4 OFF-LOAD TAP CHANGER

4.1 Off load tap-changer "MR" U III 300 /600/800/1000ME

Operating instructions	BA249
Off circuit tap changer	897625 2M/TUU1
Dimension drawing	8976251E
Adjustment plan	8956874E

Datum Date	Izradio Designed	Odobrio Approved	Prc Re
VIII 2005.	ing. Taslak	mr. Biloš	

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Off-Circuit Tap-Changer DEETAP® U

Operating Instructions BA 249

Contents

NOTE

Data contained herein may differ in details from the equipment delivered. We reserve the right to make alterations without notice.

1 General

1.1 Safety instructions

All personnel involved in installing, commissioning, operating, maintaining or repairing the equipment must:

- be suitably qualified and
- strictly observe these Operating Instructions.

Improper operation or misuse can lead to

- serious or fatal injury,
- damage to the equipment and property of the user and
- a reduction in the efficiency of the equipment.

Safety instructions in this manual are presented in 3 different forms to emphasize important information.

WARNING

This information indicates particular danger to life and health. Disregarding such a warning can lead to serious or fatal injury.

ACHTUNG

This information indicates particular danger to the equipment or other property of the user. Serious or fatal injury cannot be excluded.

NOTE

These notes give important information on specific subjects.

1.2 Specified application

CAUTION

The off-circuit tap-changer may only be used with the transformer specified in the order.
Installation, electrical connection and commissioning of the off-circuit tap-changer must only be carried out by qualified, skilled personnel and only in accordance with these Operating Instructions.

It is the responsibility of the user to ensure that the off-circuit tap-changer is used for the specified application only.
For safety reasons, any unauthorised work such as installation, alteration, electrical connection, commissioning or modification to the tap-changer equipment is forbidden without first consulting MR.

The trouble-free operation of the drive, off-circuit tap-changer and transformer may be put at risk.

WARNING

All relevant fire protection regulations must be strictly observed.

2 Structure / Design

The off-circuit tap-changers DEETAP® U are available in the following designs (see basic circuit diagrams in **fig. 1**):

- Linear off-circuit tap-changers
- Single-bridging off-circuit tap-changers
- Double-bridging off-circuit tap-changers
- Series-parallel off-circuit tap-changers
- Off-circuit tap-changers for special applications

Off-circuit tap-changers are designed on the principle of a modular system allowing maximum rated through-currents of 300 A, 600 A, 800 A and 1000 A per current path.

)ff-circuit tap-changers DEETAP® U are available with up to 17 service positions (see survey, **fig. 2**).

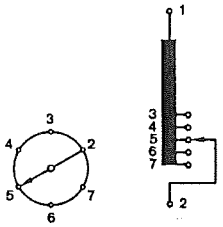
All models correspond to IEC 60214-1.

Switching principle: the off-circuit tap-changer is changed over from one operating position to the next by rotating an insulating drive shaft. The off-circuit tap-changer is either actuated by hand wheel or operating key directly on the insulating drive shaft or via a step-by step gear by manual drive BM 75, manual drive MR 404 or motor-drive ED.

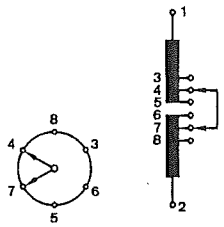
CAUTION

The off-circuit tap-changer; with the relevant drive is to be used only with the transformer specified in the order.
Installation, electrical connection and commissioning of the off-circuit tap-changer must be carried out by qualified, skilled personnel and in accordance with these Operating Instructions.
Do not alter or modify the equipment without first consulting MR.
Any unauthorized works such as installation, electrical connection or commissioning of the off-circuit tap-changer equipment endangers the trouble-free operation of the manual or motor-drive, of the off-circuit tap-changer and of the transformer.

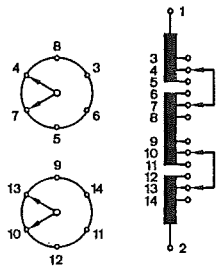
Linear off-circuit tap-changer



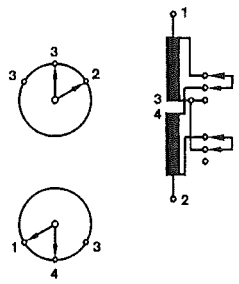
Single-bridging off-circuit tap-changer



Double-bridging off-circuit tap-changer



Series-parallel off-circuit tap-changer



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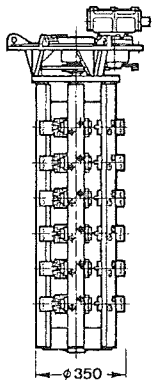
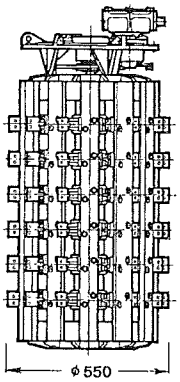
Basic circuit diagrams of off-circuit tap-changers

1



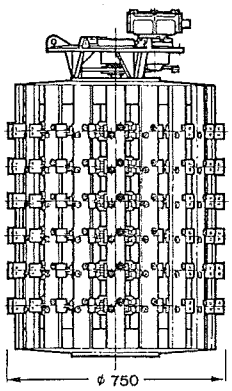
Max. rated through-current
300 A, 600 A, 800 A, 1000 A

up to 5 operating positions



Max. rated through-current
300 A, 600 A, 800 A, 1000 A

up to 11 operating positions



Max. rated through-current
300 A, 600 A, 800 A, 1000 A

up to 17 operating positions

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Off-circuit tap-changers DEETAP® U – survey

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3 Shipment

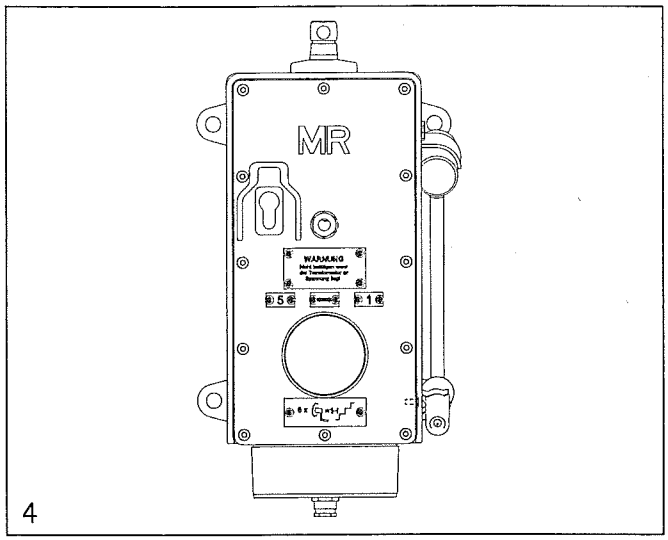
Off-circuit tap-changer, manual drive and motor-drive are shipped in the adjustment position.

The shipment of the off-circuit tap-changing equipment comprises:

- off-circuit tap-changer DEETAP® U (**fig. 3**)
- optional with manual drive MR 404 (**fig. 4**), manual drive BM 75 (**fig. 5**) or motor-drive unit ED (**fig. 6**)
- drive shaft with coupling parts and bevel gear (not included in case of hand wheel/slip-on ring wrench)

Check completeness of the shipment against the documents.

All parts must be stored in a dry place until use. The off-circuit tap-changer must be left in its protective cover and should be unpacked only immediately before installation.



