CHAPTER 2

TURBINE CONTROL CABINET

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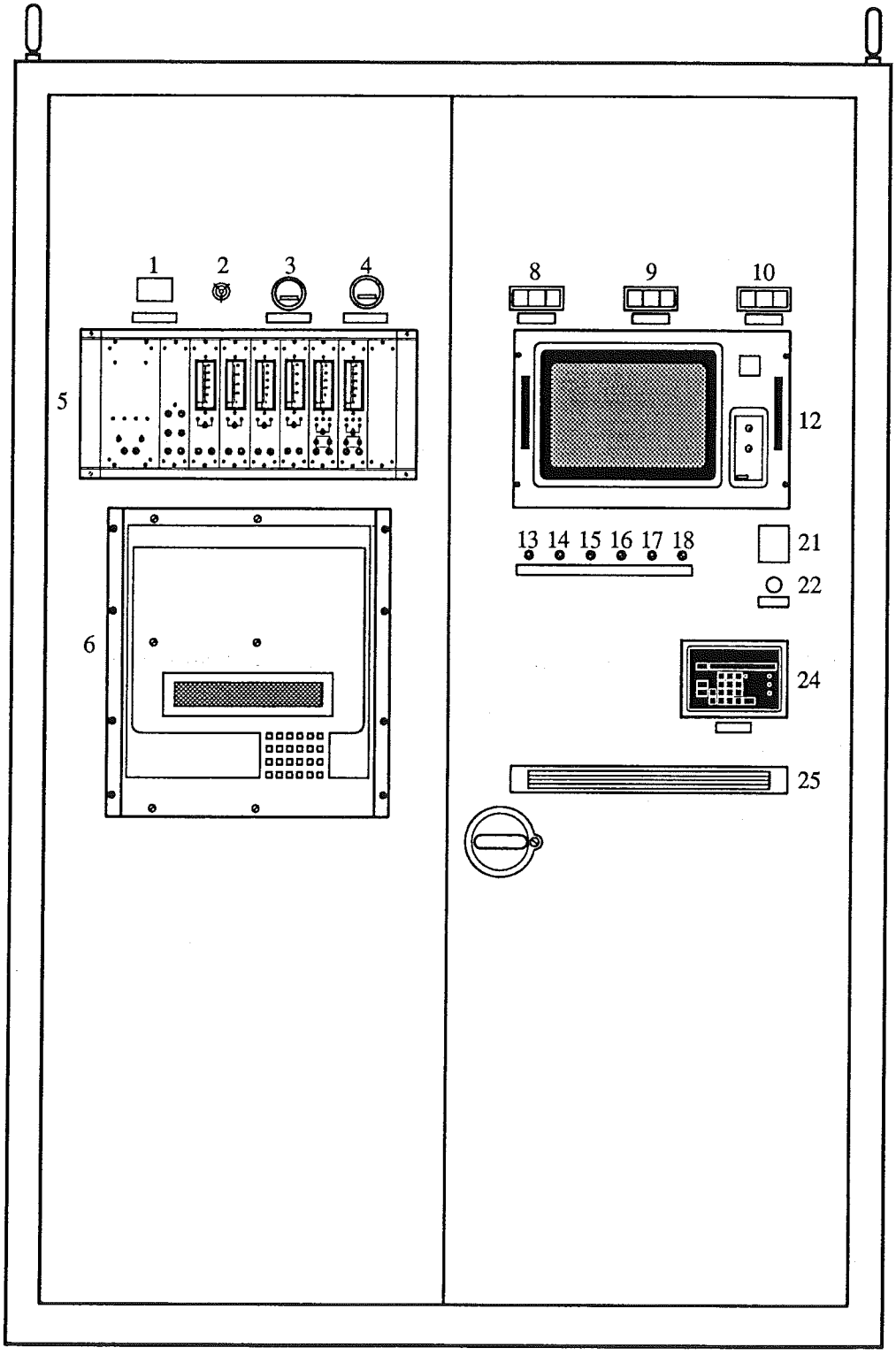

Figure 2.1 - Turbine Control Panels

1 GENERAL

The Turbine Control Cabinet, for the Gas Turbine/Generator Unit, is located in the local control room. The alphanumeric codes in parentheses "( )" following the descriptive titles refer to the Figures, representing the front panels of the Turbine Control Cabinet, opposite the descriptions. The actual Dutch labels appearing on the respective components are given in the "{ }" brackets to avoid any potential translation errors.

