HYUNDAI

HEAVY INDUSTRIES CO. BULGARIA

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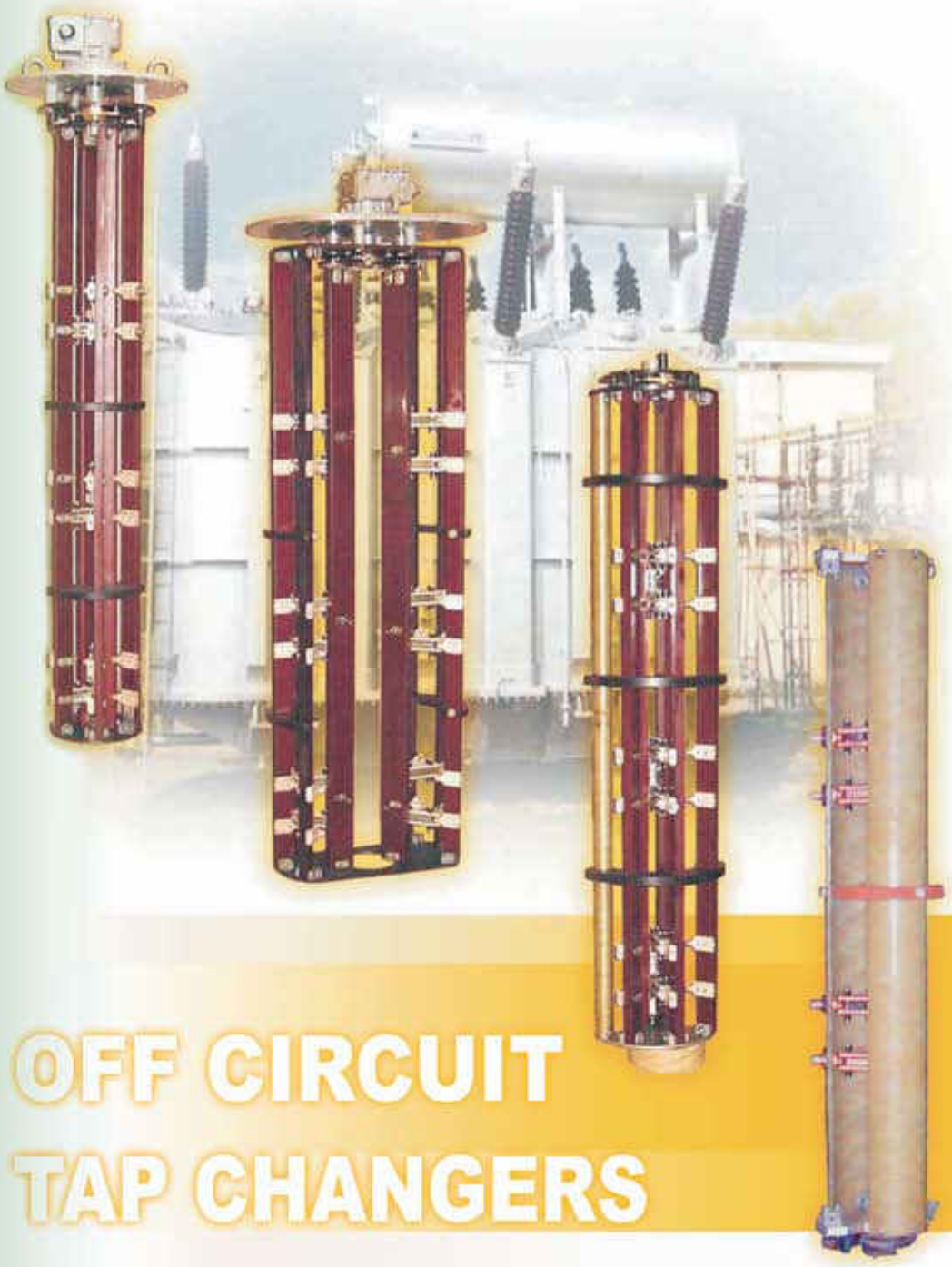
# OFF CIRCUIT TAP CHANGERS



OFF CIRCUIT TAP CHANGERS

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Throughout the years, various types of off circuit tap changers (OCTCs) have been developed in Hyundai Heavy Industries Co. Bulgaria (HHIB):

- *PBV*
- *PBVK*
- *PBVE*
- *PBVL*
- *PBVR*
- *PBVKL*

The OCTCs manufactured in HHIB are installed in a wide range of transformers and are currently in operation in USA, Canada, Russia, Mexico, Korea and many other countries in Asia, Europe, South and North America. The basic OCTC series developed by HHIB comply with the requirements of the IEC 60214-1; 2003 standard.
The HHIB off circuit tap changers can be used for the following basic connection diagrams:

- Linear regulation in the neutral (Linear OCTC);
- Single-bridging off circuit tap changers;
- Double-bridging off circuit tap changers;
- Series/Parallel switching of transformer windings;
- Star/Delta switching of transformer windings;
- Special switching of transformer windings.

