

Power^{IT} MV Live Tank SF6 Circuit Breaker Model OHB



Industrial^{IT}
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ABB - a global leader in power and automation technologies

ABB (www.abb.com) is a global leader in power and automation technologies that enable utility and industry customers to improve performance while lowering environmental impact. The ABB Group of companies operates in around 100 countries.

ABB's Power Technologies Division serves electric, gas and water utilities, as well as industrial and commercial customers with a wide range of products, services and solutions for power transmission and distribution. ABB offers turnkey solutions for substations, utility automation, HVDC and FACTS (Flexible AC Transmission System).

ABB's power technologies product portfolio includes outdoor and indoor circuit breakers, gas insulated switchgear, power transformers, instrument transformers, disconnectors, capacitor banks and reactive power compensators.

ABB's medium voltage product offering encompasses a complete range of innovative products, systems and technologies for applications in the 1 to 50 kV class. This includes indoor air insulated and gas insulated panels with vacuum and SF6 gas circuit breakers, outdoor vacuum and SF6 gas circuit breakers, ring main units, auto-reclosers, fuses, switch disconnectors and prefabricated modular solutions for power distribution.

Industrial^{IT}

The OHB circuit breaker is certified as complying with the ABB Industrial^{IT} architecture. In this architecture the OHB

circuit breaker is part of the Power^{IT} suite. The products complying with the Industrial^{IT} architecture can be effectively integrated in a system with high added value and a true 'Plug & Produce' mode.

This product has been tested and certified as Industrial^{IT} Enabled, Level 0 - Information. All product information is supplied in interactive electronic format, compatible with ABB Aspect ObjectTM technology. The Industrial^{IT} commitment from ABB ensures that every enterprise building block is equipped with the integral tools necessary to install, operate, and maintain efficiently throughout the product lifecycle.

Further information about the advantages of ABB Industrial^{IT} architecture is available at www.abb.com/industrialit.



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Description

General information

OHB medium voltage circuit-breakers for outdoor installation use sulphur hexafluoride gas (SF6) to extinguish the electric arc and as the insulating medium.

Breaking in SF6 gas takes place without current chopping or generation of overvoltages.

These characteristics guarantee a long electrical life for the circuit-breaker and limited dynamic, di-electric and thermal stresses on the installation.

The ESH type of stored energy and free release mechanical operating mechanism allows opening and closing operations through local and remote control.

The operating mechanism, the activating kinematics of the moving contacts and the anti-condensation heater are located inside a tight metal enclosure which also acts as the support for the poles.

The above-mentioned structure is supported by a frame made of telescopic metal sections which allow the height of the circuit-breaker terminal to be adapted from 2800 mm to 3700 mm.



The metal enclosure has IP 54(*) degree of protection and is fitted with a tight door with an inspection window.

The circuit-breaker is compact and ensures a high level of sturdiness and excellent mechanical reliability.

The enclosure is made out of a steel plate with adequate surface protection by a special metalising and painting process. The support structures are hot dip galvanised.

Fields of application

OHB circuit-breakers are used in power distribution for control and protection of lines and for control and protection of transformers, rectifier units, capacitor banks, etc.

Due to the SF6 autopuffer breaking technique, the OHB circuit-breakers do not generate overvoltage during switching, and are therefore also highly suitable for retrofitting, upgrading and enlarging older installations where the insulating materials of the cables and apparatus may have already been stressed during service.

(*) IP 54 is obtained by placing filters over the ventilation holes on the bottom of the casing (the filters are supplied on request)

- Breaking chamber identical to the type used for the HD4 series
- Mechanical operating mechanism identical to the type used for the HD4 series
- Upper and lower terminals with NEMA4 drilling
- Gas pressure control device for each pole
- Poles made with porcelain insulators, assembled by means of flanges with terminals
- Pole covers and cases made of aluminium
- Pole covers with safety valve
- Inspection window in the pole supporting casing near the operating mechanism signals
- Complete range of accessories
- Wide range of power supply voltages of the electrical accessories

Standards and approvals

The OHB circuit-breakers comply with the IEC 62271-100 standard as well as of other major industrialised countries. They have undergone the tests indicated below and ensure service safety and reliability of the apparatus in all installations.

Type tests:

- Temperature rise test
- Di-electric test
- Short circuit test duties
- Short time current test
- Mechanical endurance test

Routine tests:

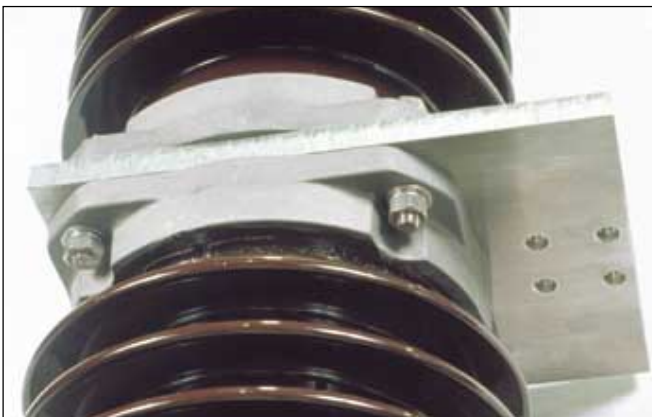
- Power frequency voltage with stand test
- Insulation test on auxiliary and control circuits
- Measurement of main circuit resistance
- Mechanical and electrical operation test



Porcelain insulators

Service safety

The mechanical and electrical locking devices have been provided to prevent incorrect operations and to carry out inspection of the installations while guaranteeing maximum operator safety.



Lower terminals



Telescopic supports

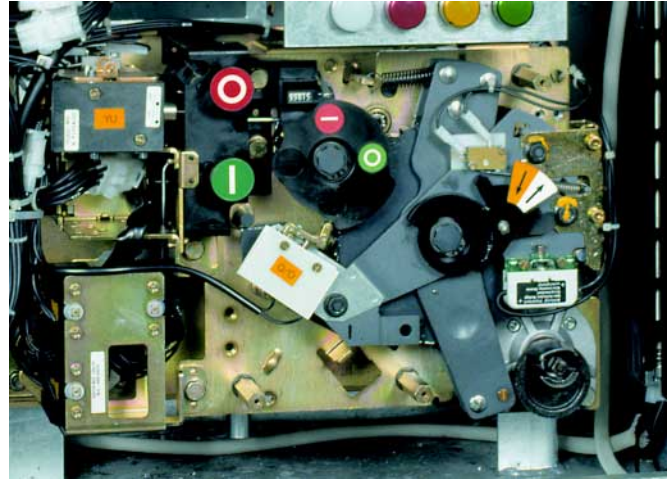
Accessories

The OHB circuit-breakers have a complete range of accessories which means all installation requirements can be satisfied.