2 METERS AND COUNTERS

START COUNTER {TELLER AANTAL STARTS} (1)
This recording instrument indicates the total number of times that the gas turbine has been started. An attempted start, where the exhaust gas temperature does not reach 204°C, will not be registered by the counter.

RUNNING TIME METER {BEDRYFSUREN TELLER} (3)
This instrument records the total gas turbine running time. The hours are recorded by a digital counter and the minutes by an analogue scale.

PEAK RUNNING TIME METER {BEDRYFSUREN PIEKBEDRYF} (4)
This instrument records the total of the time that the gas turbine is running with the exhaust gas temperature above 822.2°C. The hours are recorded by a digital counter and the minutes by an analogue scale.

GAS GENERATOR SPEED {TOERENTAL GG (N1)} (8)
This is a five digit digital indicator, continuously displaying the rotational speed (RPM) of the gas turbine gas generator rotor, as detected by a magnetic pick-up.

POWER TURBINE SPEED {TOERENTAL PT (N2)} (9)
This is a five digit digital indicator, continuously displaying the rotational speed (RPM) of the gas turbine power turbine rotor (and directly driven generator), as detected by a magnetic pick-up.

POWER TURBINE INLET TEMPERATURE (AVERAGE) {?????????????} (10)
This is a five digit digital indicator, continuously displaying the temperature (°C) of the gases exiting from the gas generator power turbine. The reading is the mean level obtained from thermocouples equispaced around the turbine.

3 INDICATORS

The Turbine Control Panel contains 6 red indicator lamps. In addition an audible warning horn (2) is provided to sound at the same time as a visual alarm is given.

These red lamps indicated that a parameter has exceeded a preset limit, or an action has been taken which requires immediate automatic shut-down of the turbine.

All indicator lamps may be tested for operation by the Operator selecting the 'LAMP TEST' item on the 'CONTROL FUNCTIONS' menu screen on the Video Display and depressing the 'Enter' key on the Control Keyboard.