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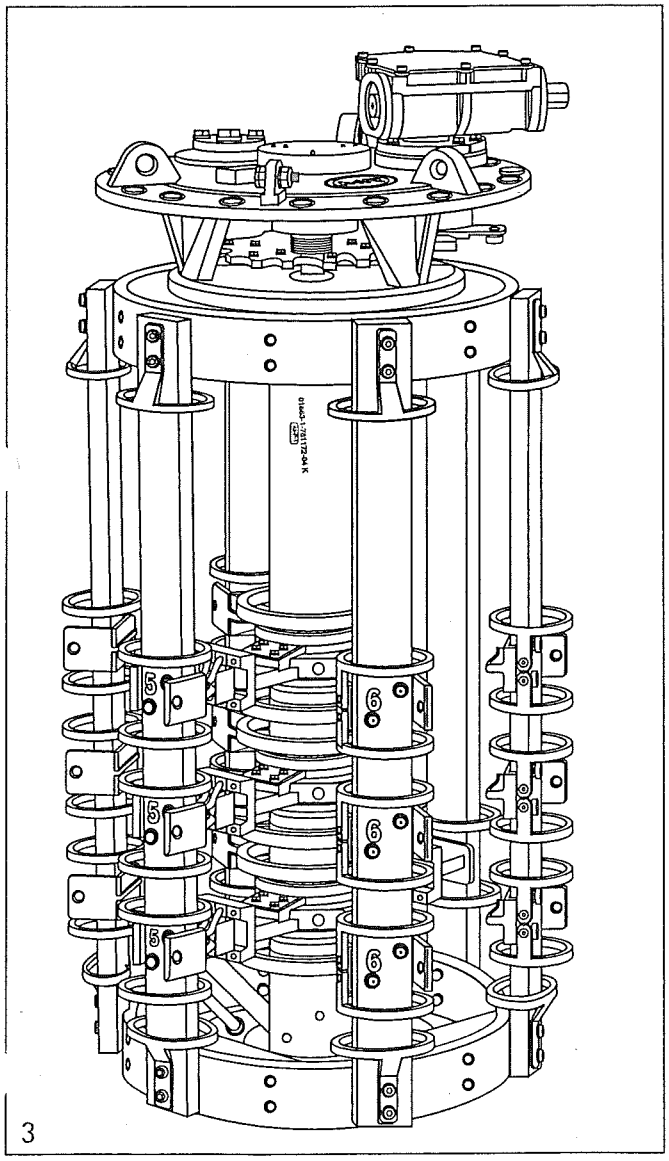

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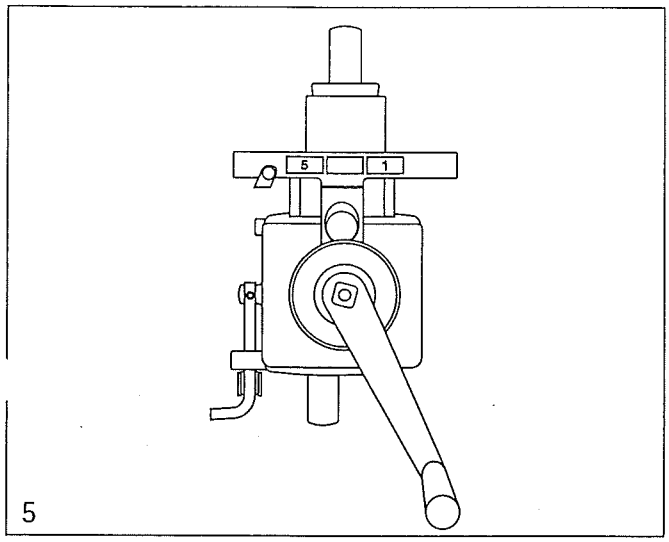

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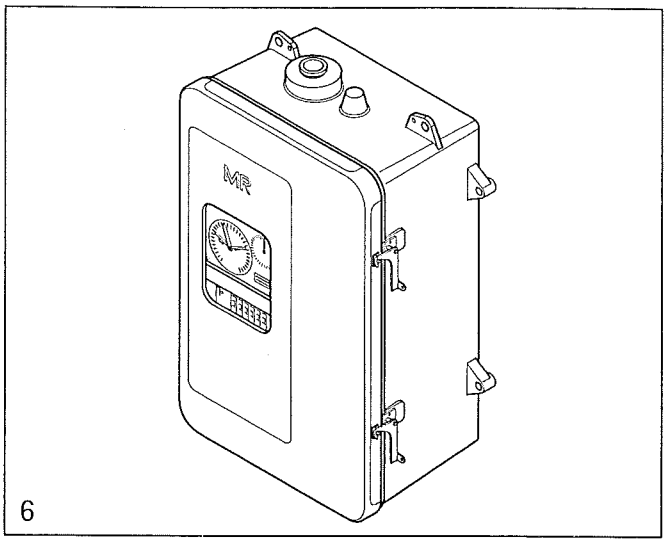

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4 Installation of the off-circuit tap-changer for cover mounting

A mounting flange is necessary for mounting the off-circuit tap-changer head to the transformer cover, (see **fig. 7** and section 12, drawings 895171, 895222). This flange has to match the gasketing area of the off-circuit tap-changer head.

To position the thread studs (M12, length 45 mm) we recommend the use of a drilling template (see **fig. 8** and section 12, dwg. 896135) which, if requested, will be supplied for the first installation of an off-circuit tap-changer free of charge.

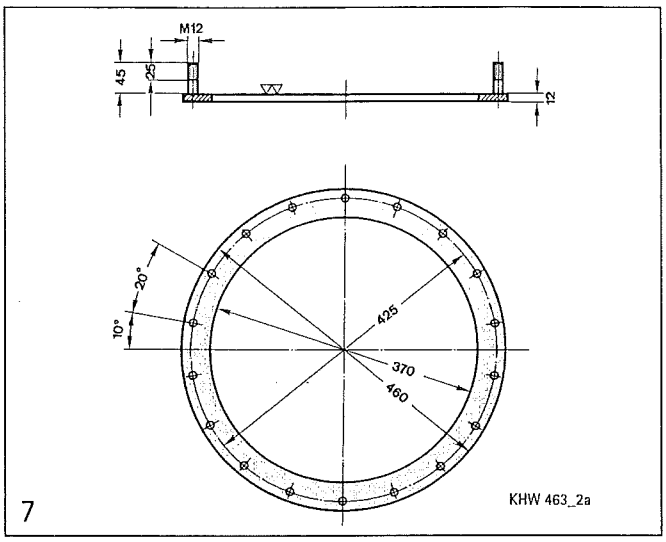
Contact circle diameter 350 mm:

Before mounting, the off-circuit tap-changer is lowered through the cover aperture into the transformer (see **fig. 9** and section 12, installation drawing 895 171).

1. Place the off-circuit tap-changer on a level surface. Clean the gasket surfaces (head underside, mounting flange).
2. Place an oil-proof gasket on the mounting flange of the transformer cover.

   Before lifting, resp. positioning the tap-changer head, turn the Geneva crank of the step-by-step gear inwards by 90° (see **fig. 10** and appendix, installation drawing 895171).

   Lift the off-circuit tap-changer over the mounting flange and lower it carefully into the opening of the mounting flange.
   Take care not to damage the terminals (and screening rings, if any).
3. Check correct position of the tap-changer head and the off-circuit tap-changer.
4. Fasten the drive head to the mounting flange.
5. Turn the Geneva crank of the step-by-step gear back into the original position by 90° (see installation drawing 895171).



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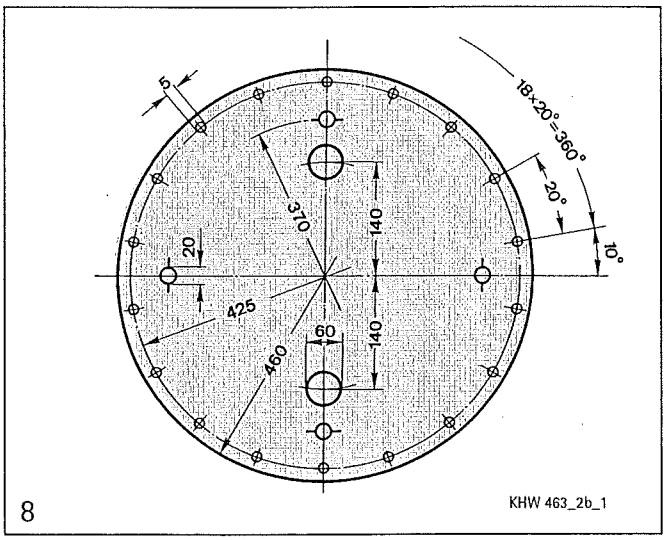

