INTEGRATED SYSTEM OF GENERATION-PROPULSION
SECTION ELECTRIC GENERATION
Mod. PGP-1/EV

TRAINING PROGRAM:

- Example of an Integrated System of Generation-Propulsion: description of the electrical installation of an oil rig.
- Electrical installations in hazardous areas with risk of explosion
- Electric power generation:
  - motor-alternator sets used in the Integrated Systems of Generation-Propulsion
  - study of 3-phase brushless alternators
  - devices for controlling and regulating the output voltage
  - devices for controlling and regulating the reactive power and sharing of this power when the machines run in parallel
  - electronic relay for protection against overloads. Setting the relay parameters
  - electronic relay for protection against the max/min limits of the output voltage. Setting the relay parameters. Relation with alternator excitation
  - electronic relay for protection against the max/min limits of the frequency of output voltage. Setting the relay parameters. Relation with the RPM of the prime mover
  - electronic relay for protection against the wrong three-phase circuit sequence, missing phase and phase unbalance. Setting the relay parameters
  - action of the aforesaid safety devices on the main switch of M-G set
  - parallel procedure of alternators
  - instrument for measuring and optimizing the % value of the (active) power consumed versus the total available power on the bars. Utility and programming of this instrument
  - display of the output waveforms on the oscilloscope; effect of the different types of load
  - harmonic analysis of voltage and current versus the different types of load
  - study of 3-ph transformer in no-load and load conditions (transformer and load supplied separately)

TECHNICAL CHARACTERISTICS:

CONTROL PANEL OF THE GENERATION SECTION

- vertical panel wholly wired with components of industrial type
- fore side with devices and connections marked with their international symbols
- all connections are carried out exclusively via safety terminals, leads and jumpers with plugs of 4 mm
- multi-pole connectors for connecting prime movers and alternators are placed at the sides of the panel
- mushroom-head emergency pushbutton with mechanical holding.

The control panel includes:

- 2 microprocessor-controlled drives for the motors (prime movers), with possibility of selecting operational modes: V/f or vector, and of modifying ramp times, ON-OFF switch, potentiometer for speed control and stand-by switch.
- 2 Automatic Voltage Regulators (AVR) for the 3-ph alternator, with potentiometer for adjusting the output voltage
- 2 RPS (Reactive Power Sharing) for the 3-ph alternator operating in parallel
- 2 microprocessor-controlled multi-function instruments (one for each alternator), for measuring frequency, voltage (up to 850 V), current (up to 10 A), active, reactive and apparent power, phase and 3-ph. power factor, and for harmonic analysis of output energy. It is provided with communication RS485 port for data acquisition via PC (not included), and connections are carried out via safety terminals for plugs with diameter of 4 mm. They are provided with display to

show up to 4 electric parameters chosen by the user, simultaneously. Possibility of connection with other similar instruments in LAN

- 2 protection relays for control of min/max voltage, min/max frequency, correct phase presence, asymmetry and phase sequence, in the range 380-440 V 50-60 Hz. Regulation of voltage threshold Un between 80 and 115%, of frequency threshold f between ±1 and 10 % with delay time between 0.1 and 20 s, instantaneous intervention for wrong sequence or missing phase and with asymmetry over 30%. An exchange contact will signal abnormal condition, with automatic reset when normal conditions are restored

- 2 automatic switches with fixed magnetic threshold and adjustable thermal relay for protection of alternator against overload and short-circuit.
- 2 contactors for the parallel, with START/STOP pushbuttons and selector for starting the automatic parallel procedure.
- 1 double vertical voltmeter of 500 Vac + 1 double vertical frequency-meter of 45-65 Hz - 500 Vac for the parallel
- 1 electronic microprocessor-controlled synchronoscope, with relay of consensus for the automatic parallel. This instrument has some LEDs (18 LEDs, 2 colors) to indicate lead-lag and coincidence of the two 3-ph voltage circuits. Adjustment between 1 and 10 % of difference of two voltages, or between 2 and 20 degrees of difference of the two 3-ph voltage circuits; the delay time for closing the relay is selectable between 1 and 10 s
- 3 filament lamps of 400 V - 5 W for signaling the sequence of three-phase voltage circuits and helping the parallel
- 1 selector for connecting the instruments for parallel between bus-bars and alternators
- 1 digital instrument for showing the % value of the instantaneous absorbed power versus the power available on bus bars. This instrument includes 2 LEDs to indicate which and how many generators are connected with the bus bars (available power), another LED that blinks when load exceeds 80% of the available power, pushbuttons to display and program the values of the involved powers. A 3-ph active power converter for unbalanced loads will detect the instantaneous consumed power and sends its data to the instrument for % comparison.
- 1 general 4-pole magneto-thermal automatic switch with min.-voltage releasing coil, voltage pilot lamp
- 1 mushroom-head emergency pushbutton with mechanical holding.
- 2 universal single-ph 2-pin sockets Unel 230 V - 10, 16 A, for powering various apparatuses.

Power supply for the complete system mod. PGP-1/EV:
3 x 400 V - 50 Hz - 10 kVA
(other voltage and frequency on demand)
Dimensions of the panel: 1340 x 660 x 830 mm
Net weight: 73 kg

MOTOR - ALTERNATOR SETS:

- Prime mover: three-phase squirrel-cage asynchronous motor; power: 3 kW at 3000 r.p.m. - 2 poles, with microprocessor electronic drive
- Brushless 3-ph alternator of 400V; power: 2 kVA at 3000 RPM - 2 poles
- The machines are fixed onto a strong steel base with rubber feet and they are connected with the control panel via cables and multi-pole connectors, to simplify their installation.
- All the moving mechanical parts and couplings are protected with orange painted safety covers as it is stated by international standards.

Dimensions of each M-G set: 900 x 400 x 700 mm
Net weight: 177 kg

IMPORTANT NOTE

Although unit mod. PGP-1/EV can operate separately, the typical phenomena of the Integrated Systems can be examined and checked only when this unit operates jointly with unit mod. CLP-1/EV.

REQUIRED (NOT INCLUDED)

SINGLE-PHASE/THREE-PHASE R-L-C LOAD
Mod. RLC-2K/EV

SUPPLIED WITH

OPERATIONAL HANDBOOK
WITH EXERCISES

ACCESSORIES:

- Set of 4 cables and 22 jumpers, all with 4 mm safety plugs.
- RS485 - USB Converter and software for data acquisition from multifunction instruments
- Three-phase power cord of 5 m, with socket and plug IEC309, 5 poles, 400 V - 16 A