

# **Technical Specification**

**Switchgear and Control System  
for the Electrical Equipment of a Diesel Power Station**

**8 x 6500 kVA, 11 kV, 50 Hz**

## Item A List of Contents

Item A	List of Contents	2
Item B	Power Plant Mode of Operation	3
Item C	General Information	4
Item 1	Medium Voltage Switchboard	7
Item 2	Neutral Earthing Board	14
Item 3	Control Board	15
3.1	Alternator Control Board	15
3.2	Local Data Board	22
Item 4	Transformers	24
4.1	Station Transformers	24
Item 5	Low Voltage Station Board	25
Item 6	DC Supply	28
Item 7	Spare Parts / Accessories	29
Item 8	Installation Material	31
Item 9	Earthing Material For Inside Power Station	32
Item 10	Power Station Scada System "PSS"	33

## **Item B Power Plant Mode of Operation**

- Manual start order of the engines
- Automatic start sequence procedure
- Automatic or manual synchronizing of alternators
- After paralleling of the gen.-sets automatic or manual load sharing between gen.-sets
- Monitoring and regulation of the system frequency in case of island operation
- Automatic or manual pre-selected power output of gen.-sets in case of mains parallel operation
- During mains parallel operation, decoupling from the mains within an extremely short time for safe operation of the power station
- Mains voltage and frequency variation shall not exceed normal (+/- 5 %) or acc. to request
- Load shedding occurs if gen.-sets are overloaded

## **Item C    General Information**

### **Ambient conditions**

Ambient Temperature:            40° C

Max. humidity:                    90 %

Altitude:                            Up to 1000 m above sea level

### **Standards**

All material offered complies with the relevant Standards:

IEC  
ISO  
VDE  
DIN/EN

The products and system described in this specification are manufactured and marketed using a quality system certified by TÜV Rheinland and based on German Standard DIN ISO 9001/EN29001.

## Drawings and Documentation

Drawings and documentation will be issued to the above mentioned standards.

3-fold in DIN A4 size, English language.

Drawings will be generated with our engineering system CAE 33.

Preparation of documents used in Electric Technology Part 2:

Function-oriented diagrams acc. to DIN/EN 61082-1-3 (IEC 1082-1-3)

Diagrams, charts, tables:

Item designation acc. to DIN 40 719-2 (IEC 750).

Graphical symbols of diagrams acc. to DIN 40 900-1.....12  
(IEC 617-1.....12).

## Normal colour codes of the wiring as follows:

black	- the 3 phases and normal control wiring and secondary winding of p.t.'s
light blue	- neutral
yellow/green	- earthing
red	- DC-wiring 24 V+
blue	- DC-wiring 24 V-
brown	- DC-wiring 110 V+
violet	- DC-wiring 110 V-
grey	- secondary wiring of c.t.'s
white	- wiring for potential free contacts.

## LV-Wirings

All secondary circuits are wired with PVC-insulated flexible copper wires, with a minimum cross section of 0.75 sq.mm. The wiring is laid in plastic trunking and in flexible PVC conduit for crossover of wiring to door-mounted components.

## **Terminals**

All terminals of "non hygroscopic" material. The terminals have a minimum rating of at least 1.5 at operating intensity. Terminals for the secondaries of p.t.'s and c.t.'s are designed as test terminals.

## **Protection Relays:**

Protection relays, not included in the MPU, make SEG type HIGH TECH LINE, are micro processor controlled, plug-in type, for flush mounting, with alpha-numerical display for menu-guided value adjustment and indication of actual measurements, and LED's for indication of selected values and tripped protection elements.

## **Measuring Transformers**

Are of cast resin types. Current/voltage transformers are dimensioned according to load and accuracy requirements and according to the short-circuit capacity of the switchboard.

## **Measuring Instruments**

Are flush-mounted, frame size 96x96 mm, with 90° scale deflection, accuracy class 1.5

## **LV Switchboard design:**

Factory built and tested switchboard acc. to DIN EN 60439, classification VDE 0660, part 500 for indoor installation in enclosed electrical work shops as partial type tested switchboard (PTSK).

Designed as free-standing type in a steel plated frame construction, with front doors, with rubber profile gasket and sash fasteners.