The operating mechanism is of the same type for the whole series and has a standardised range of accessories and spare parts which are easy to identify and order. Use, maintenance and service of the apparatus have been simplified and require limited use of resources.

ESH operating mechanism

- Single operating mechanism for the whole series
- The same accessories for all types of circuit-breakers
- Easy assembly and replacement of the accessories



ESH type of operating mechanism



Device for monitoring SF6 gas pressure



Detail of the supports for fixing to the floor

Quality Assurance System

Certified by an independent organisation as complying with ISO 9001 Standards.

Environmental Management System

Certified by an independent organisation as complying with ISO 14001 Standards.

Test laboratory

Accredited by an independent organisation as complying with ISO 45001 Standards.

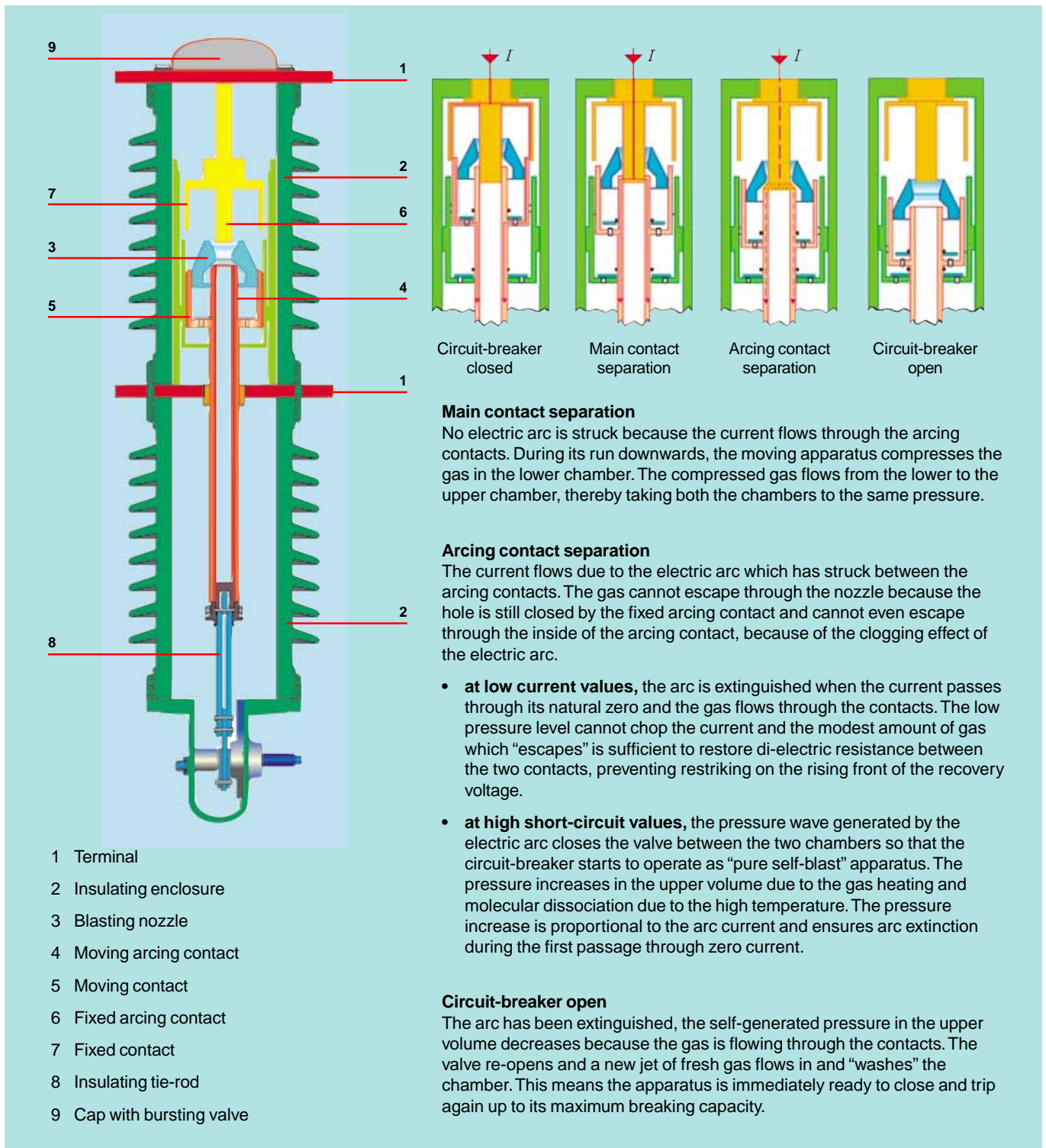
Electrical characteristics

| Circuit-breaker | | OHB 24 | | OHB 36 | | OHB 40 | |
|-------------------------|------|---------|---------|---------|---------|---------|---------|
| Rated voltage | [kV] | 24 | 24 | 36 | 36 | 40.5 | 40.5 |
| Rated normal current | [A] | 1250 | 2500 | 1250 | 2500 | 1250 | 2500 |
| Rated breaking capacity | [kA] | 25-31.5 | 25-31.5 | 25-31.5 | 25-31.5 | 25-31.5 | 25-31.5 |

Breaking technique

The breaking principle of OHB circuit-breakers is based on compression and self-blast technique to obtain top performances at all breaking current values, with minimum arc times, gradual arc extinction without chopping, and no restriking or switching overvoltages.

This breaking technique - already widely appreciated and used in high voltage circuit-breakers, has been introduced into medium voltage with the HD4 series circuit-breakers for indoor installation.



