Operation and Maintenance

Operation and Precautions

To Start

1. See that circuit breaker and main switch are open.
2. Cut in all resistance in field rheostat.
3. See that the throttle valve is closed and the overspeed trip device is latched in place.
4. Check oil level in reservoir.
5. Drain steam and exhaust piping.
6. Open steam chest and turbine drains.
7. Turn steam on glands.
8. Open exhaust valve wide.
9. Open the throttle valve and bring turbine slowly up to speed, making sure that the governor takes control when normal no load speed is attained. This can be determined by noting the inlet gauge which will drop back when the governor takes over.
10. Make sure that bearings are receiving oil.
11. Close drain lines.
12. Adjust rheostat for normal generator voltage.
13. Connect generator to the line and put on load.

To Parallel

To put machine on the line in parallel with a machine already operating:

1. Bring the machine up to normal speed as described above.
2. While watching the voltmeter, gradually increase the voltage by cutting out resistance in the rheostat until approximately the voltage of the other machine is reached.
3. Throw in circuit breaker.
4. Throw in equalizer switch.
5. Throw in main switches and adjust rheostat until generator takes its proportion of the load.

The proper voltage to obtain before throwing a generator in parallel with others can best be found by trial. It may vary slightly from line voltage, depending on local conditions.

To Shut Down

1. Reduce the load to nearly zero by cutting in resistance with field rheostat.

2. Throw off the load by opening the circuit breaker, then the main generator switch and then the equalizer.

3. Close the turbine throttle valve. (This should be done by tripping the overspeed trip device.)

4. Shut off water to oil cooler.

5. Shut off steam to glands.

6. Clean machine and put it in good order for the next run.

Precautions

1. Always avoid passing steam through the turbine with the rotor at rest. When the throttle and governor valves are closed the drain between them should be open.

2. Avoid letting air be drawn through the glands when the rotor is at rest.

3. At regular intervals, say once a month, inspect the overspeed trip device and make sure that it works freely.

4. Keep the throttle and governor valve stems clean and free from corrosion. Do not paint these stems.

5. Keep oil level in reservoir between the indicated limits.

6. Keep oil strainer clean.

7. Keep oil cooler clean.

8. Leave all switches open when machine is not running.

9. At the least sign of trouble, stop the machine immediately. Investigate and correct the trouble before again operating.

Inspection

About once a year, or when the ship is drydocked, the unit should be dismantled and thoroughly inspected and cleaned. Erosion of blades, nozzles and valves, wear of bearings and changes in clearances are the main points for which to look. The gearcase cover should be lifted and the gear teeth inspected. If the gear tooth contact is not well distributed over the tooth surfaces, the alignment of the unit should be checked.

The oil cooler and strainer, and the steam strainer should be cleaned and the oil piping disconnected, thoroughly washed and blown out with compressed air. When reassembling, joints should be cleaned and made up with a light coat of shellac. The correct running clearances are shown on a separate data sheet.

MAINTENANCE

Lifting Gear

A lifting gear of welded pipe is provided for raising the cylinder cover. The lifting bolt holes are accessible through holes in the lagging.

The lifting gear consists of a horizontal pipe welded to two vertical pieces of unequal lengths. The lifting bolts are to be inserted through the vertical legs and screwed into the lifting bolt holes until they are pulled up solid. The shorter leg is for the exhaust end and the longer leg for the steam chest end of the cylinder. The cover is then raised by using a sling on the ends of the horizontal pipe member.

For lifting the rotor out of the cylinder base, two slings should be used with a spreader of timber between them over the tips of the rotor blades to prevent damage to the latter.

Lubricating Oil

The oiling system should be filled with a pure mineral oil having a Saybolt viscosity of approximately 130 seconds at 130 deg. F. The importance of using high grade oil, free from acid and animal or vegetable oil compounds, cannot be over-emphasized.