Universally enclosed with 1.5 mm sheet steel, doors 2 mm thick, primer with respective pretreatment and finishing paint with structural lacquer.

Bottom open for mounting on a cable duct to be mounted on site for incoming and outgoing cables.

For protective measures, rigid earthing is provided according to VDE 0110 with total potential balance, N- and PE busbars are layed separately, N busbar isolated

## Item 1 Medium Voltage Switchboard

Metal **clad** type tested cubicles with draw-out circuit breakers and fixed mounted load break switches.  
Shock-wave resistant construction.  
Arc-resistant design  
Floor mounted type  
Ready assembled, wired and factory tested.

### Standard and ratings:

IEC 298  
DIN/VDE 0670 Part 6  
Protection Class IP 4X

### Technical data:

The following data are subject to detailed calculations by the supplier of the electrical equipment:

Service voltage:	11 kV
Rated voltage:	12 kV
Service frequency:	50 Hz
Rated short-circuit breaking current (3 s):	25 kA
Rated current of busbar:	1600 A

### Insulation Level:

Rated lightning impulse withstand voltage (peak) phase to earth (B.I.L.):	75 kV
Rated power frequency withstand voltage (rms) phase to earth (for 1 min.):	28 kV

**Surface treatment:**

- Steel sections and sheets:	galvanized
- Front doors and rear covering plates:	Electrophoretic primer and then stove- enamelled grey (RAL 7035)
Required room height:	min. 3000 mm
Required space in front of the switchgear: (For removing the circuit breaker part)	min. 1500 mm

The panels are self-supporting steel constructions with a maximum of stability and a minimum of weight.

Live parts are covered, against accidental contacts, with earthed sheet-steel inside and outside the panel. The circuit breakers are draw-out types and metal safety shutters will automatically close the fixed power contacts in the test position.

The panels are divided into 4 compartments:

1. Busbar compartment
2. Circuit breaker compartment
3. P.t./c.t./cable termination compartment
4. Low voltage compartment for measuring and protection.

The erection of the panel can be done directly on the levelled floor. The design is done to allow safe operation in extremely onerous climatic conditions.

Cables can be easily installed in the cable connection chamber at the lower part of the panel

Type tests are carried out. - Test certificates are available.

**The switchboard consisting of:**

- 8 Generator panels (one per gen.-set)
- 1 Busbar voltage measuring panel
- 1 Busbar sectionalizing double panel
- 2 Station transformer panels
- 6 Feeder panels (2 mains, 4 consumer)

**Outside Panel Dimensions (approx.):**

Height: 2200 mm  
Width: (subject to necessary design engineering)  
Depth: 1300 mm

## **The Generator Panels consisting of, each:**

### ***Power Part***

- 1 Busbar system
- 1 Vacuum circuit breaker, 630 A, 25 kA at 11 kV withdrawable, with safety shutters, motor charged, spring operated, with closing/tripping and undervoltage coil, with emergency hand operation and the necessary auxiliary contacts
- 3 Current transformers, double-core type  
core 1 for measuring cl. 1FS5  
core 2 for protection cl. 5P20
- 3 Potential transformers, single-pole type

### **For delivery to the alternator manufacturer:**

- 3 Current transformers, single-core type, for mounting in the alternator star point for differential protection

### ***LV-Part***

- 1 Voltmeter
- 1 Voltmeter selector switch
- Test terminals for c.t.'s and p.t.'s

## **The Busbar Voltage Measuring Panel consisting of:**

### ***Power Part***

- 1 Busbar system
- 3 Voltage transformers, single-pole type, with two secondary windings  
one for measuring bus voltage  
one for earth fault measuring (open delta)
- 3 Lightning arrestors

### ***LV-Part***

- 1 Voltmeter
- 1 Voltmeter selector switch

## **The Busbar Sectionalizing double Panel consisting of:**

### ***Power Part***

- 1 Busbar system left hand side
- 1 Vacuum circuit breaker, 1600 A, 25 kA at 11 kV withdrawable, with safety shutters. motor charged, spring operated, with closing and tripping coil, with emergency hand operation and the necessary auxiliary contacts
- 3 Current transformers, double-core type  
core one for measuring, cl. 1FS5  
core two for protection, cl. 5P20
- 3 Voltage transformers, single-pole type, with two secondary windings  
one for measuring bus voltage  
one for earth fault measuring (open delta)
- 3 Lightning arrestors
- 1 Busbar system right hand side