Circuit-Breaker Selection and Ordering

General characteristics

| Circuit-breaker on column | | OHB 24 | | OHB 36 | | OHB 40 | |
|--|---|---------------------|------|---------------------|------|---------------------|------|
| Standards | IEC 62271-100 | ■ | | ■ | | ■ | |
| Rated voltage | Ur [kV] | 24 | | 36 | | 40.5 | |
| Rated insulation voltage | Us [kV] | 24 | | 36 | | 40.5 | |
| Withstand voltage at 50 Hz | Ud (1 min) [kV] | 70 (dry) / 60 (wet) | | 95 (dry) / 80 (wet) | | 95 (dry) / 80 (wet) | |
| Impulse withstand voltage | Up [kV] | 150 | | 200 | | 200 | |
| Rated frequency | fr [Hz] | 50-60 | | 50-60 | | 50-60 | |
| Rated normal current (40°C) | Ir [A] | 1250 | 2500 | 1250 | 2500 | 1250 | 2500 |
| Rated breaking capacity | Isc [kA] | 25 | 25 | 25 | 25 | 25 | 25 |
| | | 31.5 | 31.5 | 31.5 | 31.5 | 31.5 | 31.5 |
| Rated short-time withstand current (3 s) | Ik [kA] | 25 | 25 | 25 | 25 | 25 | 25 |
| | | 31.5 | 31.5 | 31.5 | 31.5 | 31.5 | 31.5 |
| Making capacity | Ip [kA] | 63 | 63 | 63 | 63 | 63 | 63 |
| | | 80 | 80 | 80 | 80 | 80 | 80 |
| Operation sequence | [O-0, 3s-CO-15s-CO] | ■ | | ■ | | ■ | |
| Opening time | [ms] | 45±10 | | 45±10 | | 45±10 | |
| Arcing time | [ms] | 10-15 | | 10-15 | | 10-15 | |
| Total breaking time | [ms] | 55-60 | | 55-60 | | 55-60 | |
| Closing time | [ms] | 75±10 | | 75±10 | | 75±10 | |
| Overall dimensions | on frame | | | | | | |
| | H [mm] | 3090 – 3840 | | 3090 – 3840 | | 3090 – 3840 | |
| | L [mm] | 900 | | 900 | | 900 | |
| | P [mm] | 686 | | 686 | | 686 | |
| Weight | [Kg] | 900 | | 900 | | 900 | |
| SF6 gas absolute pressure | Rated service value [kPa] | 380 | | 380 | | 550 | |
| Operating temperature ⁽¹⁾ | [°C] | -25...+40 | | -25...+40 | | -25...+40 | |
| Tropicalisation | IEC: 60068-2-30, 721-2-1 | ■ | | ■ | | ■ | |
| Electromagnetic compatibility | IEC: 60694, 61000-6-2, 61000-6-4 | ■ | | ■ | | ■ | |
| Solar radiation | [W/m ²] | 1000 | | 1000 | | 1000 | |
| Presence of pollution | IEC 815 - table 1 | Level III | | Level III | | Level III | |
| Creepage distance | [cm/kV] | 2.5 | | 2.5 | | 2.75 | |
| Ice coating | [mm] | 10 | | 10 | | 10 | |
| Wind speed | [m/s] | 34 | | 34 | | 34 | |
| Earthquake resistance | [g] | 0.3 | | 0.3 | | 0.3 | |
| Static force on the terminals | Longitudinal [N] | 750 | | 750 | | 750 | |
| | Transversal [N] | 500 | | 500 | | 500 | |
| | Vertical [N] | 750 | | 750 | | 750 | |

(1) For lower operating temperatures, please consult us.

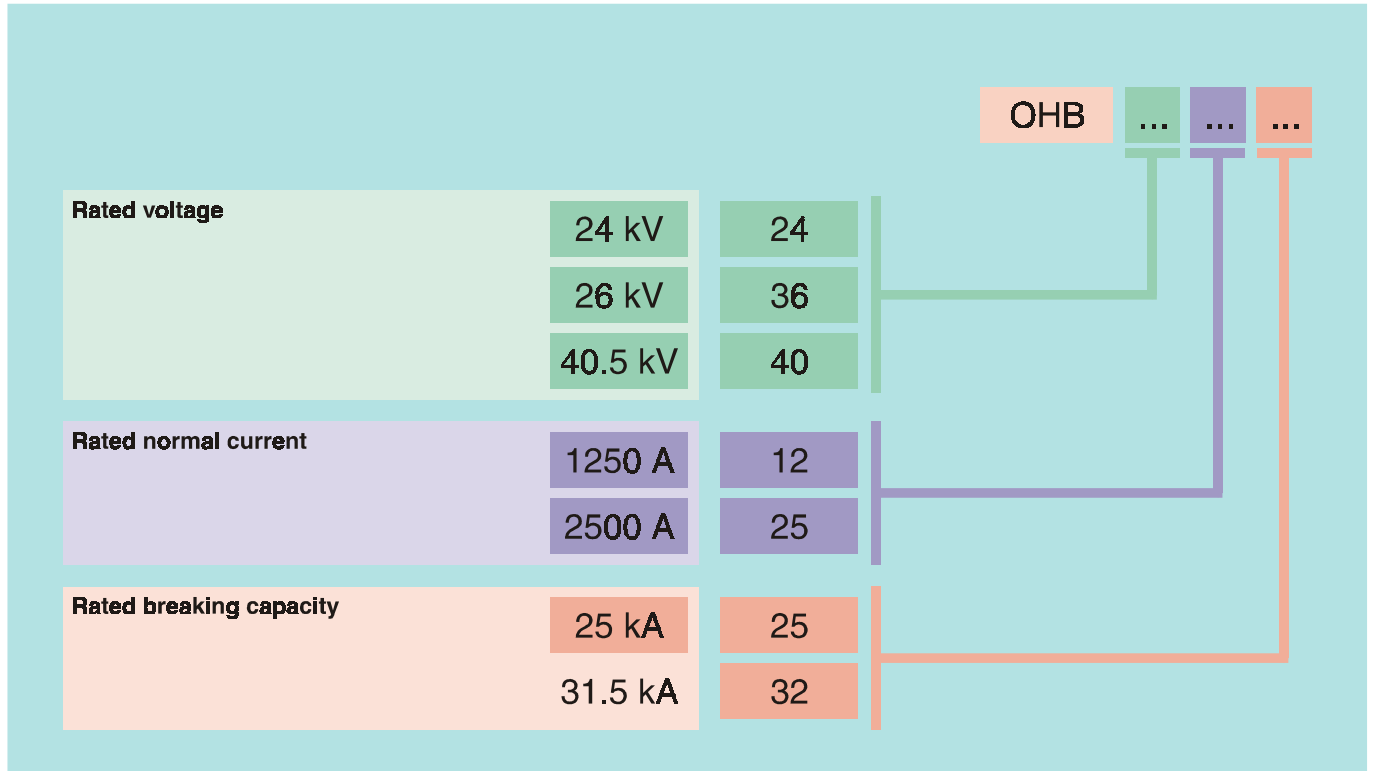
Identification of the circuit-breaker type

The identification code of a circuit-breaker is made up with the elements indicated in the table below. For correct identification of a circuit-breaker, please refer to the characteristics table on page 8. The circuit-breaker selected can then be completed with the optional accessories indicated on the following pages.

Example of identification: code **OHB 36.25.32** identifies a circuit-breaker for outdoor installation with 36 kV rated voltage, 2500 A rated normal current and 31.5 kA breaking capacity.