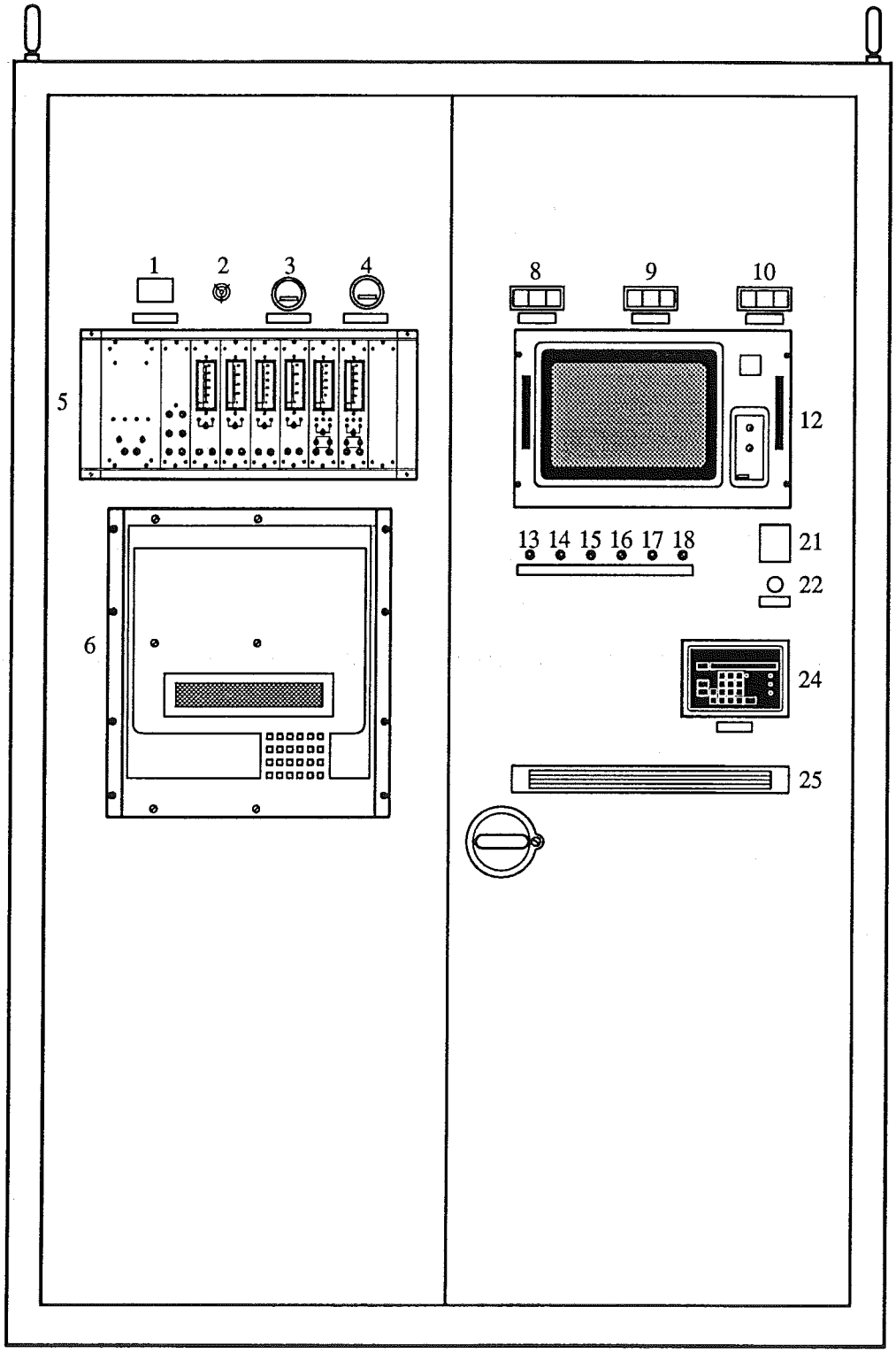

Figure 2.1 - Turbine Control Panel

3.1 INDICATOR LAMPS

COMPUTER WATCHDOG TIMER TIMEDOUT SHUT-DOWN {WATCHDOG TIMER} (13)
This red indicator, when illuminated, informs that the computer watchdog timer has timed-out. The watchdog timer monitors the computer for correct operation. A Turbine Generator/Unit shut-down has been initiated.

COMPUTER POWER FAIL SHUTDOWN {VOEDINGSSPANNING UITVAL} (14)
This red indicator, when illuminated, informs that the power supply to the Central Processor Unit (CPU) has failed, or a momentary failure has also had the effect of cancelling the operating sequence in effect at the time. A Turbine Generator/Unit shut-down has been initiated.

SWITCH I/O CHASSIS RESPONSE FAIL SHUT-DOWN {UITVAL DIG. I/O REK} (15)
This red indicator, when illuminated, informs that the communication between the computer chassis and the discrete input and output chassis has failed. A Turbine/Generator Unit shut-down has been initiated.

ANALOGUE CHASSIS RESPONSE FAIL SHUT-DOWN {UITVAL ANALOOG REK} (16)
This red indicator, when illuminated, informs that the communication between the computer chassis and the analogue chassis has failed. A Turbine/Generator Unit shut-down has been initiated.

LIMITS MEMORY FAIL SHUT-DOWN {MEMORY TEST DITRONIC} (17)
This red indicator, when illuminated, informs that the checksum calculated by the computer does not match the EEPROM checksum. A Turbine/Generator Unit shut-down has been initiated.

GG OR PT (GAS GENERATOR/POWER TURBINE) BACKUP OVERSPEED SHUTDOWN {GT/PT OVERTOERENTAL BEVEILIGING} (18)
This red indicator, when illuminated, informs that the Gas Generator or Power Turbine backup speed detection system is registering an excessive speed condition. A Turbine/Generator Unit shut-down has been initiated.

3.2 AUDIBLE WARNING

HORN (2)
This horn will sound when an alarm or shut-down indication is given by the Control System, whilst operating the turbine in 'local' mode. The horn can be silenced by the operator acknowledging the alarm. This is achieved by the Operator selecting the 'ACKNOWLEDGE' item on the 'CONTROL FUNCTIONS' menu screen on the Video Display and depressing the 'Enter' key on the Control Keyboard.