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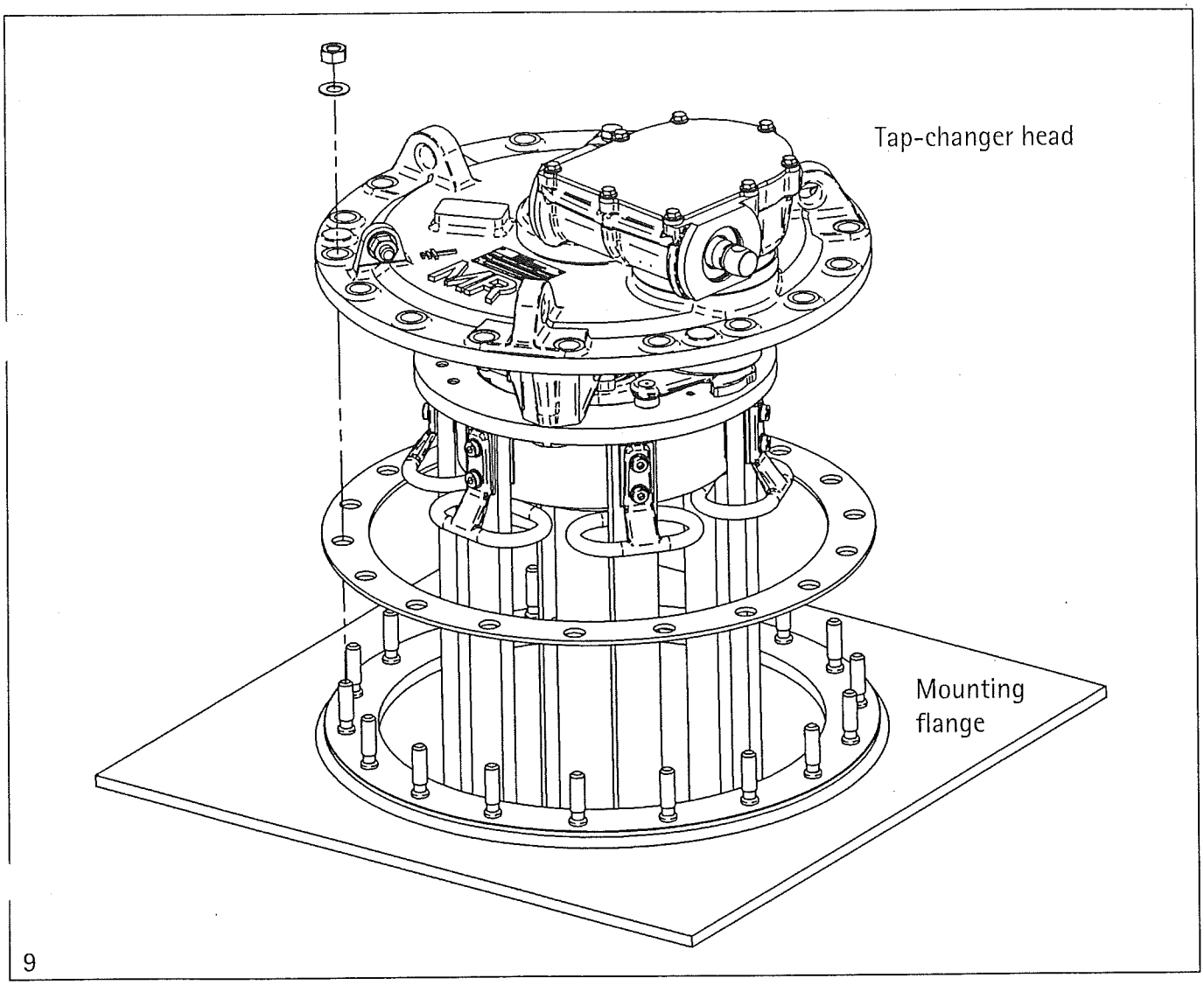

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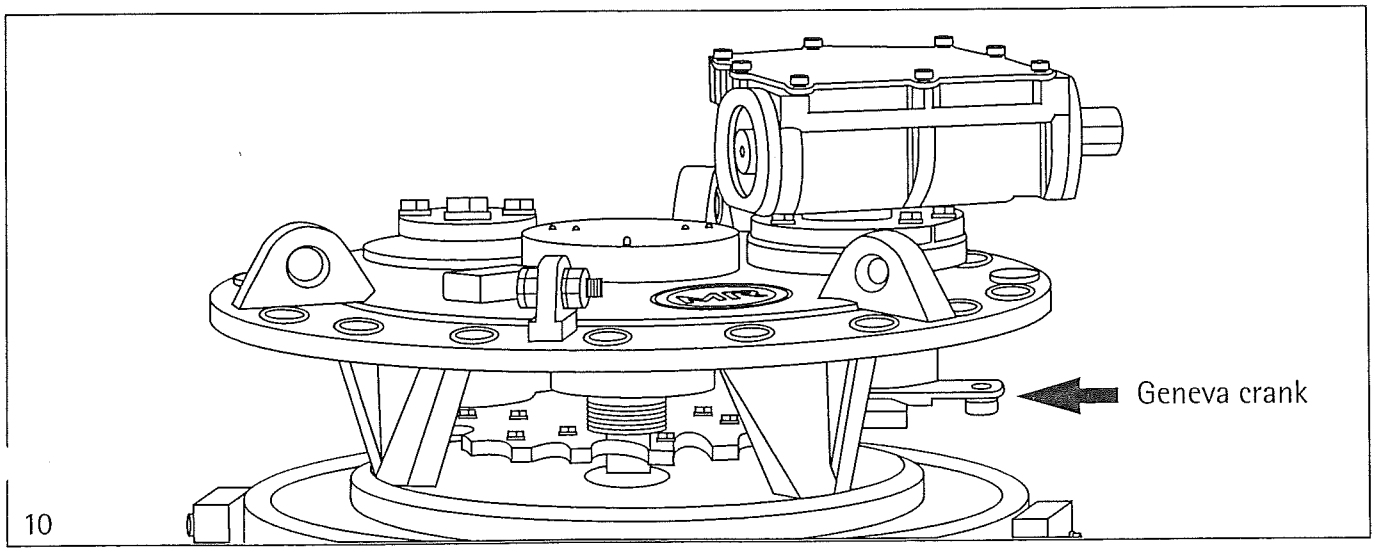

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Contact circle 550 mm or 750 mm diameter:

Due to the larger contact circle diameter the tap-changer head has to be removed before mounting the off-circuit tap-changer (**fig. 11, 12**).
Fix the tap-changer head on the mounting flange of the transformer cover. The tap-changer head is then attached to the mounting flange of the transformer cover and the off-circuit tap-changer mounted to the tap-changer head from below (see **fig. 13** and section 12, dwg. 895222).

Proceed as follows:

. Place the off-circuit tap-changer on a level surface. Remove 3 screws M12 (wrench size 19) on the underside of the upper cage ring. Keep washers and lock tabs. Take off the tap-changer head.

2. Clean gasket surfaces (head underside, mounting flange). Put an oil-proof gasket on the mounting flange.

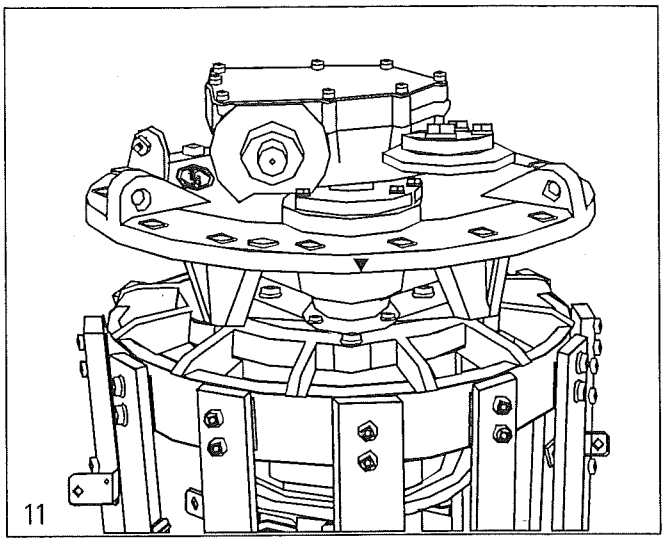
3. Turn the Geneva crank of the step-by-step gear inwards by 90° (see **fig. 10** and appendix, installation drawing 895222). Place the tap-changer head onto the mounting flange.

4. Check its installation position which determines the mounting position of the off-circuit tap-changer when installed. Attach the tap-changer head to the mounting flange.