Standard equipment

- 1) ESH operating mechanism, complete with manual opening and closing push buttons, mechanical key lock in open position (key removed in the open position), mechanical indicators for circuit-breaker "open or closed" and for springs "charged or discharged", the mechanical indicators can be seen through the inspection window on the door
- 2) YO1 shunt opening release
- 3) YC shunt closing release
- 4) Spring-charging geared motor
- 5) Lever for manual spring charging
- 6) Pressure switch with two levels (one per pole); suitable for operation down to -25°C. For lower service temperatures, please contact us
- 7) Locking circuit for insufficient gas pressure (automatic opening with additional YO2 shunt opening release and lock in the open position by means of closing circuit interruption)
- 8) Electrical contacts signalling: springs charged (or alternatively springs discharged)
- 9) Auxiliary contacts (10 NC + 10 NO)
- 10) Automatic remote operation is not possible with the door open by means of a limit switch mounted on the door
- 11) Anti-condensation/heating circuit for low temperatures with armoured anti-condensation heating elements and thermostat; solution provided for operation down to -25°C
- 12) Support terminal box with isolation for YO1 shunt opening release, YC shunt closing release, M motor and YU undervoltage release (if requested)



- 13) The cabinet is fitted with cable gland plate for control, cables and with padlockable front door

The circuit-breaker is supplied with asymmetrical terminal connections on one side of the poles only and with 4 holes as per NEMA form 4 Standards. The lower terminal is turned towards the rear of the apparatus, the upper terminals are provided as standard turned towards the front of the apparatus but, on request, it can be turned towards the rear of the apparatus

The structures provided are:

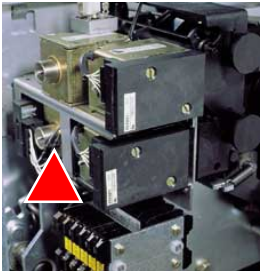
- T structures with telescopic supports adjustable in height
- The structure and framework are always made of hot galvanised steel

Equipment supplied on request

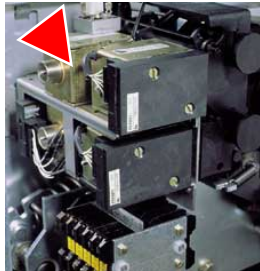
- 14) MCB for geared motor protection
- 15) Signalling lamps placed inside the cabinet, in a position visible from the inspection window on the door. A single solution with 4 lamps is provided for:
- signalling circuit-breaker closed (red lamp)
 - signalling circuit-breaker open (green lamp)

- signalling springs charged (or alternatively discharged) (yellow lamp)
- signalling insufficient gas pressure (white lamp)

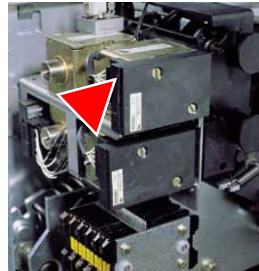
- 16) Selector switch for local/remote control
- 17) Control switch for local ON/OFF electrical operation through shunt closing and opening releases
- 18) YU undervoltage release
- 19) Electrical signalling of YU undervoltage release energised (or de-energised)
- 20) Electronic time delay device for YU undervoltage release
- 21) Q0 Transient closing contact (NO contact which closes transiently during circuit-breaker opening)
- 22) 20 auxiliary switches contacts (10 NO + 10 NC)
- 23) Single-phase socket
- 24) Illumination lamp which automatically switches on by means of a limit switch when the door is opened
- 25) IP54 ventilation filters on the discharge holes located on the bottom of the casing
- 26) CT support structure units terminal connector



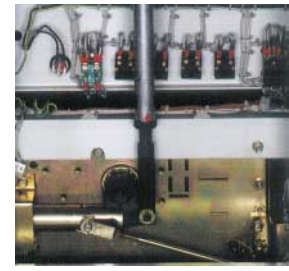
Shunt closing release



Shunt opening release



Undervoltage release



Auxiliary contacts with linkage



Spring charging geared motor

Characteristics of the electrical accessories of the ESH operating mechanism

| | | | | | | |
|-------------------------------------|-------------|---|----------|----------|----------|----------|
| Shunt opening release | Ps | = 125 W / VA x 45 ms (instantaneous service) | | | | |
| | Un | = 24, 30, 48, 60, 110, 125, 220 V– | | | | |
| | Un | = 48, 110, 127, 220, 230, 240 V~ 50 Hz | | | | |
| | Un | = 110, 127, 220, 230, 240 V~ 60 Hz | | | | |
| Shunt closing release | Ps | = 250 W / VA x 150 ms | | | | |
| | Pc | = 5 W / VA (anti-pumping function - continuous service) | | | | |
| | Un | = 24, 30, 48, 60, 110, 125, 220 V– | | | | |
| | Un | = 48, 110, 127, 220, 230, 240 V~ 50 Hz | | | | |
| | Un | = 110, 127, 220, 230, 240 V~ 60 Hz | | | | |
| Undervoltage release | Ps | = 250 W / VA x 150 ms | | | | |
| | Pc | = 5 W / VA (continuous service) | | | | |
| | Un | = 24, 30, 48, 60, 110, 125, 220 V– | | | | |
| | Un | = 48, 110, 127, 220, 230, 240 V~ 50 Hz | | | | |
| | Un | = 110, 127, 220, 230, 240 V~ 60 Hz | | | | |
| Spring charging geared motor | Ps | = 1500 W / VA x 100 ms | | | | |
| | Pc | = 400 W / VA x 6 s | | | | |
| | Un | = 24, 30, 48, 60, 110, 125, 220 V– | | | | |
| | Un | = 48, 110, 127, 220, 230, 240 V~ 50 Hz | | | | |
| | Un | = 110, 127, 220, 230, 240 V~ 60 Hz | | | | |
| Signalling contacts | Un | = 110 V~ | = 230 V~ | = 400 V~ | = 110 V– | = 220 V– |
| | Icu | = 4 A | = 3 A | = 1.5 A | = 0.25 A | = 0.13 A |
| | cosφ | = 0.3 | = 0.3 | = 0.3 | = – | = – |
| | T | = – | = – | = – | = 10 ms | = 10 ms |
| Signalling contacts | Un | = 400 V~ | = 220 V– | | | |
| | Icu | = 15 A | = 1.5 A | | | |
| | cosφ | = 0.4 | = – | | | |
| | T | = – | = 10 ms | | | |

Un Rated voltage

Cosφ Power factor

Icu Breaking capacity

Ps Inrush absorbed power

Pc Continuous service absorbed power

T Time constant

Product Characteristics

Resistance to vibrations

The OHB circuit-breakers are unaffected by mechanical vibrations.

Tropicalisation



The OHB circuit-breakers are manufactured in compliance with the strictest regulations for use in hot-humid-saline climates.

