

## CHAPTER 3

### PREPARATION FOR STARTING

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**1 GENERAL**

The following preparations are normally carried out after an period of inactivity of the unit where:

The control power has been interrupted, but, it is not necessary to carry out the full inspection of the control equipment cabinets as the internal switches have not been disturbed

or

The checks with regard to internal switching of the cabinets have been carried out, in line with the procedures in the previous Chapter, at the time of initial commissioning or after a major service interval.

The preparations are carried out initially at the Local Control Room and apply equally to a local or remote start for the gas turbine generator unit. Working systematically through the controls at each cabinet before moving to the next will avoid errors and omissions caused by haphazard setting of controls.

Prior to starting the Gas Turbine/Generator unit from the Remote Control Console (or other remote) preparation for starting (and the pre-start checks in the next Chapter) have to be completed in the Local Control Room.

**2 LOCAL CONTROL ROOM**

1. Check that the MODE SELECTOR SWITCH on the Turbine Control Panel is set to the 'Off' position. The selection of an alternative position, at this stage of preparation, may cause functions to become operational when connecting power to the respective control circuits.
2. Where necessary restore power from the 110 v dc and/or 220 v ac Distribution Panels.
3. Where the power is being restored to the Computer Units - unlatch and swing out the Turbine Control Panel.
  - » Close the Miniature Circuit-breakers mounted in the enclosure interior including those for incoming power supplies.
  - » Observe that the Video Display Unit is functioning and that the 'Computer Power Fail Shut-down' Indicator Lamp on the Turbine Control Panel is not illuminated.
  - » Withdraw the Keyboard Draw at the front of the Turbine Control Panel. Observe the 'Main Menu' Screen is displayed and easily read in the ambient light conditions.
  - » If the screen is not easily discernible the screen Brightness and/or Contrast Controls require adjustment. These controls are at the left-hand side of the Video Display Unit when viewed from the rear.
3. Close and secure the Turbine Control Panel
4. If not previously withdrawn, during operation 3 above, pull out the Configuration Keyboard Drawer. Select the CONTROL FUNCTIONS Screen by depressing the 'F' Key on the Configuration Keyboard.
5. When the screen display changes depress the DOWN ARROW Key three times to move the screen cursor to alongside the LAMP TEST indication. Depress and hold down the Enter Key and observe that the LAMP TEST item on the screen changes to a yellow colour and all the indicator lamps on the Turbine Control Panel and Vibration Monitor Unit illuminate.

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6. Release the ENTER Key on the Configuration Keyboard to cancel the lamp test; and observe that all indicator lamps on the Turbine Control Panel and Vibration Monitor Unit are extinguished. Power indications on the Vibration Monitor Unit will remain illuminated but all other indicators should extinguish.
7. If indications other than those above are given investigate the cause and rectify. After carrying out corrective action again carry out the above procedure (4 & 5) and confirm the indications are correct.
8. Depress the LAMP TEST Switch on the Generator Control Cabinet front left-hand panel. Observe all the Indicator Lamps on that panel illuminate.

Release the LAMP TEST Switch and observe that the GENERATOR and EXCITATION FIELD CIRCUIT-BREAKER OPEN Indicator Lamps on the Generator Control Cabinet front panel are illuminated.

9. Set the MODE SELECTOR Switch on the Generator Control Cabinet to the desired position; that is:
  - » Automatic For automatic synchronization.
  - » Manual For Operator control of synchronization.
  - » Test For testing of the synchronising process, but the actual closing of the Circuit-breaker is inhibited.

**NOTE:** Where operation is to be controlled from the Remote Terminals this switch has to set to the 'Automatic' mode. This is to enable generator synchronization to take place and the Generator Circuit-breaker closed without the intervention of the Operator.

10. Check that all the respective Circuit-breaker Switches on the Motor Control Centre panels are set to the 'On' position.

**NOTE:** The following functions carried out from the Operator Interface on the Turbine Control Panel may equally be carried out from the Remote Terminal in exactly the same manner. To enable this to be carried out the MODE SECTOR Switch on the Turbine Control Panel has to be set to the 'Remote' position and the Remote Terminal switched on and the 'Control Functions Screen' of the operating software accessed.

11. Return to the Turbine Control Cabinet and observe that the CONTROL FUNCTIONS Screen is still displayed. The operator interface may be used to select which Hydraulic Pump is to be the MAIN pump, (P4200) 'A' or 'B'. The pump that is not selected as the MAIN pump is defined as the STANDBY or BACKUP pump. This selection feature allows the operator to equalize running time on both pumps.
12. The operator interface may also be used to select which generator lubrication oil pump is selected to be the MAIN pump, 'A' (P4438) or 'B' (P4457). The pump that is not selected as the MAIN pump is defined as the STANDBY or BACKUP pump. This selection feature allows the operator to equalize running time on both pumps.