When operating the turbine in 'remote' mode, from the Central Control Room, the horn is inhibited and will not sound when an alarm is given.

3.3 VIDEO DISPLAY UNIT (12)

The video display unit is a Cathode Ray Tube (CRT) used to display operating 'menus' and messages on the performance of the Gas Turbine Unit. The messages are grouped in 'Pages' and the required information group can be called up using the CONFIGURATION KEYBOARD (25).

Refer to Chapter 3, of this Part of the Operating manual, for a description of this Video Display and the Configuration Keyboard.

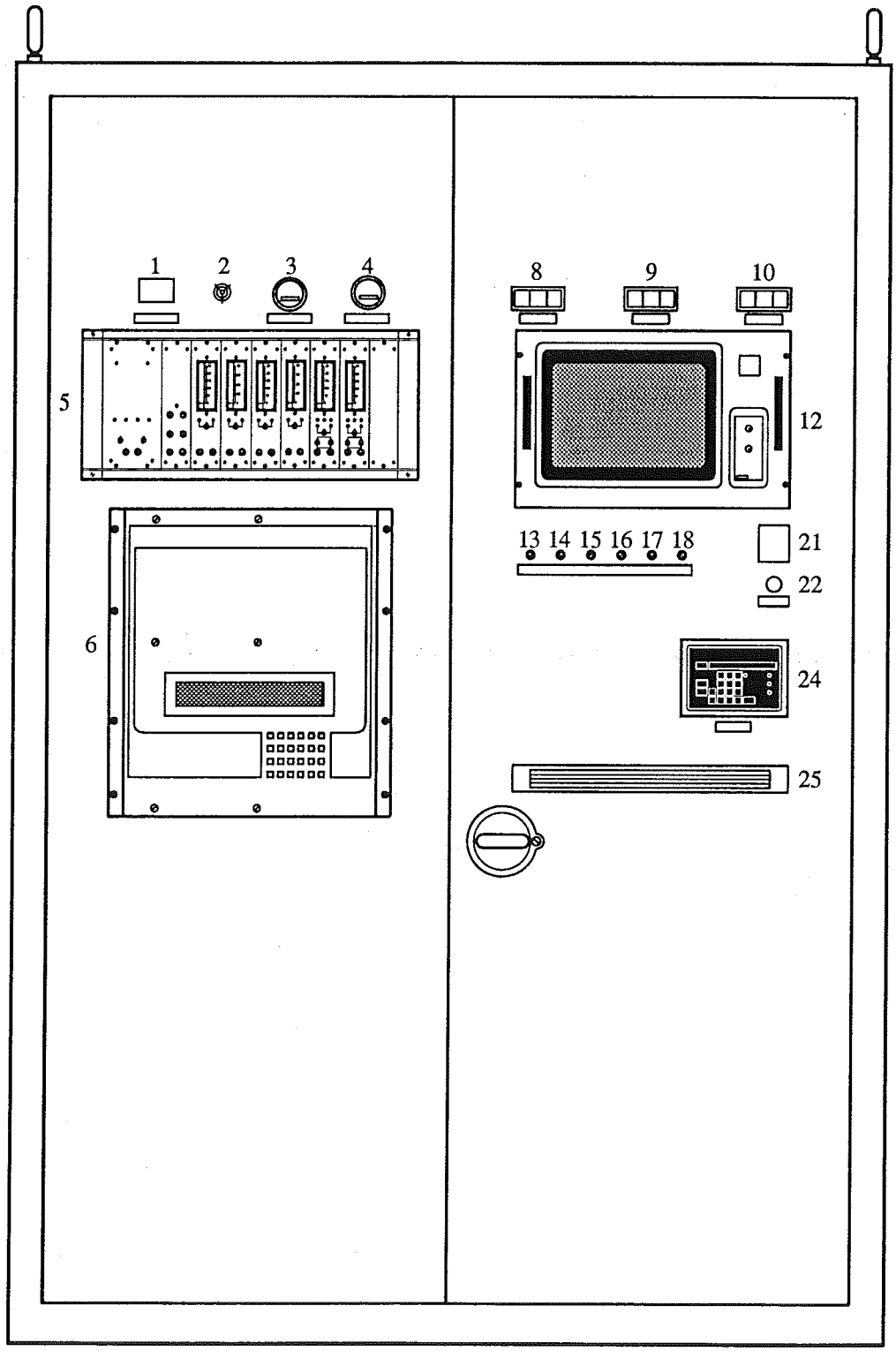

Figure 2.1 - Turbine Control Panel

4 SWITCHES AND CONTROLS

MODE SELECT {MODE SELECTIE} (21)
This four-position rotary-switch enables the operator to select the mode of operation for the turbine generator unit.