All the important metal components are treated against corrosion. The sheet metal components are

metalised with zinc and painted to ensure protection against corrosion. The support structures are hot dip galvanised. These construction characteristics mean the OHB circuit-breakers and their accessories comply with climate graph 8 of the IEC 60721-2-1 and IEC 60068-2-2 (Test B: Dry Heat) / IEC 60068-2-30 (Test Bd: Damp Heat, cyclic) Standards.

Altitude



The insulating property of air decreases as the altitude increases. This fact must therefore be taken into account for external insulation of the apparatus (the internal insulation does not undergo any variation because it is guaranteed by the SF6 gas).

The phenomenon must always be considered during the design stage of the insulating components of the apparatus which are to be installed over 1000 m above sea level.

In this case a correction coefficient must be considered, which can be taken from the graph at the side, built up on the basis of the indications in the IEC 60694 Standards.

The following example is a clear interpretation of the indications given above.

Example

- Installation altitude: 2000 m
- Service at 24 kV rated voltage
- Power frequency withstand voltage: 70 kVrms
- Impulse withstand voltage: 150 kVp
- Ka factor, which can be taken from the graph = 1.13

Considering the above parameters, the apparatus must withstand (on test at zero altitude, i.e. at sea level).

– power frequency withstand voltages:

$$70 \times 1.13 = 79.1 \text{ kVrms}$$

– impulse withstand voltage:

$$150 \times 1.13 = 169.5 \text{ kVp}$$

From the above, it can be deduced that for installations at an altitude of 2000 m above sea level, with 24 kV service voltage, apparatus must be provided with 36 kV rated voltage, characterised by insulation levels at power frequency of 95 kVrms with 200 kVp impulse withstand voltage.

Graph for determining the Ka correction factor according to the altitude

H = altitude in metres

m = value based on power frequency, impulse and phase to phase withstand voltage

Operation of special loads

The table shows the breaking capacities which can be guaranteed for operation of special loads.

| Circuit-breaker | | OHB | |
|---|---------------------------|---------|---------|
| Rated normal current | I_n [A] | 1250 | 2500 |
| No-load MV/LV transformer breaking | I_{sc} [A] | 10 | 10 |
| No-load line breaking | I_{sc} [A] | 31.5 | 31.5 |
| Capacitive current breaking (single bank) | I_{sc} [A] | 400 (*) | 400 (*) |
| Compensation reactance current breaking | I_{sc} [A] | 630 | 1250 |



N.B. The maximum overvoltages found in all breaking, under the conditions considered, are < 2.5 PU

$$(PU = \text{Per Unit} = 2.5 \times \sqrt{2} \times \frac{V_n}{\sqrt{3}})$$

(*) Back-to-back: 400 A, 20 kA inrush current, 4.25 kHz inrush frequency; for higher values of capacitive currents, please consult us.

Environmental protection programme

The OHB circuit-breakers are manufactured in accordance with the ISO 14000 Standards (Guidelines for environmental management).

The production processes are carried out in compliance with the Standards for environmental protection in terms of reduction in energy consumption as well as in raw materials and production of waste materials. All this is due to the medium voltage apparatus manufacturing facility environmental management system, certified by an external independent organisation.

Assessment of the environment impact during the life cycle of the product (LCA - Life Cycle Assessment), is carried out during the design stage itself and materials, processes and packing methods are selected to minimise the same.

Production techniques which prepare the products for simple dismantling and separation of the components are used during manufacture of the circuit-breakers. This is to allow maximum recycling at the end of the useful life cycle of the apparatus.

Anti-pumping device

The ESH operating mechanism on OHB circuit-breakers (in all versions) is fitted with a mechanical anti-pumping device which prevents reclosing due to either electrical or mechanical commands.

Should both the closing command and any one of the opening commands be active at the same time, there would be a continuous succession of opening and closing operations. The anti-pumping device avoids this situation, ensuring that each closing operation is only followed by a single opening operation and that there is no closing operation after this. To obtain a further closing operation, the closing command must be released and then relaunched.

Furthermore, the anti-pumping device only allows circuit-breaker closure if the following conditions are present at the same time:

- operating mechanism springs fully charged
- opening push button and/or opening release (YO1) not enabled



Spare parts

- Opening springs ⁽¹⁾
- Closing springs ⁽¹⁾
- Complete pole ⁽¹⁾
- Basic operating mechanism ⁽¹⁾
- Spring charging geared motor ⁽¹⁾
- Geared motor limit contact
- Anti-condensation heater
- Shunt opening release
- Thermostat
- Operating mechanism auxiliary contacts ⁽¹⁾
- Undervoltage release ⁽¹⁾
- SF6 gas filling kit ⁽²⁾
- SF6 5-litre gas cylinder ⁽²⁾