5. Lift the off-circuit tap changer to the drive head from below. A centering bolt allows attachment and coupling of tap-changer head and off-circuit tap-changer in the correct position only.

6. Attach the off-circuit tap-changer to the tap-changer head from below by 3 screws M12 (w. s. 19), with washers and lock tabs, max. torque 80 Nm. The screws must be safely locked!

7. Turn the Geneva crank of the step-by-step gear back into the original position by 90° (see installation drawing 895222).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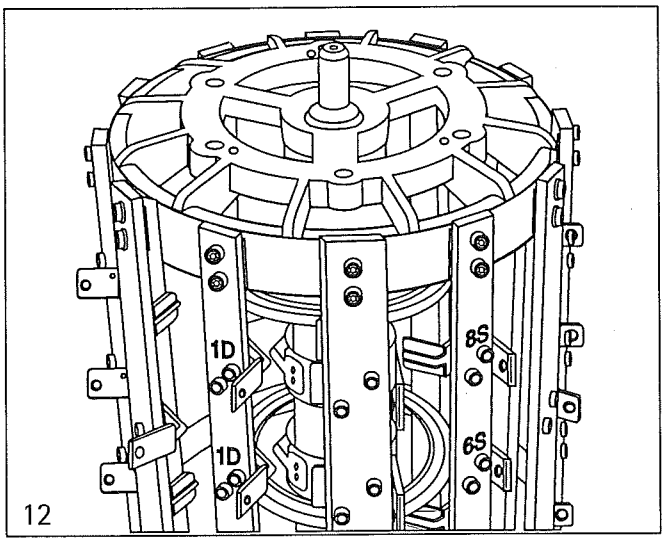

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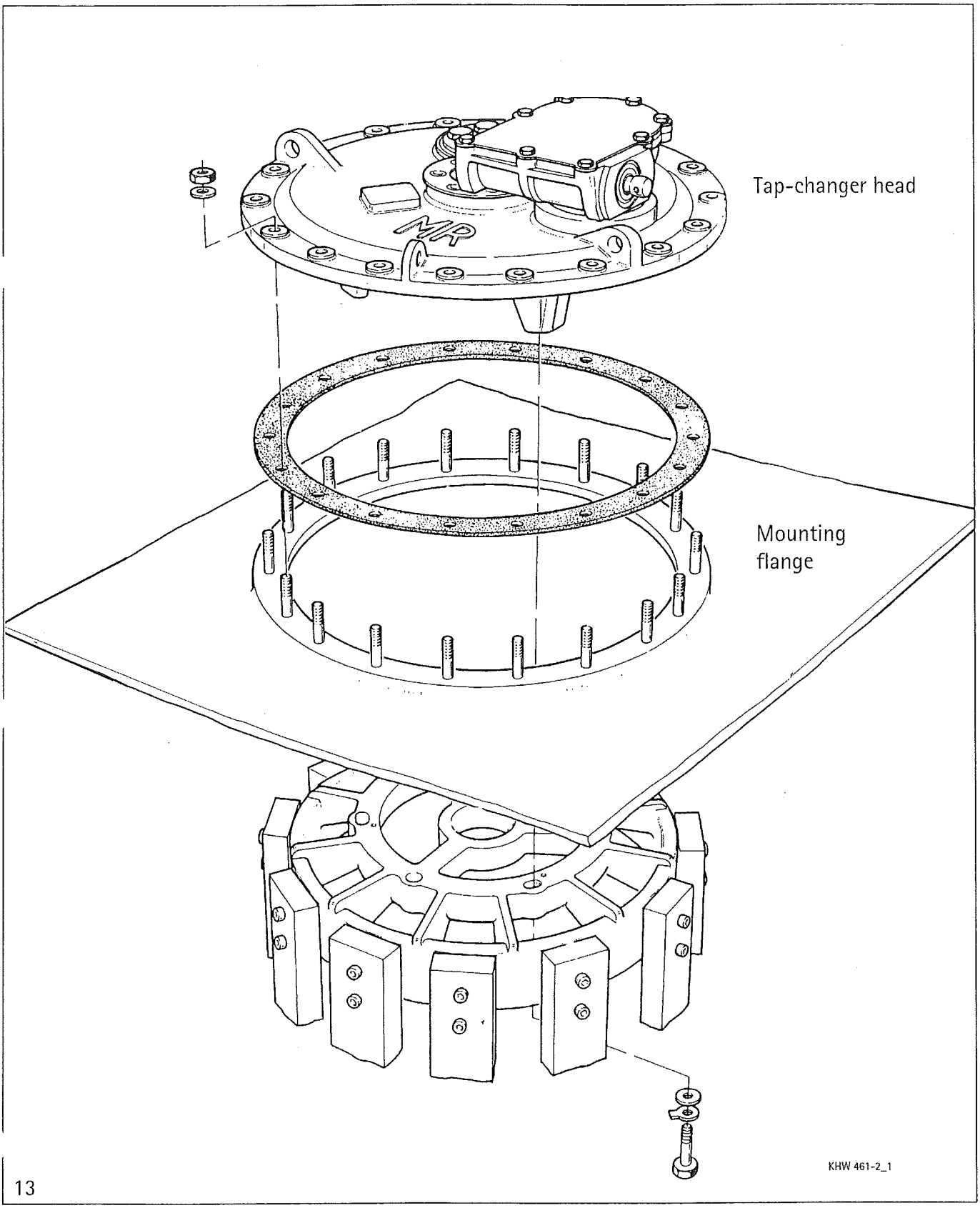

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5 Installation of the off-circuit tap-changer into bell-type tank (see section 12, dwgs. 895664, 895717)

The connection of the off-circuit tap-changer requires the use of a supporting structure that allows the tap-changer to be provisionally attached to the supporting flange. The attachment of the tap-changer head, which is here equipped with an intermediate flange, requires a different mounting flange on the transformer tank, as described in section 4 (**fig. 14**).

The respective drilling template (see **fig. 15** and section 12, dwg. 896136) will be supplied on request with the first off-circuit tap-changer for bell-type tank installation, free of charge.

The off-circuit tap-changer is lifted onto the supporting structure, fixed in this provisional position and connected to the leads.

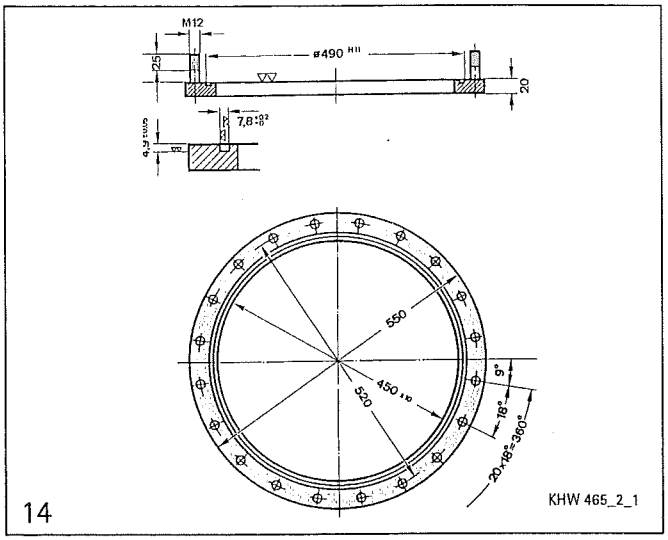
Then the tap-changer head and intermediate flange are removed from the off-circuit tap-changer.

The intermediate flange is mounted to the mounting flange of the bell-type tank. After the set-up of the bell-type tank, the off-circuit tap-changer below is lifted to its final position and securely fastened to the intermediate flange (**fig. 16**).

Finally, the tap-changer head is placed on the intermediate flange and fastened.

Proceed in detail as follows:

1. Lift the off-circuit tap-changer onto the supporting structure and fix it there. Check the position of the off-circuit tap-changer, which should be aligned to the tap-changer head that will be mounted with the bell-type cover set up later on.
2. To connect the off-circuit tap-changer to the transformer winding follow the instructions in section 6.
3. After installation of the off-circuit tap-changer, a transformer ratio test is to be performed (see section 7).
4. Remove all 18 nuts M12/w. s. 19 from the tap-changer head.
   Take the tap-changer head off the intermediate flange.