The modes that can be selected are as follows:-

A Off {UIT} In this position the turbine cannot be operated either from this panel or remotely.

B Manual Crank {MANUAL CRANK} In this position the gas turbine may be cranked by the starter system, without the fuel or ignition systems being activated. The operation of the MANUAL CRANK switch (11) will only activate the starting system when this MODE switch is at this setting.

C UCP Remote Control {REMOTE BEDENING} In this position the gas turbine may be operated by signals from the Remote Control Terminal or other remote source.

D UCP Local Control {LOCALE BEDENING} In this position the gas turbine can be operated from this Local Control Panel.

EMERGENCY STOP {NOODSTOP} (22)
This push-button switch will initiate an emergency stop for the Gas Turbine and Generator. All systems will come to a rapid stop without off-load or cooling-down periods.

NOTE: This control should only be used in the event of an actual emergency. It's use under normal circumstances should be strictly prohibited. Shutting-down the systems directly from load may have detrimental effect on components. Any warranty currently in force on the installation or components may be invalidated.

5 VIBRATION MONITOR UNIT {TRILLINGS MONITOR} (5)

The Vibration Monitor Unit is of modular construction mounted within a pull-out chassis. The end panel of each unit (card) is visible to the Operator with, where provided, visual indicators to display the operational condition of the system.

Refer to Chapter 4, of this Part of the Operating Manual, for a description of the Vibration Monitor Unit operator facilities.

6 FUEL CONTROL UNIT (6)

The Fuel Control Unit is mounted within the left-hand cabinet door. The unit controls the quantity of fuel delivered by the Fuel Metering Valve in response to the monitored turbine operating conditions and the load demands.

Refer to Chapter 5, of this Part of this Operating manual, for a description of the Fuel Control Unit operator facilities.

7 STEAM FLOW COMPUTER {MASSFLOW COMPUTER STOOM} (24)

The Steam Flow Computer Unit is mounted within the right-hand cabinet door. The unit controls the quantity of steam delivered by the Steam Metering Valve, whilst the steam injection system is activated, in response to the monitored turbine operating conditions and the load demands.

Refer to Chapter 6, of this Part of the Operating manual, for a description of the Steam Flow Computer Unit operator facilities.