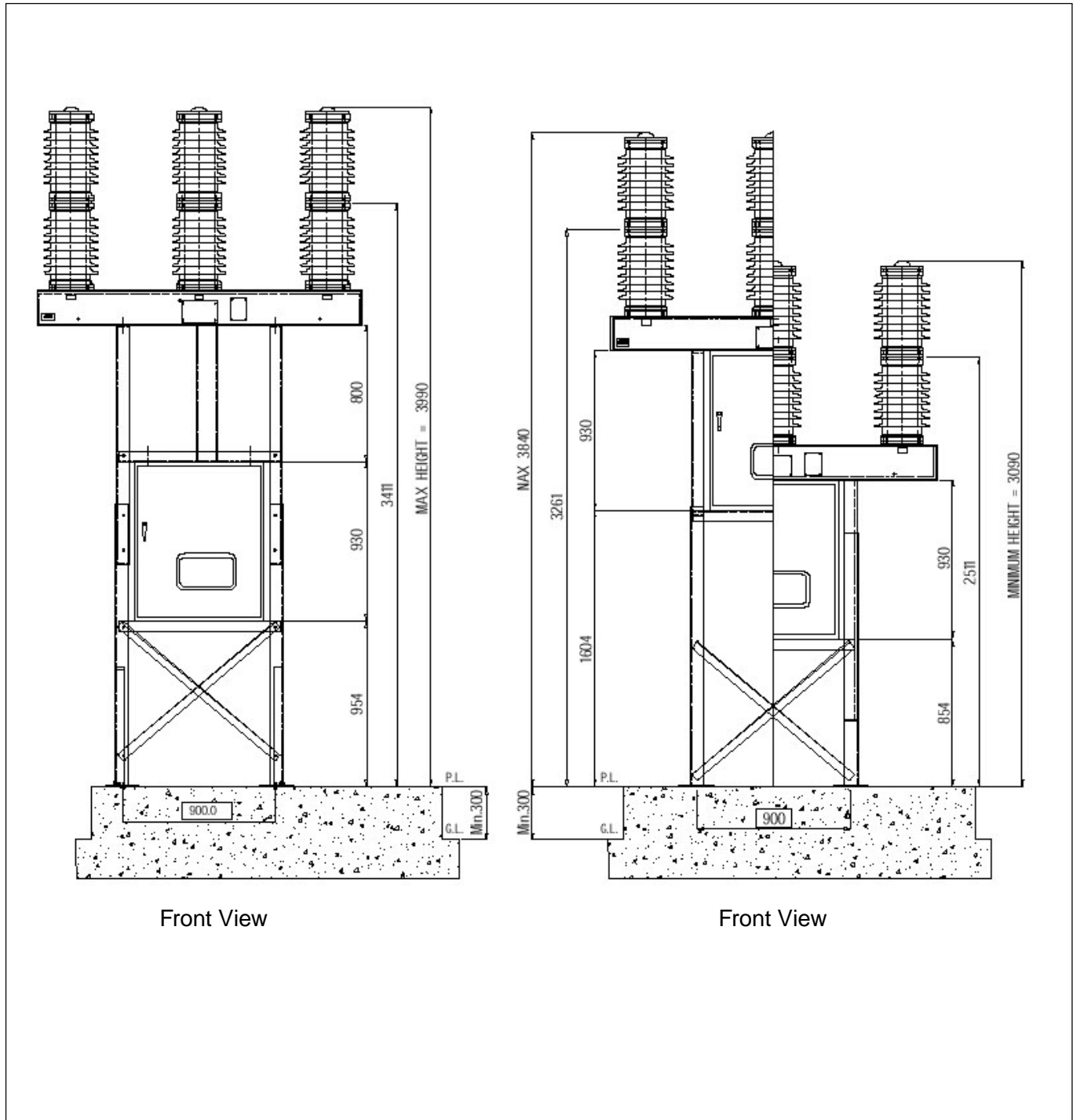
Ordering

For availability and ordering of spare parts, please contact the ABB Service, specifying the circuit-breaker serial number.

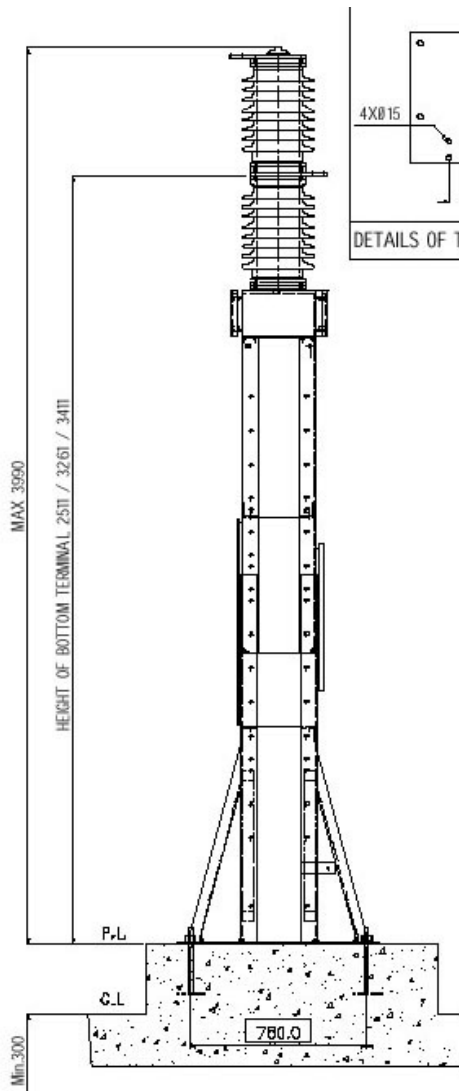
⁽¹⁾ Replacement can only be carried out by trained personnel and/or in our workshops.

⁽²⁾ Only to be used by trained personnel or at an ABB Service.

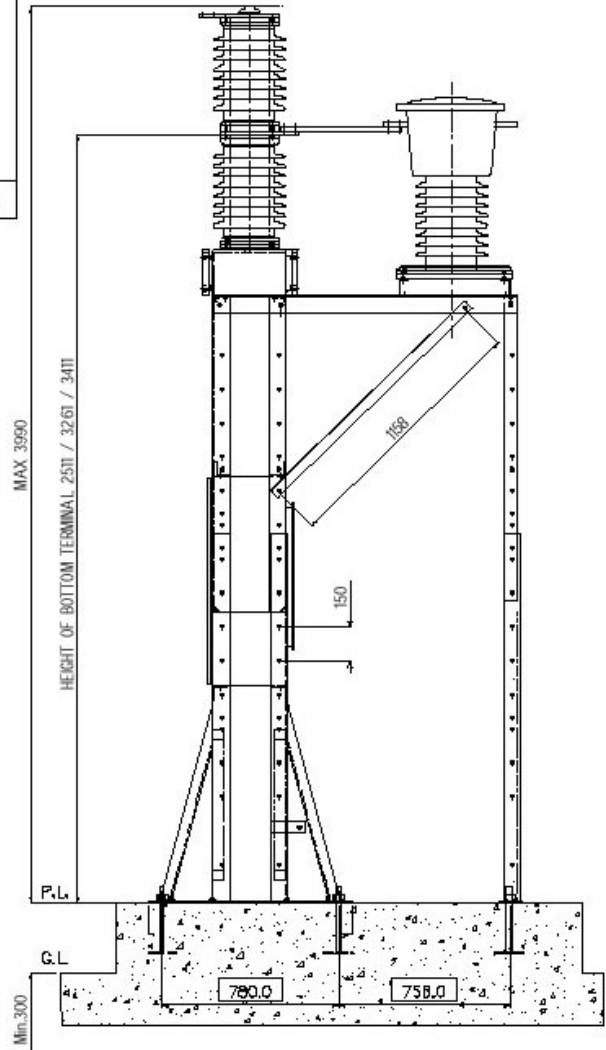
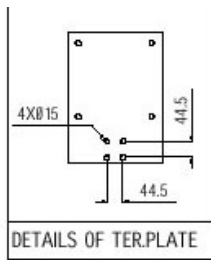
Overall Dimensions



| | OHB36 | OHB40 |
|-----|------------------|------------------|
| Ur | 36 kV | 40.5 kV |
| Ir | 1250 A 2500 A | 1250 A 2500 A |
| Isc | 25 kA 31.5 kA | 25 kA 31.5 kA |