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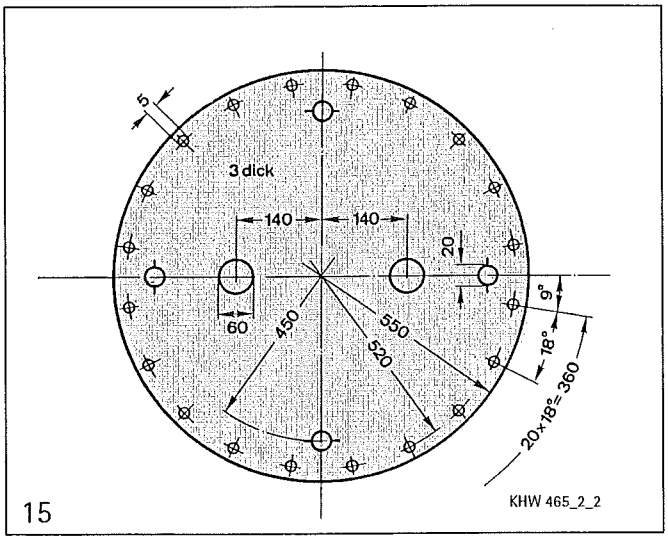

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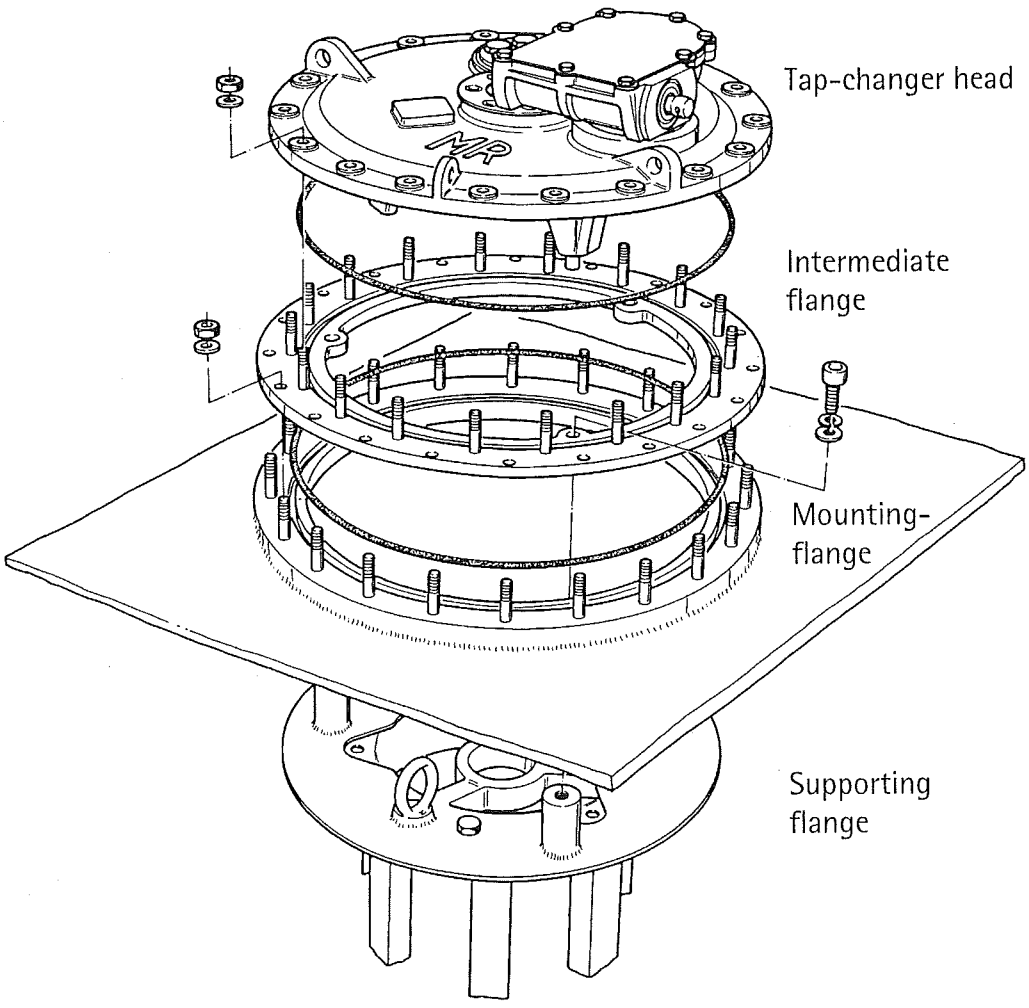
CAUTION

The connected tap leads must not exert any force on the off-circuit tap-changer.
Moreover there must be sufficient clearance so that it is possible to raise the off-circuit tap-changer to its final installation position after the bell-type tank has been set up.

5. Remove the 3 suspension screws (hexagon socket type M12/w. s. 8) which attach the intermediate flange to the off-circuit tap-changer.
   Keep the lock washers.
   Take the intermediate flange off the tap-changer.
   Mind the O-ring gasket.
   Keep all loose parts for reinstallation.
6. Lift the bell-type cover over transformer core and coils.
   Prior to mounting the intermediate flange, clean the gasket surfaces (underside of intermediate flange, top side of mounting flange).
   Place the O-ring gasket in mounting flange.
   Place the intermediate flange on the mounting flange and fasten securely.
   Depending on the final height adjustment there must be a clearance of 5 6 to 20 mm between intermediate flange and top of off-circuit tap-changer.
   Check position of intermediate flange and tap-changer head.
7. Lift the off-circuit tap-changer by its lifting lugs positioned at its supporting flange. Attach the off-circuit tap-changer to the intermediate flange (3 screws M12/ w. s. 8, max. torque 80 Nm, secure with spring washers).
8. Before mounting the tap-changer head clean the gasket surfaces and turn the Geneva gear crank inwards by 90° (**fig. 10**).
   Place the tap-changer head in position. A centering bolt allows the tap-changer head to be mounted in its correct position only.
9. Attach the tap-changer head to the intermediate flange (18 nuts M12/w. s. 19, with washers, max torque 40 Nm).



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6 Connection of the transformer winding

The connection of the off-circuit tap-changer has to be carried out in accordance with the connecting diagram of the off-circuit tap-changer which accompanies the delivery. The terminals are clearly indicated on the insulating bars.

Depending on the terminal contact's design, screws of 10 mm diameter or screws of 12 mm diameter are to be used when connecting the leads (see **fig. 17**).

CAUTION

All connections to the off-circuit tap-changer must be made carefully and secured. The tap leads must be assembled in such a way as to allow all leads to be connected to the off-circuit tap-changer without tension. If necessary, the connection ends of the tap leads must be shaped in form of expansion loops.

7 Transformer ratio test

Before drying it is recommended to carry out a ratio test.

If the off-circuit tap-changer is equipped with the manual drive MR 404 or BM 75 resp., motor-drive ED, a short tube (nominal width 25 mm) with a coupling bolt inserted (12 mm dia.) together with a hand wheel or a hand crank must be used to operate the drive shaft in the off-circuit tap-changer head.

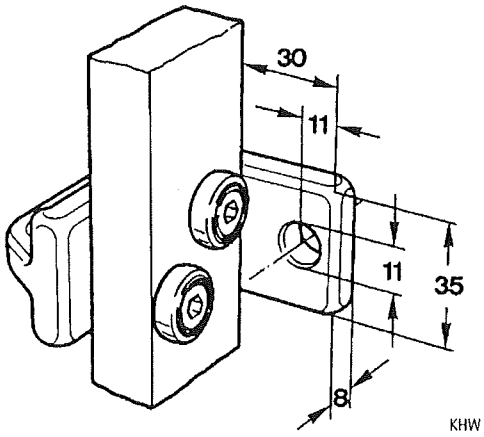
Operating the off-circuit tap-changer from one operating position to the next requires:

- in case of MR 404: 2 revolutions
- in case of BM 75: 1 revolution
- in case of ED: 16.5 revolutions

Check each operating position (arrow and indication disc on top of the off-circuit tap-changer head) against the connecting diagram.

