

## **1 WARMING UP**

### 1.1. Day One.

As soon as steam is available from the boiler house, usually early afternoon if the boiler has been started up from cold, set steam PCV at 0.5\_bar and open steam valve S52, at the east end of the camshaft gallery. Crack open valves to HP jacket and bottom cover and fully open valves to IP and LP jackets and both ends of the reheater. Open the LP jacket and IP jacket steam trap bypass valves. Leave at this pressure for rest of day. Close S52 at end of day but leave the other valves as set.

### 1.2. Day Two.

Set steam PCV at 1.0 bar, open S52 and fully open HP jacket and bottom cover valves.

Check jacket steam inlet and condensate outlet temperatures at intervals until the condensate temperature is within 15°C of the steam inlet temperature for each jacket and then close the relevant jacket steam trap bypass valve. If the NE basement sump rumbles and boils, shut the bypass valves. It normally takes **about three hours** for this part of the warming up process.

During this period take the opportunity to blow down each of the four drain pockets on the steam main. This requires a careful opening of each drain valve to flush out any water and dirt in the pockets. The pockets are located at the SE corner of the basement, under the riser to the engine in the basement, downstream of the steam pressure control valve and under the riser to the barring engine.

When both bypass valves are shut and condensate temperatures are acceptable, **close the LP reheater steam inlet valve** and increase steam pressure to 2.0 bars.

As soon as jacket steam and condensate temperatures balance out, probably 45 to 60 minutes, increase steam pressure to 3.0 bars.

Repeat above procedure to 4.0 bars and hold to end of day. Close S52 at the end of the day but leave all other valves as set.

### 1.3. Day Three.

**Make sure that the aquaria feed valves are turned off so that the main oil tank is not drained whilst the engine is warmed up.**

Check that Set the steam pressure at 3.0 bar and open valve S52. As soon as steam and condensate temperatures balance out, increase pressure to 4.0 bar.

When steam and condensate temperatures balance at 4 bars the engine is ready to start.

### 1.4. Day Four etc.

If the engine has been run on the previous day, then open the HP reheater and LP jacket steam valves and proceed as for day three

### 1.5. Valve Locations

The jacket steam valves are all on the north camshaft gallery adjacent to the cylinders which they serve. The steam trap assemblies are on the north reheater gallery and the valves all have descriptive labels on them. The reheater steam valves are at the top each end of the reheater.

## **2 BEFORE STARTING**

- 2.1 Check that steam is set at 4 bars and engine is warmed up. If in doubt, refer to Engine Warm Up for details.
- 2.2 Latch in emergency shut down valve (ESD).
- 2.3. Open steam valve S66 located at east end of reheater gallery.
- 2.4 Lubricate barring engines and run at minimum speed for 10 minutes to warm up. Check that both engines are ready to go. If visitors are present, the barring engines **must be attended at all times when running**.
- 2.5 Turn on oil to main bearings 10 minutes before scheduled start up (15 minutes before first start up of the day). Open the cocks on the feed lines to the aquaria to about three quarters open and check that oil is flowing in. Set the three lower aquarium cocks to give minimum continuous streams of oil. **Do not over lubricate.**
- 2.6 Turn on oil to basement pumps 10 minutes before start up (rack at east end of engine).
- 2.7 Log temperatures of LP bottom end bearing.
- 2.8 Open cylinder drain valves.
- 2.9 Before starting the engine **close the HP reheater steam valve and the LP cylinder jacket steam valve** and leave both closed for the rest of the day.

## **3 STARTING THE ENGINE.**

- 3.1 Check lubes and water are ready.
- 3.2 Sound starter bell. This tells barring engine driver to turn engine.
- 3.2 After at least two turns of engine, open main steam valve fully, preferably just before the start of HP upstroke, and start engine. If it does not start, repeat procedure until it does.
- 3.3 Close cylinder drain valves.
- 3.4 **Watch tachometer, steam pressure into HP cylinder and condenser vacuum.** As the condenser vacuum builds up, steadily close the steam valve to control engine speed within the range 15 to 20 rpm. At this speed the condenser vacuum will settle out above

20ins Hg and steam pressure to the HP cylinder will be about 20psig. **If the engine Exceeds 25rpm, pull the emergency shut down lever to stop the engine.** Then try again.

#### **4 RUNNING**

- 4.1 Speed adjustments are best made by small changes to steam pressure. Turn the steam valve wheel about a quarter turn at a time and wait for one or two minutes for the engine to settle down to a steady speed. Watch the tachometer to check the rate of change of speed and final steady speed. There is significant backlash in the linkage between the handwheel and the steam valve, which can easily be felt, and must be allowed for.
- 4.2 Check that oil is flowing out of all three crosshead overflow pipes. This may take 5 or 10 minutes after starting. If it fails to appear, warn the lubes operator.
- 4.3 Check that the aquaria top tanks have sufficient oil and are not overflowing. Adjust the feed cocks as necessary.
- 4.4 Record bearing temperatures every 30 minutes.
- 4.5 Complete at least one set of log sheet readings for each run.

#### **5 SHUTTING DOWN**

- 5.1 Close main steam valve or pull ESD lever.
- 5.2 Shut off oil to basement pumps.
- 5.3 Shut off oil to main bearings.
- 5.4 At end of day shut valves S52 and S66.
- 5.5 After last steaming of weekend or other running period use barring engine to position IP piston at top dead centre and leave in gear. This is needed to provide access for cleaning the crank drain trays.