# OCTCs IN CURRENT PRODUCTION

## PBV OCTC Series (PBV 01, PBV 02.1 and PBV 03)

The PBV OCTCs are designed for installation to the active part of the transformer.

- Rated currents (A)
  - 200, 400, 630, 1000 for a single current-carrying path;
  - up to 2000 in transformers with two parallel current-carrying paths (enforced current splitting).
- Rated voltage (kV)
  - up to 170 in a three-phase design;
  - up to 245 in a single-phase design.
- Withstand test voltages across the tap winding – "tap range" (kV)
  - 125, 180, 240 – rated lightning impulse voltage (1,2/50 μS);
  - 40, 50, 80 – rated power-frequency voltage (50 Hz, 1 min.).
- Number of steps:
  - up to15.

## PBVK and PBVE OCTC Series

The PBVK and PBVE OCTCs are to be installed on the transformer cover.

- Carrying flange:
  - PBVK – round flange;
  - PBVE – elliptic flange.
- Rated currents (A)
  - 200, 400, 630,1000 for a single current-carrying path;
  - 2x1000 in transformers with two parallel current-carrying paths (enforced current splitting).
- Rated voltage (kV)
  - up to 170 in a three-phase design;
  - up to 245 in a single-phase design.
- Withstand test voltages across the tap winding – "tap range" (kV)
  - 125, 220, 270 – rated lightning impulse voltage (1,2/50 μS);
  - 40, 50, 80 – rated power-frequency voltage (50Hz, 1 min.).
- Number of steps
  - PBVK – up to 17;
  - PBVE – up to 5.

## PBVR OCTC series

The PBVR OCTCs are designed for installation to the active part of the transformer.

- Rated currents (A)
  - 200,400,630 for a single current carrying path;
  - up to 1250 in transformers with two parallel branches (enforced current splitting).
- Rated voltage (kV)
  - up to 170 in a three-phase design;
  - up to 245 in a single-phase design.
- Withstand test voltages across the tap winding – "tap range" (kV)
  - 240 with lightning impulse voltage 1,2/50 μs;
  - 70 with separate source AC peak value voltage and duration 1 min (r.m.s value).
- Number of steps
  - up to 5.

## PBVL and PBVKL OCTC Series

The PBVL and PBVKL OCTCs are intended for linear regulation in the neutral and are installed on the transformer cover.

- Rated currents (A)
  - 200, 400, 630, 1000 for a single current-carrying path;
  - up to 4000 in transformers with four parallel branches (enforced current splitting).
- Rated voltage (kV)
  - up to 170 in a three-phase design;
  - up to 245 in a single-phase design.
- Withstand test voltages across the tap winding – "tap range" (kV)
  - 180-400 rated lightning impulse voltage (1,2 / 50 μs);
  - 50-110 rated power-frequency voltage (50 Hz, 1 min)
- Number of steps
  - PBVL – up to 17;
  - PBVKL – up to 17.