The oil reservoir is located inside the bedplate and is a rectangular fabricated tank. The oil strainer is of the plate type mounted in the reservoir with access from above. An oil level indicator is provided, fitted in a sounding tube in the reservoir, by means of which the oil level may be checked by withdrawing the rod, wiping it clean and then sounding the tank. Minimum and maximum level marks are stamped on the rod. The reservoir holds 15 gals. at minimum level and 19-1/2 gals. at maximum level. The capacity of the system including piping, at maximum reservoir level, is approximately 21 gals.

PIPE CONNECTIONS

The steam pipe connected to the turbine must not be rigid, as it may move the unit out of alignment or distort the turbine casing. It should be fitted with long radius bends, and should be supported at a point near the turbine. In making this connection, never spring the pipe into place. The flanges must be parallel and concentric.

The exhaust line should have a flexible expansion joint close to the turbine, preferably at the turbine exhaust flange. The exhaust pipe should be supported just beyond the expansion joint to prevent the weight damaging the expansion joint or the turbine.

Before finally connecting the steam pipe to the turbine, the line should be thoroughly blown out with high pressure steam to remove any foreign particles such as dirt, scale, pipe joint compound, etc., which if carried into the turbine might prevent the closing of the governor valve and cause overspeeding, or stop up part of the nozzle throat, thus reducing the capacity and efficiency of the unit.

Wet steam is objectionable as it causes much more rapid erosion of the blades and nozzles than dry steam. It also reduces both efficiency and capacity of the unit. Slugs of water, whether from priming of the boilers or the picking up of condensation in the pipe line, if carried through the turbine, cause serious shocks, vibration and speed fluctuation. If the pipe connections are such as to allow condensation to collect in the turbine or steam pipe, drains must be installed for use when starting up.

ALIGNMENT OF UNIT

The first step in the alignment of the unit is that of adjusting the seating of the bedplate so that the finished surfaces of the top will lie in a plane. For convenience in checking this, six aligning blocks or

lugs are welded to the bedplate, three on either side and their upper surfaces were machined in the shop so that they all lie in the same plane.

Therefore, in order to bring the top surface into one plane, the bedplate should be supported at the four corners and at either side in way of the gear and the shims should be adjusted so that a straight edge laid across the lugs on either side touches all three. At the same time the two sides must be checked to see that they have the same inclination, i.e., that the bedplate is not warped cornerwise. This can readily be done with a sensitive level and a block gauge, transferring the level from side to side and adjusting shims until the readings agree. When the bedplate had thus carefully been aligned in the shop, the turbine gear and generator were accurately lined up. Hence, if the bedplate is thus checked up and made true, it is not expected that any change will be found to have taken place in the alignment of the unit as established in the shop. However, this may be checked as follows:

Having determined that the top of the bedplate is a plane surface, the turbine should be bolted down and the gear aligned to it and then the generator aligned to the gear. The turbine and gear are connected by means of a "Fast" coupling and brief instructions for its alignment will be found on a separate instruction leaflet shipped with the unit.

In checking the alignment of the generator and gear the following method should be used:

With the gear case cover and the top halves of the gear bearings removed, clamp the gear journals down tight in the bearings and set a dial indicator on each journal. Unbolt the generator flange coupling and move the generator half back sufficiently to have about 1/32-inch opening between the flanges and letting the generator shaft hang on the spigot fit. Care should, of course, be taken not to move the generator rotor far enough to let it come off the spigot which is 1/4" deep.

With the unit in this condition, feeler gauge measurements at top and bottom of the coupling should show a slightly larger reading at the bottom, the amount varying with the size and type of generator up to .008 or more.

After noting the amount of the difference, bolt up the coupling and set the dial indicators at zero. Now loosen the clamp on the generator end journal. It should rise in the bearing not more than 3/4 of a thousandth (elasticity of the bearing). Next reclamp this journal and slack off the other. It also should rise not over 3/4 of a thousandth. Then remove both clamps and both journals should rise an equal amount.

If the journal movements are not equal the generator outboard pedestal should be raised or lowered a slight amount until equal journal movements are obtained.

This method of alignment takes account of the flexibility of the generator shaft and produces proper running alignment. It is a practical approximation of a theoretically more accurate method, not readily applicable in the field, but a large number of comparative tests in the shop have shown the method above described to be adequate to produce excellent results.

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