Repowering Project

CT Lube Oil Flush Procedure

Revision: Draft

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1.0 OBJECTIVE

The objective of this procedure is to provide instruction for the safe and thorough flushing of the CT Lube Oil System. The Gas Turbine, Gas Turbine Generator and support equipment require flushing of their respective Lube Oil, Hydraulic Oil and Trip Oil Circuits to remove contaminants in the field installed inter-connecting piping, and any contaminant in the control internal piping resulting from shipping and storage of this equipment.

Reference Documentation

	ML Num.	Dwg. Num.	Rev.	Description
1.1.1	MLA125	362A1608	---	INST-FLUSHING, GT LO SYS
1.1.2	MLA125	115E6436	B	PP ARR, LUBO FIELD FLUSH
1.1.3	ML 0416	115E2560	A	DIAG, SCHEM PP-Lubricant 0il
1.1.4	ML 0418	115E2560	A	DIAG, SCHEM PP-TRIP OIL
1.1.5	ML 0422	115E1233	B	DIAG, SCHEM PP-FUEL GAS
1.1.6	ML 0434	115E1229	---	DIAG, SCHEM PP-HYD/LIFT
1.1.7	ML 0469	355B7323	A	DIAG, SCHEM PP-IGV
1.1.8	ML 0440	352B4408	C	DIAG, SCHEM PP-LOAD EQUIP
1.1.9	ML 0969	117E3987	C	PP ARR, CONTROL OIL, INT
1.1.10	ML 0905	114E1342	C	PPG, LUBO-FD&DR-1 (0905) 7FA
1.1.11	ML 0906	111E3574	B	PPG, LUBO-FD&DR-1 (0906) 7FA
1.1.12	ML 0907	111E3581	B	PPG, LUBO-FD&DR-1 (0907) 7FA
1.1.13	ML A160	363A4973	B	ACCESSORY MODULE

2.0 SAFETY/ENVIRONMENTAL PRECAUTIONS

2.1 Safety

Equipment to be energized is identified to all site personnel.

All non-essential personnel shall be kept clear of the equipment to be energized.

Follow Black & Veatch Tagging Procedure for clearance permits while conducting the test.

Pump motor amps must be monitored at every change in the flushing circuit to be sure that full load amps are not exceeded.

2.2 Environmental Precautions

Precaution to guard against oil spill associated with oil flushing should include the contact information of cleanup/rescue crews available locally.

3.0 PREREQUSITES

Initials

De-energize tank heaters whenever reservoir is empty. _____

Drain any existing oil and clean reservoir & junction boxes. _____

Verify that the main lubricant oil filters, hydraulic oil filters and "last chance" inline hydraulic filters are installed. _____

If the unit has been stored for more than one year replace the lube oil filters and hydraulic oil filters. _____

Verify lube oil & hydraulic filter transfer valves operate freely. _____

Remove #1 and #2 Bearing feed orifice. _____

Remove and cap the sensing line on the VPR2-1 regulating valve so that it will always be wide open. _____

Remove the regulating orifice (in parallel with VPR2-1) and replace with full area spacer (P71). _____

Approximately 5000 gallons of lube oil will be necessary (to cover the auxiliary lube pump suction (strainer) for the flush. Note that the factory flush oil (and test oil) was Shell VSI 32. A sample of this oil is contained in a bottle secured to the lube oil gauge panel. This is provided so that compatibility checks can be made (by the oil supplier) with the operating oil.

Due to the unavailability of cooling water the lube oil coolers will be temporarily supplied. _____

Functional checkout of lube oil pumps, heaters and calibration of required instrumentation for flush is complete. _____

Align lube oil system valves as required for flush. _____

4.0 PROCEDURE

4.1 Phased Flush Setup (Drawing 115E6436)

Initials

4.1.1 Setup at #1 Bearing (Initial Run, Phase I, Final Run).

4.1.1.1 Remove spools and install bypass hardware-jumper assembly, valve (P35), strainer (P39), shown at Section D-6. _____

4.1.1.2 Open valve (P35). _____

4.1.1.3 Cover the continuation piping to prevent entrance of foreign material. _____

4.1.1.4 Install fabs and strainers (P34, P41, P76, P14) to lift oil lines _____

4.1.2 Setup at #2 Bearing (Initial Run, Phase II, Final Run).

Note: Setup at #2 Bearing will be modified from the A125 instructions.

4.1.2.1 Verify bearing and lift oil supply lines and drain line is clean. _____

4.1.2.2 Cover the continuation piping to prevent entrance of foreign material. _____

4.1.2.3 Modify as required and install at Lube Oil Junction Box #2 strainers to lube feed (P1) and lift lines (P14) per View B-2, D-5. _____

4.1.2.4 Add return cap (P2). _____

4.1.3 Setup at Lube Junction Boxes (see ML 0969).

4.1.3.1 Remove the bearing lift flow control valve and replace with flushing block (P19) at Lube Oil Junction Box #1 per Detail E-1. _____

Initials

4.1.3.2 Remove the bearing lift flow control valve and replace _____

with flushing block (P19) at Lube Oil Junction Box #2 per Detail E-1.