***LV-Part***

- 1 Voltmeter
- 1 Voltmeter selector switch
- Test terminals for c.t.'s and v.t.'s

**The Station Transformer Panels, each consisting of:**

***Power Part***

- 1 Busbar system
- 1 Vacuum circuit breaker, 630 A, 25 kA at 11 kV withdrawable, with safety shutters. motor charged, spring operated, with closing and tripping coil, with emergency hand operation and the necessary auxiliary contacts
- 3 Current transformers, double-core type
  - core one for measuring, cl. 1FS5
  - core two for protection, cl. 5P20
- 1 Earthing switch, manually operated

***LV-part***

- 1 Ammeter
- Test terminals for c.t.'s

## **The Feeder Panels, each consisting of :**

### ***Power Part***

- 1 Busbar system
- 1 Vacuum circuit breaker, 1000 A, 25 kA at 11 kV, withdrawable, with safety shutters, motor charged, spring operated, with closing and tripping, with emergency hand operation and the necessary auxiliary contacts
- 3 Current transformers, double-core type  
core 1 for measuring cl. 1FS5  
core 2 for protection cl. 5P20
- 3 Potential transformers, single-pole type (only for mains feeders !)
- 1 Earthing switch, manually operated

### ***LV-Part***

- 1 Voltmeter
- 1 Voltmeter selector switch
- Test terminals for c.t.'s and p.t.'s

## **The Mains Feeder Panels each consisting of :**

dito. the Consumer Feeder Panels but 1600 A

## Item 2 Neutral Earthing Board

Metal enclosed cubicles with front access doors for mounting on floor or cable trench and equipped as follows:

### Ratings:

Voltage:	acc. to system voltage
Busbar:	copper busbar
Protection class:	IP42 acc. to DIN/IEC
Colour:	RAL 7032

8 Vacuum contactors (one per gen.-set), single-pole, interlocked in such a way that only one generator is earthed at any time.

1 Overcurrent relay

### For separate installation:

1 Neutral earthing resistor, mounted in IP20 enclosure, non-corrosive type, 100 A / 30 sec.

1 Cable type current transformer

## Item 3 Control Board

### 3.1 Alternator Control Board

The alternator control board is assembled in metal enclosed cubicles with front doors for floor mounting.

Flush-mounted instruments, indication lamps, push buttons, switches will be door mounted.

#### Ratings:

Voltage:	Up to 660 V
Frequency:	50 Hz
Control voltages:	24 V DC 110 V DC 400/230 V AC
Protection class:	IP 42 acc. to IEC and DIN
Colour:	RAL 7032

#### Function:

Control board for the Diesel gen.-sets and control of the Medium-Voltage Switchboard Item 1.

#### The control board consisting of:

- 8 Alternator control panels (one per gen.-set)
- 1 Common control panel

#### Outside Panel Dimensions (approx.):

Height:	2000 mm
Width:	(subject to necessary design engineering)
Depth:	600 mm

## **The Alternator Control Panels, each consisting of:**

- 1 Voltmeter with selector switch
- 1 Frequency meter
- 3 Ammeters
- 1 kW-meter, connected to the below measuring and protection unit
- 1 **Control and Monitoring unit for Gen-Set** type "CMG-2" with 10.4" graphic colour display, with digital fault and analogue value processing, for the Diesel-gen.-set specific features, such as:
  - Menu information / Display of operating electrical parameters / Display of operating engine parameters / Single line mimic diagram of alternators with status of MV circuit breakers and earthing switches / P&I diagrams of engine systems / Histogram of electrical and mechanical parameters / Histogram of up to 1000 events / Important O&M information text on plant for operator
  - Selection of operational modes "Automatic", "Manual" and "Off" by means of key switch
  - Isolated operation and mains parallel operation of single and multiple systems
  - Starting and stopping of the gen.-set
  - Adjustment of speed and voltage
  - Control of generator CB "On/Off"
  - Automatic switching over from LFO to HFO operation and reversed with adjustable switching over parameters
  - Up to ..... analogue supervision circuits (acc. to engine manufacturer monitoring list)
  - Up to ..... digital supervision circuits (acc. to engine manufacturer monitoring list)
  - Two analogue input circuits with the ability of balancing non-linear transducers by means of polygon
  - Recording, supervising and storing of alarms, measuring values and operational conditions
  - Operating hour meter and start counter
  - Display of engine data in digital and analogue form as well as diagrams
  - Exhaust gas temperature average computing as well as supervising
  - Generator winding and bearing supervision 49G/38G
  - Parameter matrix for analogue quantities and digital signals
  - Dual stage password levels