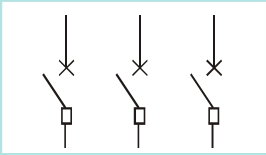
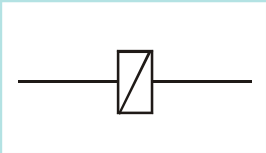

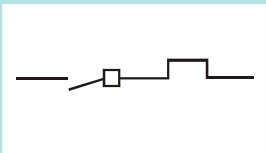

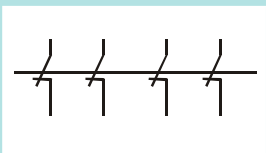
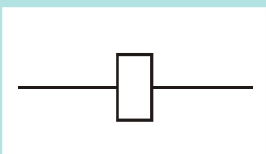
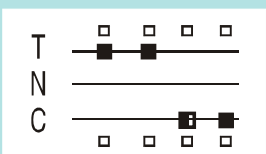
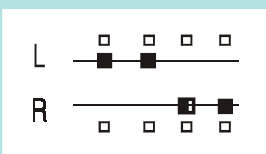


Side View w/o CT Structure

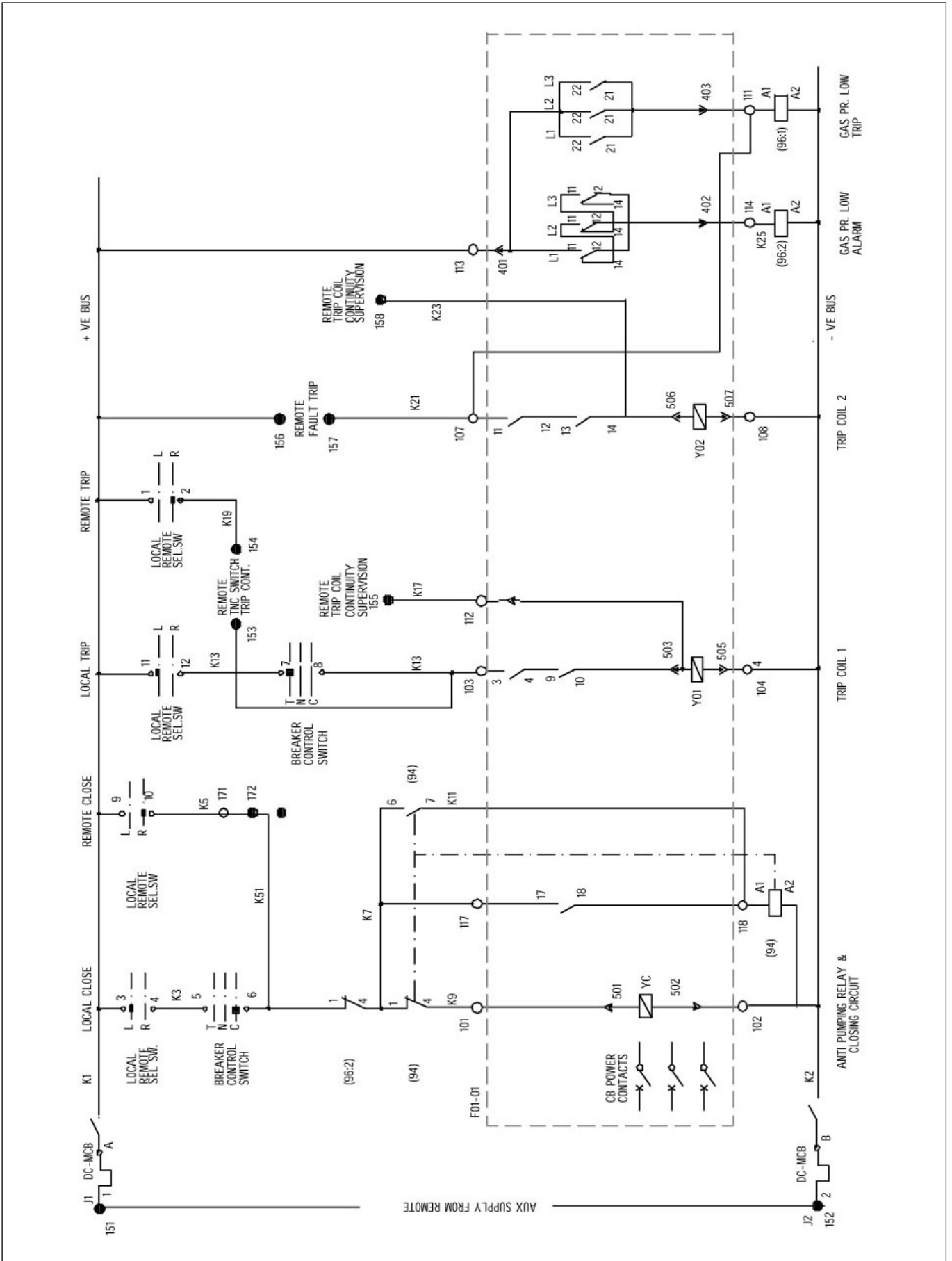


Side View with CT Structure (optional)