4.1.4 Setup at 7FH2 Generator (Initial Run, Phase III, Final Run).

4.1.4.1 Set aside drain spool (ML 0906) and replace with flush manifold and strainers shown on Detail D-2 and D-7. _____

4.1.4.2 Remove and/or rotate generator lube, lift and seal oil lines and install hose assemblies shown on Sheet 2. _____

4.1.4.3 Route hoses to drain manifold shown on Detail D-2 and D-7. _____

4.1.5 Setup at IGV (Inlet Guide Vane)

4.1.5.1 Remove hydraulic and trip oil spools and drain spools (ML 0969). _____

4.1.5.2 Install jumper assemblies as shown on View A-6 and A-8. _____

4.1.5.3 Connect jumper to NPT connections on drain pipe as shown and cap drain with blank (P16). _____

4.1.6 Hydraulic System/Servo Flushing Blocks.

Note: Trip Oil System will be flushed whenever the lube oil system is running.

4.1.6.1 Remove Fuel Gas Stop Ratio Valve 90SR-1 servo valve and install flushing block, gasket and hardware (P72, P73, P74). _____

4.1.6.2 Remove Fuel Gas Control Valve 65GC-1 servo valve and install flushing block, gasket and hardware (P72, P73, P74). _____

4.1.7 Install temporary side stream filter system. _____

Initials

4.1.8 Fill reservoir. _____

4.1.9 Commission the side stream filter system _____

4.2 Combined Phase Flush

Note: Heating of the flush oil to 160 +/- 5°F is recommended. The full sized auxiliary lube pump must run whenever the heater is on.

Note: Pump motor amps must be monitored at every change in the flushing circuit to be sure that full load amps are not exceeded.

Note: Station Personnel at strategic locations with radios to check for leaks at every change in the flushing circuit.

Note: The system should be walked down periodically during the flush to check for leaks.

4.2.1 Position the main lube oil filter transfer valve in mid position. _____

4.2.2 Align flush jumpers as follows:

4.2.2.1 Turbine #1 Bearing – Open _____

4.2.2.2 Turbine #2 Bearing – Open _____

4.2.2.3 Generator Lube Oil Collector End – Open _____

4.2.2.4 Generator Lube Oil Drive End – Open _____

4.2.2.5 Generator Seal Oil Collector End – Open _____

4.2.2.6 Generator Seal Oil Drive End – Open _____

4.2.3 Run Seal Oil Pump (motor 88QS) for one hour. _____

Note: Start one pump at a time and check for leaks.

Initials

Note: Do not start any Hydraulic Pump without an Auxiliary Lube Oil Pump running.

4.2.4 Engage manual override on the Lift Oil Solenoid to allow lube oil flow to the Lift Oil System. _____

4.2.5 Run both Auxiliary Lube Oil Pumps and one Hydraulic Pump for one hour. _____

4.2.6 Close Turbine #1 Bearing Jumper and run for one hour. _____

4.2.7 Stop the Hydraulic Pump and Close Turbine #2 Bearing Jumper and run for one hour. _____

4.2.8 Open Turbine #1 Bearing Jumper, Close Generator Seal Oil/Lube Oil Drive and Collector End Jumpers, Start a Hydraulic Pump and run for one hour. _____

4.2.9 Open Turbine #2 Bearing Jumper, Open Generator Seal Oil/Lube Oil Drive and Collector End Jumpers and run for one hour. _____

4.3 Phase I Flush

4.3.1 Stop one of the Auxiliary Lube Oil Pumps. _____

4.3.2 Close Turbine #2 Bearing Jumper, Close Generator Seal Oil/Lube Oil Drive and Collector End Jumpers and run for a minimum of 12 hours. _____

4.3.3 Take a sample of the Turbine #1 Bearing and Hydraulic supply lines to 90SR-1, 65GC-1 and IGV. _____

4.3.4 Perform analysis of each sample.

4.3.5 If analysis meets or exceeds the criteria (ISO 4406 or NAS Class 5) of 16/14/11, record results in Section 5, continue with Phase II Flush. _____

Initials

4.3.6 If analysis does not meet the criteria, continue to flush and resample every hour until criteria is met prior to proceeding with Phase II Flush.

4.4 Phase II Flush

4.4.1 Stop the Hydraulic Pump, Open Turbine #2 Bearing and Close Turbine #1 Bearing and run for a minimum of 12 hours _____

4.4.2 Take a sample of the Turbine #2. _____

4.4.3 Perform analysis of sample.

4.4.4 If analysis meets or exceeds the criteria (ISO 4406 or NAS Class 5) of 16/14/11, record results in Section 5, continue with Phase III Flush. _____

4.4.5 If analysis does not meet the criteria, continue to flush and resample every hour until criteria is met prior to proceeding with Phase III Flush.