- 10-days storage of all events on the hard disk (can be extended)
- Interface for control level, modem or notebook
- Selection of languages (Latin letters)

1 **Interconnection Remote Module** for switchboard type "IRM-2"

For more details please see our separate technical description.

1 **Measuring and Protection Unit** type "MPU-2", with function keys and LCD display, for the following applications:

Measuring with digital indication of:

- Generator voltage
- Generator frequency
- Generator currents, with maximum demand indication for 15 minutes
- Active / Reactive power
- Power factor
- kWh / kVArh counter

Evaluation / Protection:

- Overcurrent and short circuit 50/51
- Reverse power 32
- Generator over-/undervoltage 59/27
- Generator over-/underfrequency 81

Synchronization:

- Automatic Synchronizing, incl. frequency and voltage balancing
- Internal fault message processing for synchronization error / circuit breaker does not synchronise

1 Differential protection relay 87 G

1 Earth fault protection relay 50N/51N

1 Signal lamp (green) "Engine running"

1 Signal lamp (red) "Engine fault"

1 Emergency OFF push button

1 Push button for alternator circuit breaker "ON" at manual synchronization

1 Key switch manual synchronization - automatic synchronization

- De-excitation device

### **The Common Control Panel consisting of:**

- 1 **Control and Monitoring Unit** interface "CMC1" with 10.4" colour graphic display
- 1 Secondary, freely programmable logic control system (PLC) for the common control specific features
- **Interconnecting Remote Modules "IRM-1"** for the common auxiliaries

Depending on the configuration, the following modes of operation (see also page 3) and functions are available:

- Standby operation (gen.-sets are started only in case of mains failure)
- Prime power operation (permanent operation without connection to the mains)
- Mains parallel operation
- Mains parallel operation with automatic standby operation
- Black Start function
- Load management
- Interfaces for data transfer with:
  - the Control and Monitoring units for Gen-Set type "CMG-2", mounted in alternator control panels (CAN-Bus)
  - the offered Power Station Scada System PSS (Ethernet)
  - an external diagnostic device (notebook) (RS 232)

For more details please see our separate technical description.

- 1 System earth fault relay 59 N
- 1 Mimic diagram with semaphore indicator for position of c.b. and earthing switch

### **For manual synchronization:**

- 1 Synchronizing bracket containing:
  - 1 Double voltmeter
  - 1 Double frequency meter
  - 1 Synchronoscope
- 1 Synchronizing selector switch
- 1 Synchronizing check relay

### **For each station auxiliary transformers :**

- 1 **Measuring and Protection Unit** type "MPU-1", connected to the LV side of the transformer, with function keys and LCD display, for the following applications:

Measuring with digital indication of:

- Voltage
- Frequency
- Currents, with maximum demand indication for 15 minutes
- Active / Reactive power
- Power factor
- kWh / kVArh counter

Protection:

- Overcurrent and short circuit 50/51
- Earth fault 50N/51N

Switching position indication

### **For each consumer feeders :**

- 1 **Measuring and Protection Unit** type "MPU-1", with function keys and LCD display, for the following applications:

Measuring with digital indication of:

- Voltage
- Frequency
- Currents, with maximum demand indication for 15 minutes
- Active / Reactive power
- Power factor
- kWh / kVArh counter

Protection:

- Overcurrent and short circuit 50/51
- Earth fault 50N/51N

Switching position indication

- 1 Control switch

### **For each mains feeders :**

- 1 **Measuring and Protection Unit** type "MPU-2", with function keys and LCD display, for the following applications:

Measuring with digital indication of:

- Voltage busbar system A
- Frequency busbar system A
- Voltage busbar system B
- Frequency busbar system B
- Currents, with maximum demand indication for 15 minutes
- Active / Reactive power
- Power factor
- kWh / kVArh counter

Evaluation / Protection:

- Overcurrent and short circuit 50/51
- Mains decoupling, incl. over-/undervoltage, over-/underfrequency and vector shift 27/59/81/78

Synchronization:

- Automatic Synchronizing, incl. frequency and voltage balancing
- Internal fault message processing for synchronization error / circuit breaker does not synchronise

Switching position indication

- 1 Earth fault protection relay 50N/51N
- 1 Control switch

### **For the bus coupler:**

- 1 **Measuring and Protection Unit** type "MPU-2", with function keys and LCD display, for the following applications:

Measuring with digital indication of:

- Voltage busbar system A
- Frequency busbar system A
- Voltage busbar system B
- Frequency busbar system B
- Currents, with maximum demand indication for 15 minutes
- Active / Reactive power
- Power factor
- kWh / kVArh counter

Evaluation / Protection:

- Overcurrent and short circuit 50/51

Synchronization:

- Automatic Synchronizing, incl. frequency and voltage balancing
- Internal fault message processing for synchronization error / circuit breaker does not synchronise

Switching position indication

- 1 Earth fault protection relay 50N/51N
- 1 Control switch

### 3.2 Local Data Board

8 local data boards assembled in metal enclosed cubicles with front doors for floor mounting.

Flush-mounted instruments, indication lamps, push buttons, switches will be door mounted.

#### Ratings:

Voltage:	Up to 660 V
Frequency:	50 Hz
Control voltages:	24 V DC 400/230 V AC
Design:	Floor standing type
Door stop:	hinged at right hand side
Protection class:	IP 42 acc. to IEC and DIN
Colour:	RAL 7032, structural
Accessories:	Panel lighting, heater and ground socket outlets on the mounting plate
Labelling:	English, resopal white with black letters

The entire switchboard is ready assembled and wired and ready for connection.

#### Outside Dimensions for each Panel (approx.):

Height:	2000 mm
Width:	1200 mm
Depth:	600 mm

## **The Local Data Board additionally consists of:**

### **1 Programmable logic controller PLC, make SEG**

#### **PLC with the following functions:**

- Start preparation with engine-specific start-up program
- Control and supervision of the engine and its auxiliary drives
- Data collection of the analogue and digital signals of the actors and sensors of the engine
- Data transfer
- Shut-down of Diesel engine

#### **PLC consisting of:**

- Compact housing with modules of required quantity
- Power supply
- Central controller (CPU)
- Digital input channels acc. to the engine manufacturers monitoring list
- Digital output channels
- Analogue input channels acc. to the engine manufacturers monitoring list and incl. internal fault signal processing
- Interfaces for data transfer with:
  - the Control and Monitoring unit for Gen-Set type "CMG-2", mounted in alternator control panel
  - the Interconnection Remote Module for switchboard type "IRM-2", mounted in alternator control panel
  - an external diagnostic device (notebook) (RS 232)

1 Rotation flashlight orange on the top of the switchboard

1 Set of miniature circuit breakers for measuring and control circuits

#### **Installation on mounting plate of:**

- Engine electronic speed governor (issued free of charge by the engine supplier)
- Alternator voltage regulator (outside dimensions max. 320 x 550 mm)

## Item 4 Transformers

### 4.1 Station Transformers

2 Three-phase station transformers, oil-immersed type, hermetically sealed, for **outdoor** installation according to IEC 76 Standards, accessories, fittings and material testing acc. to DIN standards.

Rated power:	kVA
Rated frequency:	50 Hz
Prim. Voltage:	11 kV +/- 2 x 2.5 %
Sec. Voltage:	400/231 V
Vector Group:	Dyn11
Imped. Voltage:	6 %
Type of Cooling:	ONAN
Ambient temperature:	40° C

The transformers will be equipped with standard devices for protection, supervision and control, including:

- Oil temperature thermometer and temperature supervision unit
- Manual operating device for off-circuit tap changer

## Item 5 Low Voltage Station Board

1 Low voltage station board is assembled in metal enclosed cubicles with front doors for floor mounting.

Flush-mounted instruments, indication lamps, push buttons, switches will be door mounted.