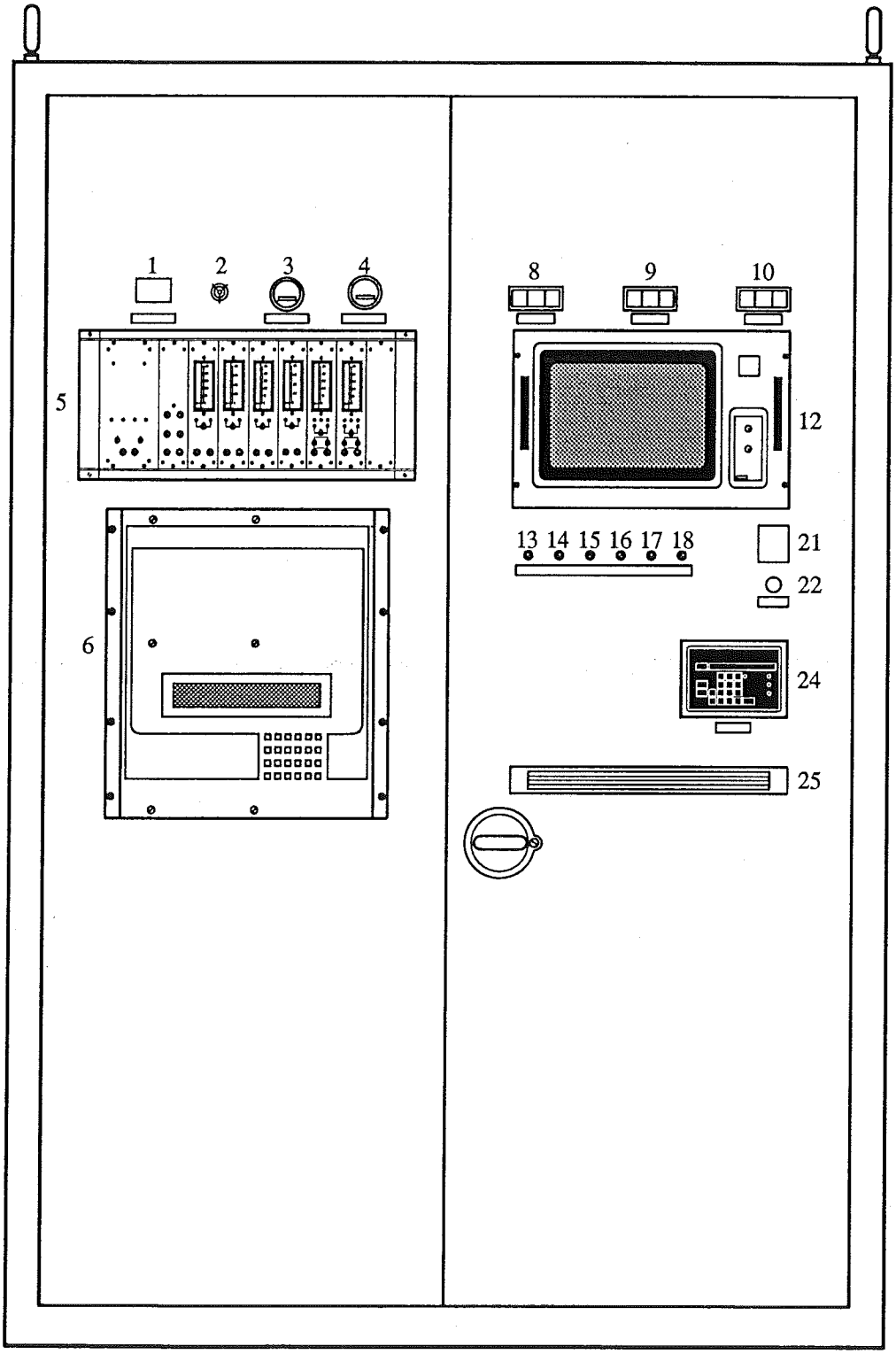

Figure 2.1 - Turbine Control Panel

8 CONFIGURATION KEYBOARD (25)

The keyboard is used to 'call-up' the required information display on the Video Display Unit (4). The Keyboard is of a conventional computer terminal type having alphanumeric, numeric and cursor keypads and additional special function keys.

The keyboard is mounted in a lockable pull-out draw; that enables it to be stowed when the turbine is being operated from the 'remote' terminal. A stowed keyboard will provide an additional precaution against accidental local operation of the unit during maintenance periods.

Refer to Chapter 3, of this Part of the Operating manual, for a description of the usage of this Configuration Keyboard in conjunction with the Video Display Unit.

9 FACILITIES WITHIN THE CABINET

Mounted within the Turbine Control Cabinet are various components that contain switches or indications of operating conditions that may require setting during the 'Pre-start Checks' by the Operator during preparation for initial operation at installation or after a maintenance interval.

WARNING: It is necessary to unlock and swing open the cabinet doors to gain access to the interior of the cabinet. Therefore all precautions with regard to electrical safety should be taken and only those personnel that are suitably qualified should be allowed access within the cabinets.

Most operator functions within the cabinet are accessed by opening the right-hand cabinet door.

Those interior items include the following:-

COMPUTER RESET PUSH-BUTTON
This push-button is mounted on the video display unit support bracket. This push-button must be used any time the panel is initially energized or when there is a computer failure. All other times, the acknowledge and reset function should be initiated from the operator interface screen.

24 VOLT DC/120 VOLT 60Hz INVERTER
This inverter unit is bracket mounted on the inside of the right-hand wall of the cabinet. The power output is for the operation of the Central Processor Unit; Video Display Unit; Remote Terminal and Data Logger Printer. On the front face of this unit are:-

On/Off Switch — This rocker switch is the On - Off switch for this unit.

Indicator Lamp — This red indicator lamp will be illuminated whilst the inverter unit is active.