After completion of the test the off-circuit tap-changer has to be set back to the adjustment position.

a



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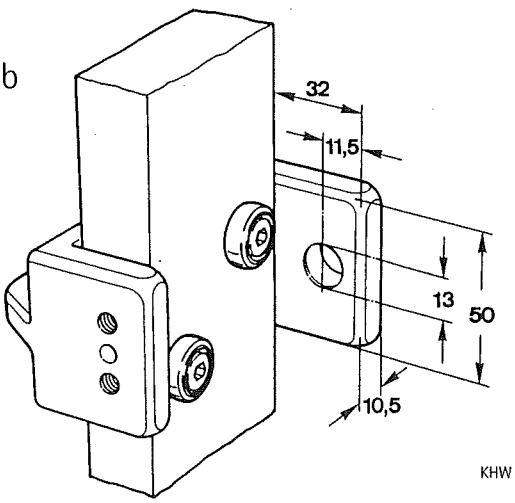

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Off-load tap-changer terminals
a - 300 A / 600 A
b - 800 / 1000 A

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8 Drying procedure of the transformer and filling with oil

Before drying the following steps must be carried out (required only for models with gear unit at the tap-changer head, see section 12, dwg. 895144):

1. Adjustment of the gear unit at the tap-changer head

   Turn the gear unit, so that it is aligned to the drive shaft of the bevel gear which will be attached and coupled to the gear unit later on (see section 9.2).

   Do not fasten the screws yet.

2. Check of adjustment position

   The adjustment position must be checked on the basis of the connection diagram supplied with the delivery of the off-circuit tap-changer.

   Make sure that the movable contacts close symmetrically on the stationary contacts.
   Exact setting of the adjustment position can be achieved by turning the drive shaft at the gear unit.

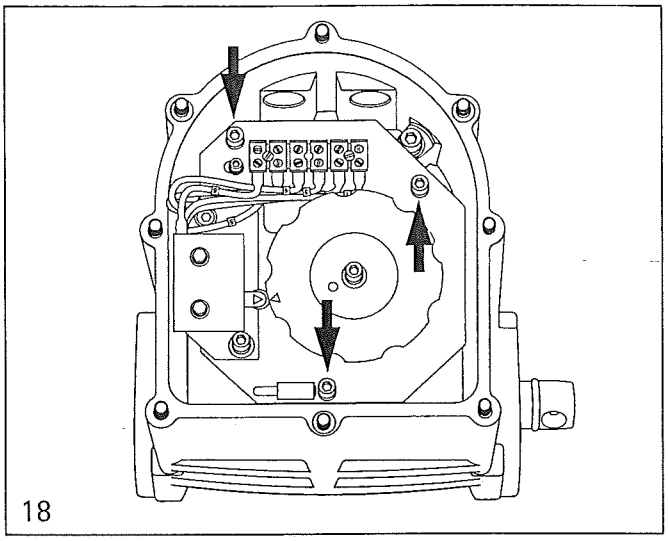
3. Removal of the supporting plate of the supervisory control at the tap-changer head (standard with motor-drive unit ED, optional with manual drive MR 404, refer to section 10.3 also).

   The supervisory control is located in a housing above the gear unit.

   Remove the cover of the housing (8 nuts M6/w. s. 10). Take off the gasket.

   Remove the bearing plate of the supervisory control (3 hexagon socket screws M6 X 20/w. s. 5, marked yellow), see **fig. 18.**

   All parts must be safely stored until reinstallation (see section 9.4).



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CAUTION

Before drying the transformer make sure that the supporting plate is removed, otherwise the installed micro-switches will be damaged during the drying procedure.

Perform the drying procedure.

The dielectric properties of the equipment, as guaranteed by us, are based on a minimum drying treatment according to the following instructions (alternatively vacuum drying or vaporphase drying):

Vacuum drying

Heating up: In air of atmospheric pressure by increasing the temperature by about 10 °C/h to a final temperature of max. 110 °C.

Preparatory drying: In circulating air for 20 hours, maximum temperature 110 °C at the off-circuit tap-changer.

Drying: Maximum temperature 110 °C at the off-circuit tap-changer, residual pressure about 10^{-3} bar.
Drying time for off-circuit tap-changer DEETAP® U at least 50 hours.

Vapor-phase drying

Heating up: Excessive increase in temperature of the insulation materials of the off-circuit tap-changer may damage these materials.
For this reason, do not expose the off-circuit tap-changer to the kerosene vapor directly at vapor entry (if necessary, use guide plates).

Drying: The temperature on the off-circuit tap-changer must not exceed 125 °C.
The drying period depends on that of the transformer. However, it should be at least 50 hours.

CAUTION

Do not operate the off-circuit tap-changer after drying without oil wetting.

Filling with oil

Fill up the transformer with new transformer oil under vacuum. Please note that insulating oils used in transformers must comply with the relevant standards, especially with respect to dielectric strength and water content, e. g. IEC 60296.

9 Final assembly (only for off-circuit tap-changer with manual drive MR 404 or manual drive BM 75 resp. motor-drive ED)

9.1 Drive unit

For comprehensive information see our Operating Instructions for the respective drive mechanism, i. e. for

Manual drive MR 404:
Operating Instructions No. 23
see also section 12, dimension drawing 893845

Manual drive BM 75:
Operating Instructions No. 109
see also section 12, dimension drawing 895603

Motor-drive ED-S, ED-L:
Operating Instructions No. 138
see also section 12, dimension drawings 898801, 898802

Please note:

- The serial number of motor-drive and off-circuit tap-changer have to be identical (rating plate).
- The drive unit has to be in the same operating position as the off-circuit tap-changer (adjustment position). This position is indicated in the connection diagram of the off-circuit tap-changer supplied with the equipment.
- The drive unit must be attached to the place provided on the transformer tank in vertical position.

9.2 Bevel gear

The bevel gear has to be attached to a support on the transformer cover by 2 bolts (see section 12, dwg. 892916).

CAUTION

The stameped serial numbers of bevel gear and off-circuit tap-changer have to be identical.
The horizontal drive shaft must be in proper alignment with the trunnion on the off-circuit tap-changer head.
After loosening 6 bolts M8/w. s. 13), the gear unit of the tap-changer head can be swivelled.
After adjusting the gear unit, the bolts have to be re-tightened (max. tightening torque 15 Nm).

9.3 Drive shaft (square shaft tube)

To assemble the drive shaft follow Operating Instructions No. 42.

The drive shaft is the mechanical connection between drive unit and off-circuit tap-changer head. Diversion of the driving force from the vertical into the horizontal position is performed by the bevel gear.

Accordingly, the vertical drive shaft is to be mounted between drive unit and bevel gear, whereas the horizontal drive shaft is to be mounted between bevel gear and tap-changer head.

The drive shaft is a square tube which is to be connected on both ends to the respective trunnion by means of two coupling brackets and one coupling bolt.

When mounting the drive shaft make sure that the shaft ends to be connected are aligned exactly.

Square tubes, coupling brackets, coupling bolts, screws and nuts are made of corrosion-proof steel. We recommend, however, to paint these parts with the regular transformer tank coating.

The square tubes and the guard plate which serves as a foot step protection for the horizontal drive shaft over the transformer cover, are supplied in oversize (various standard lengths) and have to be cut to the required length when they are mounted on the transformer.

9.4 Coupling of off-circuit tap-changer with manual drive or motor-drive

NOTE

Off-circuit tap-changer and drive unit must be in their adjustment position.

It is absolutely necessary that the tap-change operation is accomplished before the drive mechanism stops.

This is ensured by setting the time of tap-changer action at a distinct interval before the end of the drive mechanism action. In case of motor-drive the hatched section of the tap-change indication is used as a reference when adjusting. When using a manual drive its lock-in action is the reference point.