# OFF CIRCUIT TAP CHANGERS OF HHI-BULGARIA

## PBV 01


I=200,400,630A
U=17.5-123kV
2-11 steps

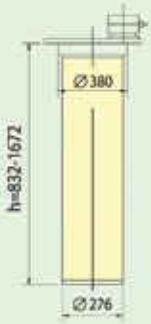
## PBV 02.1


I=200-1000A
U=17.5-170kV
2-15 steps

## PBV 03

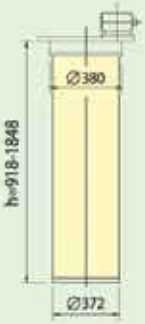

I=200,400,630A
U=17.5-72.5kV
5 steps

## PBVK 01




I=200,400,630A
U=17.5-123kV
2-11 steps

## PBVK 02

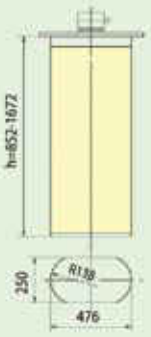



I=200-1000A
U=17.5-170kV
2-17 steps

## PBVK 03

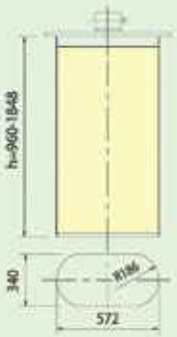

I=200,400,630A
U=17.5-72.5kV
2-11 steps

## PBVE 01




I=200,400,630A
U=24-170kV
2-5 steps

## PBVE 02

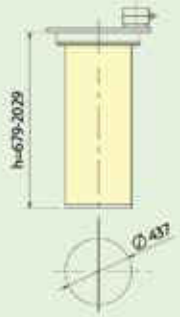



I=200-1000A
U=24-170kV
2-5 steps

## PBVKL 01

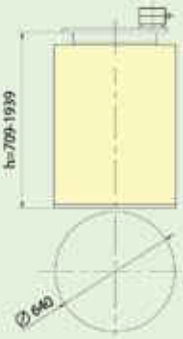

I=200-1000A
U=17.5-123kV
2-5 steps

## PBVKL 02



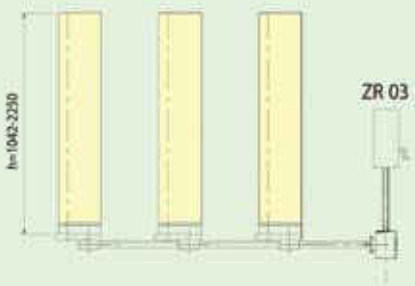

I=200-1000A
U=17.5-170kV
2-11 steps

## PBVKL 04




I=200-1000A
U=24-170kV
2-17 steps

## PBVR 01




I=200,400,630A
U=17.5-245kV
2-5 steps

## PBVL 01


I=200-1000A
U=17.5-123kV
2-5 steps

## PBVL 02


I=200-1000A
U=24-170kV
2-11 steps

## PBVL 04


I=200-1000A
U=24-170kV
2-17 steps

# DRIVING UNITS FOR OFF CIRCUIT TAP CHANGERS

Every HHIB OCTC is driven by means of a hand or motor drive unit, vertical and horizontal shafts, cardan couplers and a bevel gear.

The type of the driving unit is chosen by the client.
The following units are used for driving of the off circuit tap changers:

- ZR 03 hand drive unit – for lateral installation to the transformer tank;
- Hand wheel;
- MZ 4.1 and MZ 4.4 motor drive units.

ZR 03

## ZR 03 Hand Drive Units (HDUs)

- The HDU is installed laterally to the transformer tank at a height convenient for servicing and control. It is connected to the OCTC by means of vertical and horizontal shafts, cardan couplers and a bevel gear.
- The HDU design covers all climatic conditions.
- The HDU meets the requirements of the IEC 60214-1 ;2003 standard.
- Special design:
  - outgoing driving shaft at the HDU bottom (for PBVR);
  - locking with padlock.

## TECHNICAL DATA

| Description | Unit | Value |
|---|---|---|
| Revolutions of hand crank per switching operation | Revs | 11 |
| Torque (max value at force 200 N, applied to the hand crank) | Nm | 40 |
| Control circuit voltage | V | AC 230 |
| Insulation level | kV | 2 |
| Number of operating tap positions (max) | | 17 |
| Heating power | W | 10 |
| Degree of protection | | IP 54 |
| Weight | kg | 12 |
| Overall dimensions | mm | h-343, l-180, w-172 |