POWER OUTLET STRIP
This power outlet strip for the 120 Volt 60 Hz power outlets for the control computer systems. An On/Off Rocker Switch on the strip contains a neon indicator that will illuminate whilst the power is supplied to the six sockets on the strip.

CENTRAL PROCESSOR UNIT
This industrial duty computer central processor unit is swing-bracket mounted to the inside of the right-hand wall of the cabinet. This processor unit and operating software provide the operator's interface to the monitoring and control system bus computer.

On the front face of this unit are:-

Power Switch — This key operated switch controls the power supply unit of this processor unit.

HD Indicator — This amber indicator lamp will illuminate whilst the hard disk unit within this processor is active in reading (or writing) files.

Run Indicator — This green indicator lamp will pulse whilst the processor unit is performing functions.

BBU Indicator — This amber indicator lamp will illuminate whilst the power is supplied from an internal 12 Volt dc battery back-up system. This will enable the unit to continue functioning during short-term input power failures up to a few minutes in duration.

PWR Indicator — This red indicator lamp will illuminate whilst the power switch is 'On' and the unit is available for operation.

Floppy Disk — The $3^1/_2$" floppy disk drive unit is located behind a lockable panel to prevent unauthorised access. Also located behind this panel is a 'Reset' Switch that provides the following functions:

» Resetting the Central Processor Unit. This 'soft boot' resets the computer in a similar manner to powering up but bypasses the internal system checks.

» Ressetting the power alarm that will be tripped by loss of input power from the inverter unit.

ALTERNATING CURRENT BREAKER BOX

This unit is mounted on the inside of the right-hand wall of the cabinet. Four automatic cut-out fuse single-pole switches control the distribution of 220 Volt ac power input from a customer supply. Four output circuits, each with the fuse rated at 15 Ampere, provide protection for the following circuits.

» Heaters [ACB-1] The thermostatically controlled Cabinet Heater Circuit.

» Recepticle [ACB-2] The power outlet socket mounted within the cabinet.

» Spare [ACB-3] This circuit is not utilised at the time of installation.

» Ignitors [ACB-4] This circuit provides the power to the step-down transformer for the gas turbine ignitor systems.

MAIN CIRCUIT-BREAKER [DCB]

This unit is mounted on the rear wall of the cabinet. A two-pole automatic cut-out fuse switch controls the feed of the 24 Volt dc control power to the Breaker Box. The fuse is rated at 50 Ampere.

VOLTAGE CONTROL PANEL

This unit is mounted on the inside of the rear wall of the cabinet. Nine automatic cut-out fuse double-pole switches control the distribution of 24 Volt dc power control power to the following circuits.

» Digital I/O [DCB-1] Power to Internal Switch Input; Switch Output and Watchdog Memory Cards. Also relays and panel indicator lamps. Fuse rated at 10 Ampere.

» Field I/O [DCB-2] Power to Field Switch Input; Switch Output Cards. Fuse rated at 20 Ampere.

» Analogue Power Supply [DCB-3] Power to Converters for outputs to the Analogue Chassis of 5, 15 and 24 Volt dc. Fuse rated at 20 Ampere.

» Computer Digital I/O CRT Power Supplies [DCB-4] Power to Converters for outputs to the Computer Chassis of 5, ±12 Volt dc. Also to Watchdog Memory Card and the Inverter for the 120 Volt 60 Hz power system. Fuse rated at 20 Ampere.

» Woodward Fuel Control [DCB-5] Power to the Woodward Fuel Control Unit. Fuse rated at 10 Ampere.

» Bently-Nevada Vibration Monitor [DCB-6] Power to the Bently-Nevada Vibration Monitor Unit. Fuse rated at 10 Ampere.

» Control Outputs [DCB-7] Power to the mechanical systems control valve solenoid circuits. Fuse rated at 20 Ampere.

» Starter Speed/ Backup Overspeed/ Flow Computer/ RS232 [DCB-8] Power to the Hydraulic Starter Speed Control Card; Gas Generator and Power Turbine Overspeed Switches; Steam Flow Computer and RS232 Switching/Isolation Card. Fuse rated at 10 Ampere.

» Terminal Rack [DCB-9] Power to the Terminal Rack that is connected to Terminal Strip XL10. Fuse rated at 10 Ampere.