**Note:** The logic for both of the above systems in 11 & 13 are similar. Although it is recommended that the selection of which pump is to be the MAIN pump be done prior to starting of the turbine, it is acceptable to make or change this selection at any time, even with the unit running.

The logic provides for the necessary interlocks and time delays (adjustable) for an orderly switch over without adversely affecting the unit operation. It is necessary, however, for the associated time delays to be correctly set. If the selected MAIN Pump does not provide the necessary system pressure or flow, as sensed by associated sensing devices (pressure switches, etc.) the STANDBY Pump will automatically come on thereby allowing the turbine unit to continue to run. The failure of the MAIN Pump will be annunciated.

13. The KW controller can be selected for enable or disable. In the disable mode of operation, the load on the generator must be manually adjusted by using the Power Turbine (N2) Speed Raise and Lower operator interface selectors. With the KW controller enabled, a KW setpoint is supplied to the Fuel Control Computer via the modbus. When the Generator Circuit-breaker closes the load on the machine is automatically adjusted to this setpoint.

**NOTE:** Note that the KW controller has no effect on the unit until the Generator Circuit-breaker is closed.

14. The Power Factor Controller can be selected for enable or disable. In the disable mode of operation, the power factor of the generator is manually adjusted by using the Power Factor Raise/Lower inputs on the operator interface screen. In the enable mode of operation, the power factor of the generator is automatically adjusted to a setpoint that is transmitted via the modbus to the Control Panel.

The control of generator Power Factor can be accomplished after the Generator Circuit-breaker is closed. Before the Generator Circuit-breaker is closed, regardless of whether the power factor controller is enabled or disabled, the generator voltage is adjusted by using the Power Factor Raise/Lower operator interface points. When the Generator Circuit-breaker closes and the Power Factor Controller is enabled, the manual raise/lower of power factor is inhibited and power factor is automatically controlled.

15. The Steam Injection System (STIG) can be selected for enable or disable. The Steam Injection system will not begin operation immediately. The Steam Injection system is sequenced into operation as an integral part of the gas turbine start sequence. All necessary interlocks and their functions are incorporated into the software logic.
16. The NO<sub>x</sub> Controller can be selected for enable or disable. The NO<sub>x</sub> Controller is used in conjunction with the steam injection system. When the Controller is disabled, the steam flow setpoint to the Governor is controlled manually by using the Raise/Lower Steam Ratio operator interface points. In the enable mode of operation, the steam flow to the turbine is controlled by a remote setpoint via the modbus.
17. The Turbine Inlet Heater can be selected for enable or disable. In the enable mode the operation of the Inlet Heater will be automatically activated as required. In the disable mode an alarm will be annunciated on the video display when the heater is required for operation.
18. The MODE SELECTOR Switch on the Turbine Control Panel may be set to the 'Remote' position if it is desired to start the Turbine/Generator Unit from the Remote Terminal or the remote Main Computer.

### 3 REMOTE TERMINAL

Even where it is intended to operate the Turbine/Generator Unit from the Local Control Room it is necessary to activate the Remote Terminal for where the Data Logger functions are required.

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To enable operation of the Gas Turbine/Generator Unit from this terminal and/or enable the operation of the Data Logger proceed as follows:-

1. Switch on the Data Logger Printer and Print Buffer and observe that the respective Power Indicators Illuminate.
2. Switch on the Remote Terminal and observe that the Power Indicators on the Central Processor Unit and the Monitor illuminate. If the Power Indicator on the Monitor does not illuminate turn on the Monitor using the 'On/Off' Switch on the monitor.

**NOTE:** The monitor may normally be left with it's 'On/Off' Switch in the 'On' position as the main power is controlled by the 'On/Off' Switch in the Central Processor unit.

3. Observe that there are no error messages displayed on the terminal screen during the 'boot-up' of the Remote Terminal.
4. When the MAIN MENU Screen has appeared on the display screen check the screen for clarity under the ambient light conditions. Adjust the Monitor's Brightness and Contrast Controls if required to improve readability.
5. To enable the Data Logger depress the 'H' Key on the terminal Keyboard to call the ANALOGUE HISTORY SET-UP Screen to the display. Where it is required to change a value select the item with the screen cursor and enter from the Terminal Keyboard the desired values for samples; intervals and the start time for commencing the print-out.
6. Set the required print and Data Logger operations to enable or disable by selecting the item with the screen cursor and depressing the 'Y' Key, on the Keyboard, for 'Enable' or the 'N' Key for 'Disable'.
7. Check that there is sufficient fan fold paper for the desired print output and that it is correctly fed through the printer.

The Gas Turbine/Generator is now ready for starting from the selected Control Console.