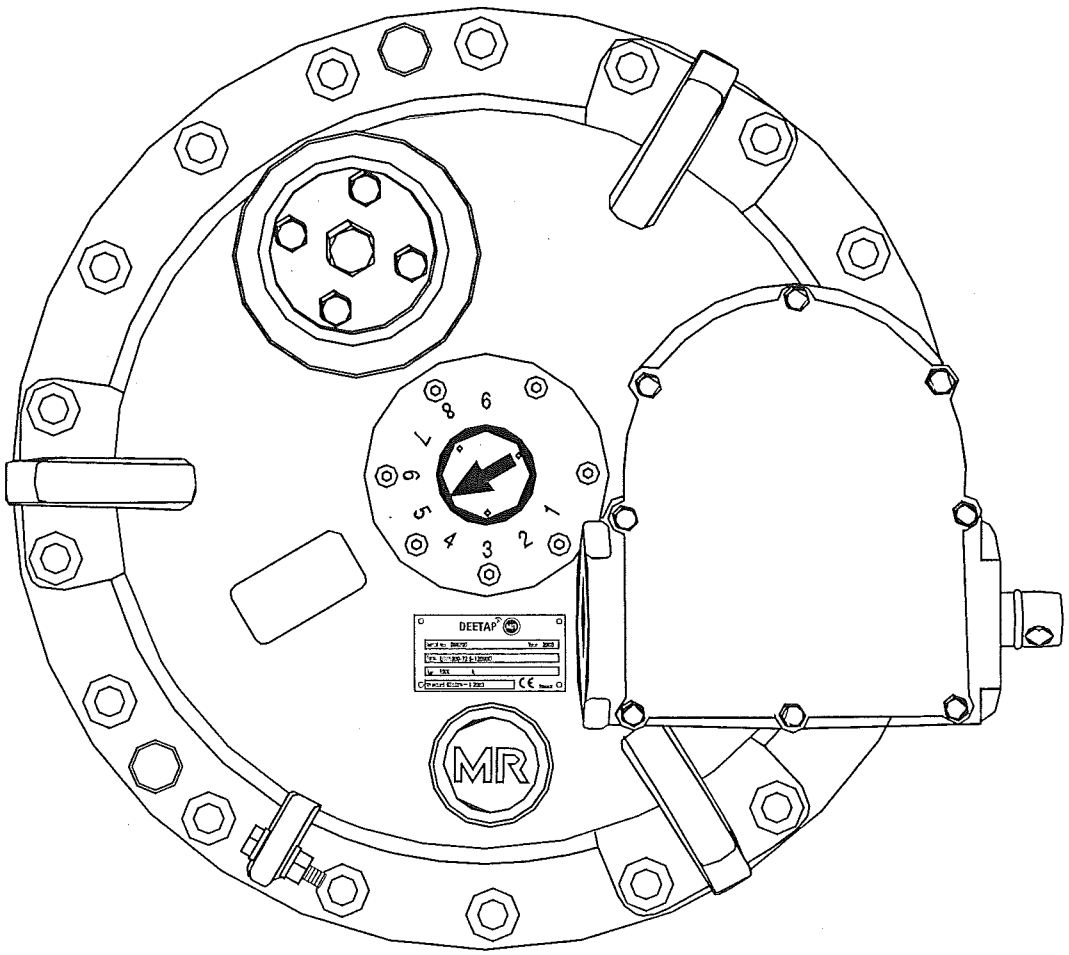
One tap-change operation corresponds to a certain number of hand crank revolutions when using a manual drive or to one revolution of the tap-change indication wheel when using a motor-drive. The tap-change indication wheel is divided into sections each of which corresponds to one hand crank revolution.

The number of hand crank revolutions from the end of the tap-change operation to the end of the drive mechanism action must be the same in both rotation directions.

Symmetrical coupling is achieved as follows:

Adjustment must be carried out by manual operation only.

- During adjustment work make sure that position indication of drive and off-circuit tap-changer are identical.
- Off-circuit tap-changer and drive mechanism must be in the adjustment position before being coupled.
- Perform coupling of off-circuit tap-changer and drive mechanism.
- Turn the hand crank in one direction until the arrow (**fig. 19**) of the position indicator in the tap-changer head stops.
- Count the number of hand crank revolutions or sections until lock-in action or until the center mark of the tap-change indication wheel is in mid-position.
- Repeat this procedure in the opposite direction.
- If there is a difference in hand crank revolutions or sections counted in both directions, the motor-drive or the hand crank must be readjusted in relation to the off-circuit tap-changer by half the difference in sections or hand crank revolutions as counted before.
- Finally check the symmetrical coupling in both directions.



19

In case of supervisory control at the tap-changer head (standard with **motor drive ED**, optional with **manual drive MR 404**) proceed as follows:

- Make sure that off-circuit tap-changer and drive unit are in the adjustment position.
- Check position of the Geneva crank in the supervisory control housing. The triangular marks must be exactly aligned (**fig. 20**).
- If the position of the Geneva crank deviates, the hexagon socket screw M6 of the Geneva crank must be loosened and turned until the triangular marks are in exact alignment.

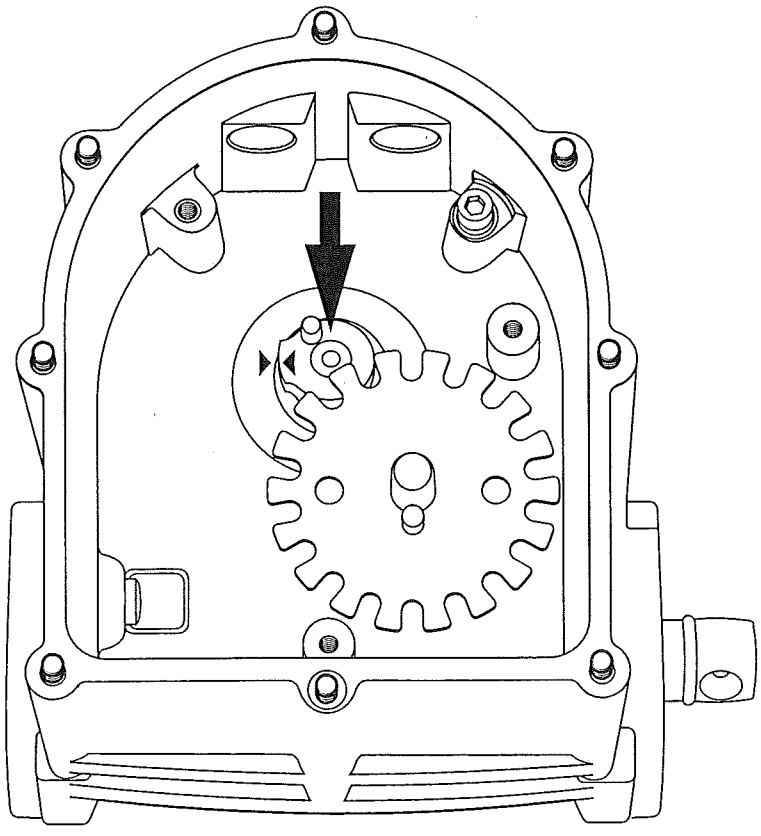
  Then fasten the screw by 9 Nm.
- Install the bearing plate:

  this is done by arresting the lever of the lower micro-switch (S90) in pressed condition by means of the retention pin (**fig. 21**).
- Place the bearing plate and remove the retention pin. Fix the bearing plate with 3 hexagon socket screws M6 x 20 (marked yellow, w. s. 5, max. torque 9 Nm) and secure with spring washers.

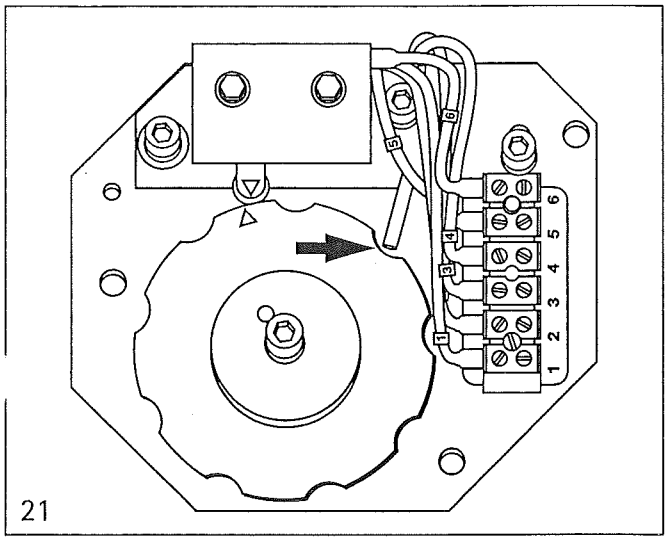
CAUTION

Make sure to remove the retention pin after the bearing plate has been mounted; otherwise the function of the supervisory control will be blocked.