### **Ratings:**

Voltage:	Up to 660 V
Frequency:	50 Hz
Control voltages:	24 V DC 400/231 V AC
Busbar system:	3 phases + N+E-conductors
Protection class:	IP 42 acc. to IEC and DIN
Colour:	RAL 7032
Switchboard design:	Form I acc. to DIN EN 60439

The low voltage board will be designed to match the required auxiliary power for electrical consumers within our scope of supply.

### **The switchboard consisting of:**

- 2 Panels for transformer incomings
- 1 Busbar sectionalizing panel
- 8 Panels for Diesel engine auxiliary drives (one per gen.-set)
- 1 Panel for common station auxiliaries

### **Outside Panel Dimensions (approx.):**

Height:	2000 mm
Width:	(subject to necessary design engineering)
Depth:	600 or 800 mm

**The Panels for Transformer Incomings, each consisting of:**

- 1 Busbar system
- 1 Air circuit breaker, triple-pole, A, motor operated, with thermal overcurrent relay and magn. short circuit protection device
- 3 Current transformers
- 1 Voltmeter
- 1 Voltmeter selector switch
- 3 Ammeters

**The Busbar sectionalizing Panel consisting of:**

- 1 Busbar system left hand side
- 1 Air circuit breaker, triple-pole, A, motor operated, with thermal overcurrent relay and magn. short circuit protection device
- 3 Current transformers
- 3 Ammeters
- 1 Busbar system right hand side

**The Panels for Diesel Engine Auxiliary Drives, each consisting of:**

- 1 Busbar system
- 1 Load break switch with fuses as main disconnecter

Compl. control and power circuits for the Diesel engine auxiliary drives acc. to the respective consumer list ( dated .2001 ).

### **The Panel for Common Station Auxiliaries consisting of:**

- 1 Busbar system
- 1 Load break switch with fuses as main disconnecter

Compl. control and power circuits for the station auxiliary drives acc. to the respective consumer list ( dated .2001 ).

- 5 outgoing moulded case circuit breakers, triple-pole up to 160 A
- 3 ditto up to 60 A
- 2 ditto up to 25 A

The above stated additional outgoing are for small power sockets, power house light, DC Board etc.

### **Optional:**

#### **For Black-Starter Gen.-Set:**

- 1 Power part for 125 kVA black-starter, with terminals for incoming power cables, 3-pole HRC-fuse, 3 current transformers, 3-pole air contactor, as well as the necessary circuits for measuring, protection and manual Start/Stop, with automatic back synchronization.

## Item 6 DC Supply

### DC Board consisting of:

- 1 Battery charger, 110 V, automatic type, with I/U-characteristic suitable for charging the above-mentioned 110 V battery
- 1 Battery voltage supervision unit 110 V
- 1 Battery charger, 24 V, automatic type, with I/U-characteristic suitable for charging the above-mentioned 24 V battery
- 1 Battery voltage supervision unit 24 V

Furthermore necessary outgoing fuses to the switchboards specified under this scope

2 Voltmeters

2 Ammeters

1 Power contactor for control room emergency lighting

The DC board is assembled in metal enclosed cubicles with front doors for floor mounting.

Flush-mounted instruments, indication lamps, push buttons, switches will be door mounted.