# MZ 4.1 and MZ 4.4 Motor Drive Units (MDUs)

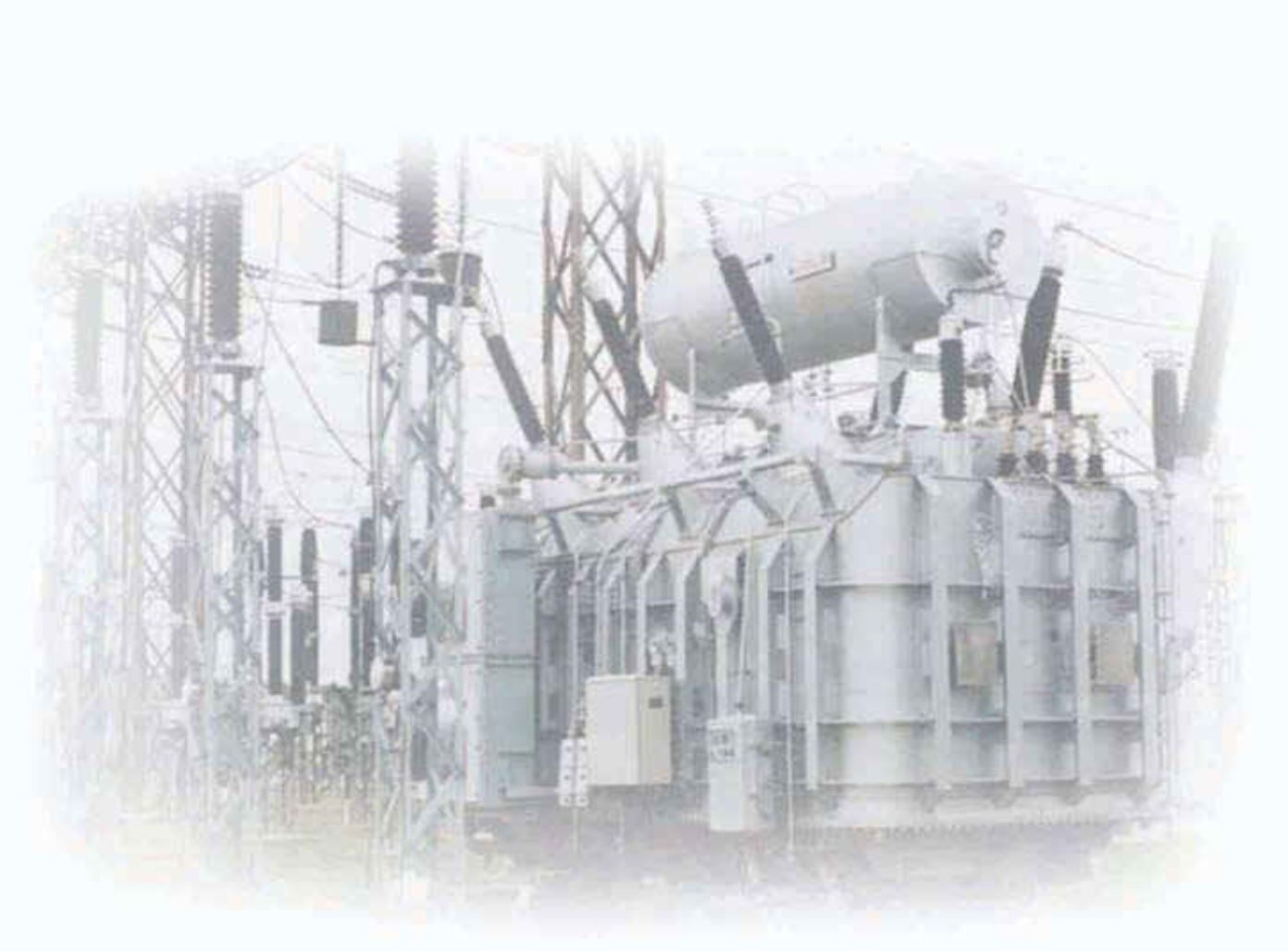
- The MDU is installed laterally to the transformer tank at a height convenient for servicing and control. It is connected to the OCTC by means of vertical and horizontal shafts, cardan couplers and a bevel gear.
- The MDU design covers all climatic conditions.
- The MDU complies with the requirements of the IEC 60214-1; 2003 standard.
- The degree of protection for the special designs is IP65.

MZ 4.1


MZ 4.4

## TECHNICAL DATA

| Description | | MZ 4.1 | MZ 4.4 |
|---|---|---|---|
| Rated power of the el. motor | kW | 0,75/1.1 | 0,75/1.1 |
| Rated frequency | Hz | 50/60 | 50/60 |
| Supply voltage | V | 3AC 400/230 | 3AC 400/230 |
| Synchronous speed | $min^{-1}$ | 1500 | 1500 |
| Duration of the switching operation | s | 2,25 | 2,25 |
| Revolutions of hand crank per switching operation | revs | 16,5 | 16,5 |
| Torque of the outgoing driving shaft | Nm | 17/24 | 17/24 |
| Control circuit voltage | V | AC 230 | AC 230 |
| Insulation level | kV | 2 | 2 |
| Number of operating tap positions (max) | | 38 | 35 |
| Heating power | W | 250 | 2x150 |
| Degree of protection | | IP 54 | IP 54 |
| Weight | kg | 86 | 104 |
| Overall dimensions | mm | H-856, D-330, W-510 | H-920, D-320, W-610 |



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