4.5 Phase III Flush

4.5.1 Open Generator Seal Oil/Lube Oil Drive and Collector End Jumpers, Close Turbine #2 Bearing Jumper, run for a minimum of 12 hours. _____

4.5.2 Take a sample of the Generator Seal Oil/Lube Oil Drive and Collector End. _____

4.5.3 Perform analysis of each sample.

4.5.4 If analysis meets or exceeds the criteria (ISO 4406 or NAS Class 5) of 16/14/11, record results in Section 5, continue with Final Combined Flush. _____

Initials

4.5.5 If analysis does not meet the criteria, continue to flush and resample every hour until criteria is met prior to proceeding with Final Combined Flush.

4.6 Final Combined Flush

4.6.1 Align flush jumpers as follows:

4.6.1.1 Turbine #1 Bearing – Open _____

4.6.1.2 Turbine #2 Bearing – Open _____

4.6.1.3 Generator Lube Oil Collector End – Open _____

4.6.1.4 Generator Lube Oil Drive End – Open _____

4.6.1.5 Generator Seal Oil Collector End – Open _____

4.6.1.6 Generator Seal Oil Drive End – Open _____

4.6.2 Start one Hydraulic Pump. _____

4.6.3 Take a sample of the following:

4.6.3.1 Turbine #1 Bearing _____

4.6.3.2 Turbine #2 Bearing _____

4.6.3.3 Generator Lube Oil Collector End _____

4.6.3.4 Generator Lube Oil Drive End _____

4.6.3.5 Generator Seal Oil Collector End _____

4.6.3.6 Generator Seal Oil Drive End _____

4.6.3.7 90SR-1 _____

Initials

4.6.3.8 65GC-1 _____

4.6.3.9 IGV _____

4.6.4 Perform analysis of each sample.

4.6.5 If analysis meets or exceeds the criteria (ISO 4406 or NAS Class 5) of 16/14/11, record results in Section 5, the flush is complete. _____

4.6.6 If analysis does not meet the criteria, continue to flush and resample every hour until criteria are met.

4.7 Flush Restoration

4.7.1 Pump flush oil to clean temporary holding tank. _____

4.7.2 Remove all flushing hardware - flush hose assemblies, strainers, jumpers, blanks, flushing blocks. _____

4.7.3 Clean the reservoir and interconnecting piping drain system (with lint free rags). _____

4.7.4 Reinstall permanent piping, spools, bearing lift flow control valves, servo valves. _____

4.7.5 Restore VPR2-1 and its sensing line and install regulating orifice. _____

4.7.6 Inspect drain line junction boxes and oil channels for debris and clean. Replace all covers. _____

4.7.7 Restore all piping and hoses to operating condition. Be sure hoses are installed with proper offset. _____

4.7.8 Install new main lube oil filter cartridges. _____

4.7.9 Verify bearing feed orifices in Turbine Bearing #1 and Turbine Bearing #2. _____

Initials

4.7.10 Fill reservoir by filtering oil from temporary holding tank, Fill _____

to operating level with new oil as necessary.

4.7.11 Re-energize tank heaters. _____

4.7.12 Re-energize auxiliary lube oil pump and check for oil leaks. _____

5.0 ACCEPTANCE CRITERIA/DATA SHEETS

Acceptance Criteria for Lube Oil Flush Samples is ISO 4406 16/14/11. This is also equivalent to NAS Class 5.

Flush Phase	Results	Date/ Time	Signature
Phase I Flush			
Turbine #1 Bearing	_____	_____	_____
90SR-1	_____	_____	_____
65GC-1	_____	_____	_____
IGV	_____	_____	_____
Phase II Flush			
Turbine #2 Bearing	_____	_____	_____
Phase III Flush			
Gen. Drive End Lube	_____	_____	_____
Gen. Drive End Seal	_____	_____	_____
Gen. Coll. End Lube	_____	_____	_____
Gen. Coll. End Seal	_____	_____	_____
Final Combined Flush			
Turbine #1 Bearing	_____	_____	_____
Turbine #2 Bearing	_____	_____	_____
Gen. Drive End Lube	_____	_____	_____
Gen. Drive End Seal	_____	_____	_____
Gen. Coll. End Lube	_____	_____	_____
Gen. Coll. End Seal	_____	_____	_____
90SR-1	_____	_____	_____
65GC-1	_____	_____	_____
IGV	_____	_____	_____

6.0 COMMENTS/EXCEPTIONS

This section will be used to note any comments and/or changes and exceptions to the procedure once issued for field use to allow person responsible for performing test to have the latitude to make changes as necessary.