### Ratings:

Voltage: Up to 660 V

Protection class: IP 42 acc. to IEC and DIN

Colour: RAL 7035

### Outside Panel Dimensions (approx.):

Height: 2000 mm

Width: (subject to necessary design engineering)

Depth: 600 or 800 mm

### Loose supply of the following batteries:

- 1 Station battery 110 V, lead acid, station type, 80 Ah for feeding the motor drives and supervision units of MV-board and control room emergency lighting
- 1 Station battery 24 V, lead acid, station type, capacity 360 Ah for feeding the Diesel engine supervision units

## **Item 7 Spare Parts / Accessories**

### **Spare parts**

Signal bulbs

- 3 Sets LT-fuses of each type used
- 2 Auxiliary relays of each type used
- 2 Time relays of each type used
- 1 Contactor of each type used
- 1 Control switch of each type used
- 1 MPU-1
- 1 MPU-2
- 1 Earth fault protection relay
- 1 Differential protection relay
- 2 Miniature circuit breakers of each type used
- 1 Module for digital inputs
- 1 Module for digital outputs
- 2 Modules for analogue inputs
- 1 CPU
- 1 Control and Monitoring unit for Gen-Set

A detailed spare parts list will be submitted after final engineering.

### **Spare parts for alternators**

- 1 Set of bearing shell ( A side only )
- 1 Set of diodes
- 1 Voltage regulator

## **Accessories**

- 1 Trolley for vacuum circuit breaker
- 1 Handle for positioning of vacuum circuit breakers inside cubicle
- 1 Lever for manual spring charging of vacuum circuit breakers
- 1 Lever for manual operation of earthing switch/load break switch
- 1 Pair of electrically protected rubber gloves
- 1 Earthing/short circuiting set for T- and ball earthing terminals, with wall storage bracket for storage
- 1 High voltage tester, with wall storage bracket for storage

## Item 8 Installation Material

Our scope of supply includes:

- MV: 11 kV power cables
- LV: 600/1000 V power cables
- LV: control cables

The quantities shall be based on the design of a standard power house layout for a max. length of 35 mtr.

### **High Voltage Cables, single-core type N2XS<sub>Y</sub> - XLPE insulated**

- Generators to Medium Voltage switchboard
- Generators to Neutral earthing board

### **Low Voltage Cables, type NYY:**

- Station Transformer to Low Voltage Station Board
- Low Voltage Station Board to auxiliary drives

Furthermore all necessary control cables for the connection of all control, measuring and signalling devices within our scope of supply.

For the mains routes: Cable ladders of the galvanized steel type, incl. the suitable brackets. Ducts or conduits for the protection of cables where these have to be protected against mechanical damage. Cable clips for all cables not laid in trays, ducts or trenches.

The necessary cable sealings for MV cables, compression glands for LV-cables and other small material.

Our offer does neither include necessary power house lighting nor communication systems, gass and/or fire detection systems, leakage detection system and air conditioning, etc. We assume that those parts will be delivered by other suppliers.

## **Item 9 Earthing Material For Inside Power Station**

The earthing system will be designed acc. to IEC and DIN Standards.

The necessary earthing material to connect all switchboards, generators, motors and transformers to the common mains earthing bus inside the power station.

Our offer does not include outside earthing network and equalization earthing, this is part of other contractors. According to IEC the measured value of outside earthing must be below 2 Ohm.

## Item 10 Power Station Scada System "PSS"

The central communication interface of the power station consists of:

- 1 Personal computer with Pentium processor with appropriate performance and memory capacity
- 1 Colour graphic monitor, 19" with high resolution
- 1 DIN A4 colour inkjet printer for event and graphic printout
- 1 Ethernet network with Ethernet cards for insertion into the vacant slots of the "CMG-2" and "CMC-1" processors
- Operating system Windows 95/98
- Graphics software "InTouch" by Wonderware
- 1 DIN A4 colour inkjet printer for event and graphic printout
- 1 UPS 1000 VA for 6 minutes
- 1 Modem for data transfer

### **The PSS includes the following features:**

- Main menu with the layout of the power station and its most important components shown as a process picture
- Fading of significant events into the relevant station components
- Selection of the individual engine control systems "CMG-2" or the Control and Monitoring Unit interface "CMC1" of the Power Station Management System
- Transmission of control and switching commands to the respective systems (with password protection)
- Long-term storage of the data and events stored in the individual subsystems "CMG-2" and "CMC-1"

### **The PSS provides the following process pictures:**

- Power station layout
- General overview of the gen-sets
- Main menus of the gen-sets
- Exhaust gas temperatures and deviations of average value
- Station single line
- Fuel oil system overview
- Cooling water system
- Alarm and protocol list
- Histograms
- 2 spare pictures