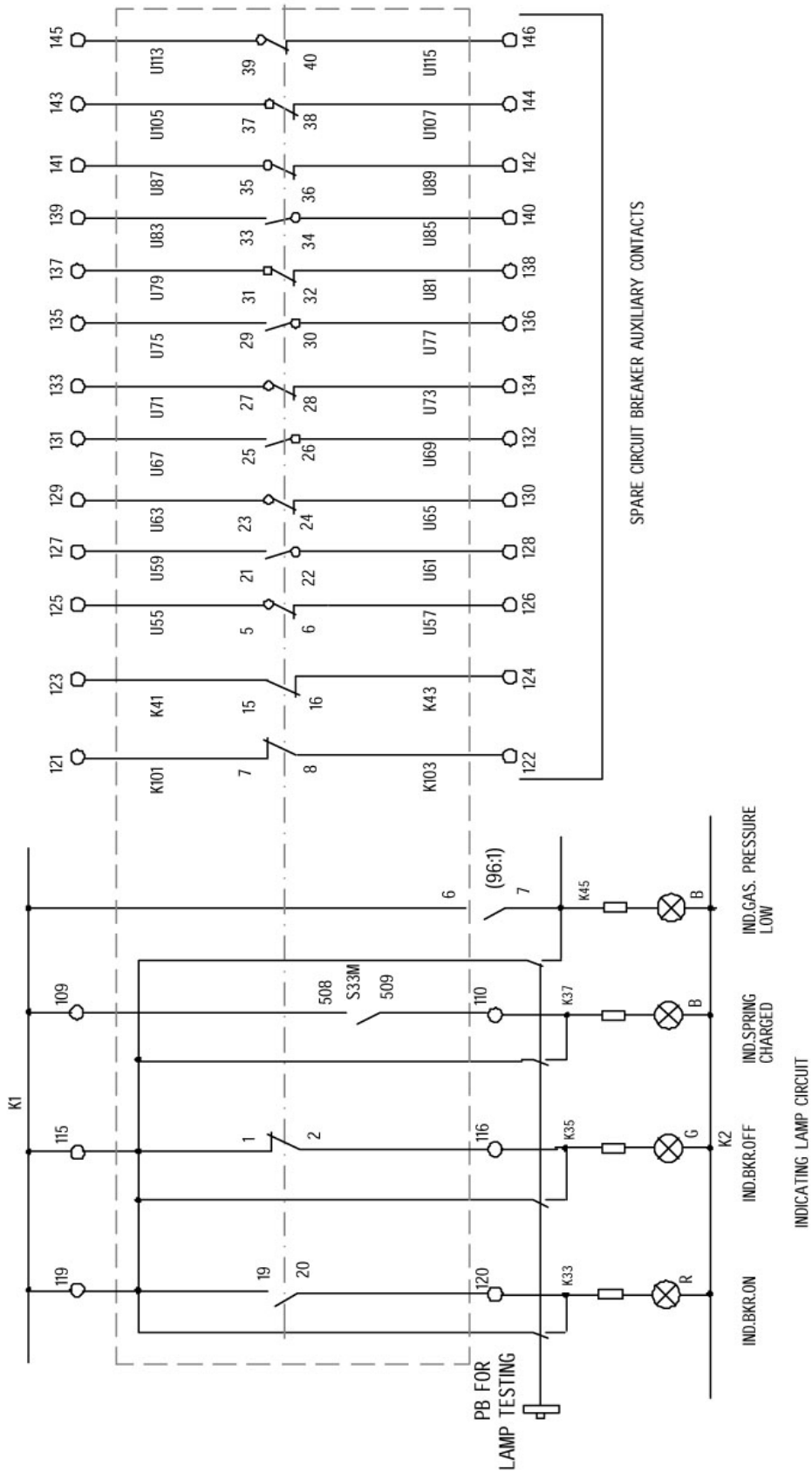
Electric Circuit Diagram

| Legend | Description |
|---|---|
|  | OHB Circuit Breaker |
|  | Closing Coil (CC) YC Trip Coil (TC1) Y01 Trip Coil (TC2) Y02 |
|  | Spring Charge Motor |
|  | MCB |
|  | Indicating Lamp |
|  | Breaker Aux. Contacts |
|  | Anti-Pumping Relay Gas Pr. Low Alarm Relay Gas Pr. Low Trip Relay |
|  | Breaker Control Switch |
|  | Local Remote Switch |

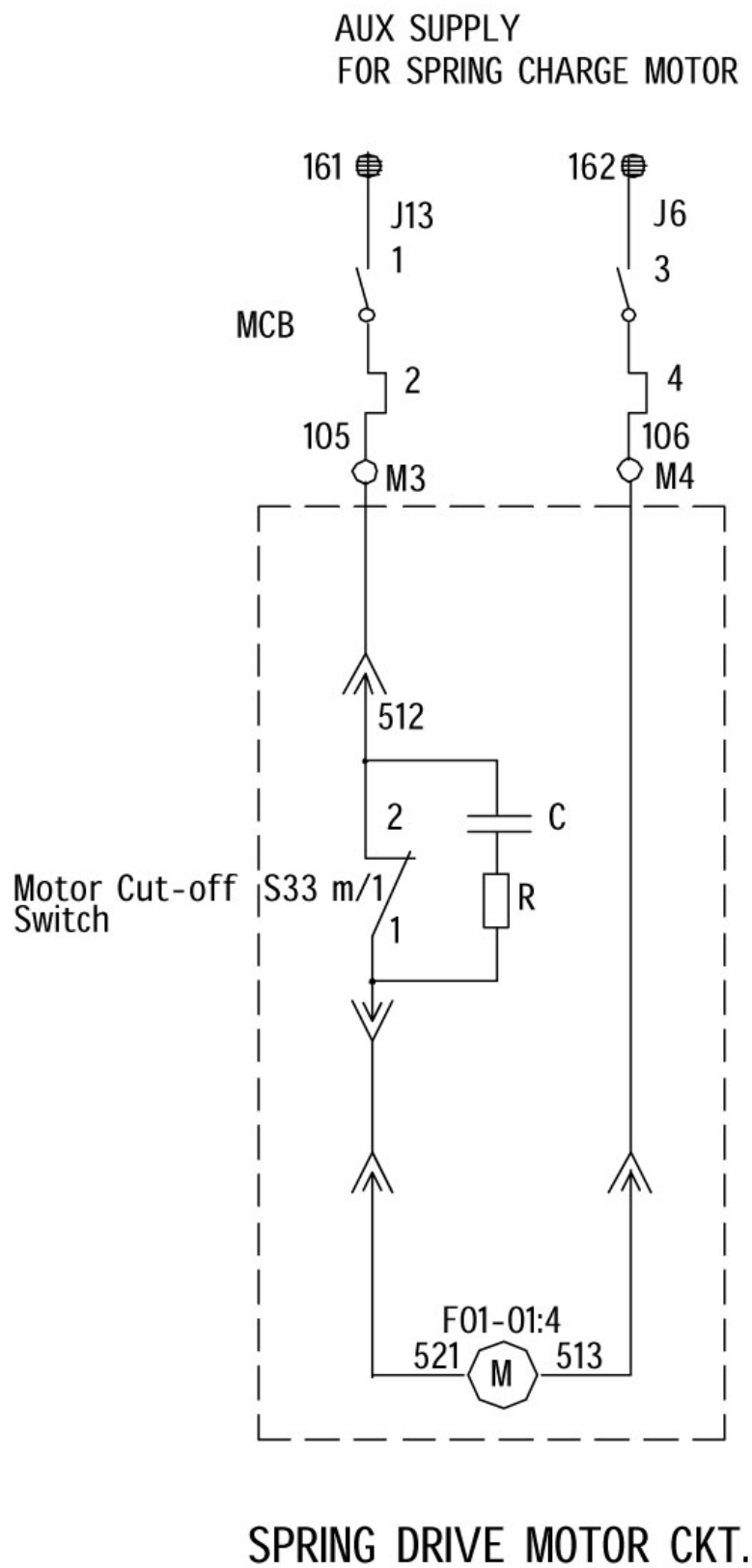
Control circuit



Auxiliary circuit and indication



Accessories and motor circuit





Medium Voltage Equipment
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Regional Marketing Offices:

| North | East | West | Central | South |
|--|---|---|---|--|
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