
52. Remove the expander rotor (do not lose the two keys).
53. Inspect rotor for wear.

54. Measure the journal bearing lift (rotor end).

> **Note 1:** .002" is standard, < .002" look for trash, and ≥ .003" replace.

> **Note 2:** Measure the shaft with a micrometer after disassembling expander.

55. Remove the back rotor seal and heat barrier wall.
56. Inspect the heat barrier vent hole for blockage (small hole about 1/32").
57. Separate the back rotor seal from the heat barrier wall.
58. Remove the oil slinger ring.
59. Inspect the o-ring in the oil slinger ring.
60. Remove the dynamometer impeller.
61. Inspect the dynamometer for wear.
62. Measure the bearing lift (dynamometer end).

> **Note:** .002" is standard, < .002" look for trash, and ≥ .003" replace.

63. Match mark the impeller seal (dynamometer end).
64. Remove the impeller seal bolts
65. Jack bolt the impeller seal out.
66. Inspect the impeller seal labyrinth for cleanliness.
67. Remove the bearing thrust ring.

> **Note:** Do not loose the 2 keys during removal.

68. Jack bolt the thrust bearing out.
69. Inspect the thrust bearing for wear and surface defects.
70. Remove the shaft from the bearing housing.
71. Remove the o-ring under the thrust bearing.
72. Inspect the thrust washer and pin for wear.
73. Remove the journal bearing.

74. Clean the journal bearing support.

75. Install the journal bearing and new o-ring (expander rotor end).

Note: Bolts should be finger tight

76. Rotate the housing

77. Install shaft, thrust washer, and pin.

78. | **Note:** Apply a light film of lubricant to the inside fit |
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    Install thrust bearing and new o-ring.

79. Install the impeller seal.

80. Install the heat barrier shield and o-ring.

81. Measure shaft thrust (push shaft toward the dynamometer impeller).

82. Zero the dial indicator and push shaft toward the journal bearing end.

Note: The shaft should jam up against the heat barrier but be able to rotate with a slight bind.

Example: .020" bump (now) with .007" from the measured thrust (above). -.007" .013" difference (allowable is .003" to .005"). Take original .007" + .003" allowable = .010". Have machine shop mill off .008 from heat barrier .013" - .010" = allowable .003".

83. Tighten the journal bearing bolts

84. Remove the impeller seal

85. Install the bearing thrust ring

86. Install the impeller seal

87. Measure the thrust (expander rotor end)

Note: 005" to 009" is the standard allowance for new parts.

88. Install oil slinger

89. Measure ID & OD on the labyrinth and expander rotor (allowable .003" clearance).

Example:

2.754" heat barrier wall (labyrinth)
-2.751" expander rotor
.003" total.

90. Install the heat shield shims

91. Install the dust free seal

92. Loosen bolts on the heat barrier wall.

93. Install expander rotor.

94. Snug the bolts loosely on the heat shield.

95. Rotate the shaft for free movement check.

96. Tighten the heat shield bolts while checking for free shaft movement.

97. Push shaft forward toward the expander rotor.

98. Visually check that the rotor labyrinth in fully inside the back rotor seal.

If:	Then:
Dynometer rotor seal in the heat shield is not fully inside the back rotor seal	Remove the expander rotor and back rotor seal. Shim under the seal. Reinstall components. Check for binding and rotor labyrinth is fully inside.
Rotor labyrinth is fully inside the back rotor seal	Proceed to the next step

99. Measure from the face of the exp. rotor to the face of the journal bearing support.

100. Measure from the face of the labyrinth seal housing to bottom of the nozzle fixed ring.

If:	Then:
Reading <.050”	Remove shims under the nozzle fixed ring.
Reading >.070”	Add shims under the nozzle fixed ring.

2.200” reading from the seal housing to the nozzle fixed ring.
-2.150” reading from the rotor face to the journal bearing support.
.050” difference (acceptable is .050” to .070”).

101. Apply seal tight to the actuator assembly flange face.

102. Install the actuator assembly to the base

103. Install the expander to the actuator assembly.

104. Torque the bolts in a sequential pattern.

105. Check the impeller for free movement while torquing the bolts.

106. Measure clearance between dynamometer inlet and impeller with (.015”) lead wire.

107. Install impeller cover.

108. Tighten impeller cover bolts in a sequential pattern.

109. Remove the impeller cover.

110. Measure the lead wire crush.

Example: If the bump was .007" , add .004" for the required distance. .007" bump. +.004" (need .004" clearance). .011" needed on micrometer reading (lead wire).

If:	Then:
Reading is >.011"	Add shims under the dynamometer impeller inlet. Check wire crush again for .011" reading.
Reading is <.011"	Remove shims under the dynamometer impeller inlet. Check wire crush again for .011" reading.

111. I

112. Install impeller cover.

113. Ensure the cover is positioned correctly for piping connections (align the match marks).

114. Transport expander to the field.

115. Install the expander to the base plate.

116. Connect the expander piping.

117. Install the bottom insulation retaining plates.

118. Notify the appropriate personnel for expander insulation/instrumentation installation.

119. Unlock switch gear.

120. Notify operations to perform an equipment check.

121. Clean the work area.

122. Document the results of this work task into databases in accordance with the general documentation procedure DOC-100.

123. Sign off Safe Work Permit.

The Result Will Be:

The expander is returned to the warehouse as a spare or pump efficiency increased and is ready for operation.

Your Work is Done As Expected When:

- ❑ When DATABASES have been updated.
- ❑ Safe Work Permit is signed off.
- ❑ 24 hours has passed after installation and no leaks are observed.
- ❑ No bearing problems.

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