- Connect the supervisory control to the drive unit (see section 10.3).
- Replace the gasket and attach the housing cover (8 nuts M6/w . s. 10).



20



21

CAUTION

After coupling the off-circuit tap-changer with the drive unit and after adjustment of the supervisory control, the off-circuit tap-changer must not be uncoupled any more. Otherwise the whole adjustment procedure must be repeated according to section 9.4.

9.5 Functional test

Operate the off-circuit tap-changer from the adjustment position across the whole tapping range by turning the hand wheel/slip-on ring wrench or using the manual drive or motor-drive. If necessary, repeat the ratio test (see section 7). If the off-circuit tap-changer is equipped with **manual drive MR 404** or **BM 75** resp., **motor-drive ED**, check in every operating position that the position indicators of drive unit and off-circuit tap-changer show the same position.

WARNING

A coupling fault between off-circuit tap-changer and drive unit exists, if off-circuit tap-changer and drive unit show different operating positions.
Misalignment of coupling between off-circuit tap-changer and drive unit leads to severe damage of off-circuit tap-changer and transformer, if operation is continued.
Danger to life and health.

9.6 Final filling with oil

The transformer is to be filled completely with new oil. While doing this vent the oil space in the tap-changer head (bleeder screw in the tap-changer head) screw plug M18/w. s. 24, max. torque 10 Nm, and slotted head screw M6, max. torque 2 Nm).

9.7 Ground connection

Connect the ground screw of the tap-changer head (screw M12/w. s. 19, max. torque 60 Nm) to the transformer cover.

Connect the ground screw of the drive mechanism MR 404 or BM 75: screw M10 (w. s. 17, max. torque 25 Nm),
or motor drive ED:
screw M12 (w. s. 19, max. torque 60 Nm) to the transformer tank.

10 Safety precautions

WARNING

After the off-circuit tap-changer has been put into service, do not operate it unless the transformer has been disconnected on the high-voltage and on the low-voltage side. The transformer must be energized only, when operating positions of off-circuit tap-changer and drive unit are the same.
The safety measures must be strictly observed.
Disregarding these rules endangers lives and may cause severe damage to the off-circuit tap-changer and the transformer.

To prevent the equipment from being actuated unintentionally or by unauthorized persons, the off-circuit tap-changer and drive unit are provided with the following safety devices:

10.1 Off-circuit tap changer with hand wheel/slip-on ring wrench on the tap-changer head

The off-circuit tap-changer can only be operated after removing the padlock and loosening a locking screw. The hand wheel is removable, locking facility by padlock exists. Supervisory control is not possible.

WARNING

Check after a tap-changer operation that the locking screw has ben screwed in until stop and tightened (max. torque 9 Nm, secured by lock washer). Replace the padlock. Otherwise the off-circuit tap-changer may be switched off under load and transformer and off-circuit tap-changer destroyed.

10.2 Manual drive BM 75 and MR 404

a) Mechanical locking
Manual drive BM 75:
Locking facility using the padlock on the manual drive
Manual drive MR 404:
Locking facility using the cylinder lock (optional: special design with padlock). In addition, the circuit breakers can be locked simultaneously by a second identical cylinder lock for the circuit breakers so the key can only be removed from the circuit breakers in an operating position of the manual drive or in the OFF position.

b) Electrical tripping and locking the transformer circuit breakers by the built-in cam-operated switch (see basic circuit on the circuit drawing ZH030002 and ZH030003). When the drive is operated, the transformer must be disconnected by the cam-operated switch before the tap-changer contacts open. The transformer can only be switched on if the off-circuit tap-changer and drive are in the same operating position and the cam-operated switch S15 has closed the circuit for reenergizing the transformer.

In case of **manual drive MR 404** the terminals for the electrical connection of the cam switch are accessible after having removed the terminal box at the bottom of the protective drive unit housing (see Operating Instructions No. 23).

Manual drive BM 75 is provided with a 4-pin plug connector at the bottom of the protective housing (see Operating Instructions No. 109).

The cam switch may be used either as N/0 or as N/C contact.

CAUTION

Before commissioning, check the safety measures for effectiveness.

10.3 Motor-drive ED, optional with manual drive MR 404, supervisory control

The supervisory control is located in a housing above the gear unit of the tap-changer head (dimension drawing 896948). In connection with the respective drive unit it fulfills the following functions:

- Automatically trips the transformer circuit breakers, if the off-circuit tap-changer is operated.
- Interlocks the reclosure of the transformer circuit breakers, if the off-circuit tap-changer or drive unit are not in a defined operating position.
- Supervises the drive shaft between off-circuit tap-changer and drive unit.

For manual drive MR 404 refer to the basic circuit according to circuit diagram ZH020013.

> **NOTE**
>
> In the following the tripping circuit of the transformer circuit breakers is regarded as the closed circuit.

a) **Manual drive MR 404** (see section 12, circuit diagram ZH020013, section 12)
The supervisory control at the drive head includes two mechanically operated microswitches S80 and S90.

S90 is operated after each switching operation of the off-circuit tap-changer, i. e. it returns to its original position after the off-circuit tap-changer has been operated by one step.

S80 is operated after every second operating position, i.e. it switches and remains in its switched position after the off-circuit tap-changer has been operated once, but returns to its original position after a second subsequent operating position has been reached.

Manual drive MR 404 offers the same function with two mechanically operated microswitches S55 and S56.

The transformer circuit breakers rnust be tripped automatically, if

1. Microswitch S90 of the supervisory control opens, i. e. the off-circuit tap-changer switching shaft is turned.
2. Microswitch S56 of the drive opens, i. e. manual drive MR 404 is operated.
3. The switched positions of microswitch S80 of the supervisory control and microswitch S55 of the manual drive do not coincide, i. e. the drive is operated but the drive shaft between manual drive and off-circuit tap-changer is disengaged.

Reclosure of the transformer circuit breakers must be possible only, if

1. Microswitch S90 of the supervisory control is closed, i. e. the off-circuit tap-changer is in a defined operating position.
2. Microswitch S56 of the manual drive is closed, i. e. the manual drive is in a defined operating position.
3. The switched positions of microswitch S80 of the supervisory control and microswitch S55 of the drive coincide, i. e. off-circuit tap-changer and manual drive are in the same operating position.

b) **Motor drive ED** (see basic circuit according to connection diagram 379995, sheet 1 and 2, section 12)

> **CAUTION**
>
> The specified connection diagrams are only examples. The wiring between tap change supervisory control and motor-drive varies with the binding connection diagram of the related motor-drive for the specific job.

The tap change supervisory control is designed as shown in connection diagram 379995.

The motor-drive also provides:

- 1 mechanical, non-directional, cam-operated switch S117 (is activated between tap-change indication wheel sections 2-31)
- 1 mechanical, cam-operated, out-of-step contact S156 (changes the state for each change in position)
- The supply voltage for the control current circuit of the motor-drive is led over potential-free contacts of the transformer circuit breaker which are closed when the circuit breaker is off.

Since the tap-change supervisory control on the motor drive is designed in accordance with the principle of the closed-circuit (i.e., a voltage failure will trip a circuit breaker), for reasons of safety, the monitoring current circuit should be powered by a UPS (Uninterruptible Power Supply).

The motor-drive can thus only be operated electrically when

- the transformer circuit breaker is off.

The motor protective switch of the motor-drive interrupts the motor and control circuit when

- a change in position is desired electrically when the circuit breaker is closed.

The circuit breaker of the transformer is tripped when

- micro-switch S90 (off-circuit tap-changer head) of the tap-change supervisory control opens (i.e., the switching shaft of the off-circuit tap-changer is turned).
- non-directional cam contact (motor drive) S117 opens (i. e., the motor-drive is not in a defined position).

The transformer circuit breaker can only be turned on, when

- micro-switch S90 (off-circuit tap-changer head) of the tap-change supervisory control is closed (i. e., the off-circuit tap-changer is located in a defined operating position).
- non-directional cam contact (motor-drive) S117 is closed (i.e., the motor-drive is in a defined position).
- micro-switch S80 (off-circuit tap-changer head) of the tap-change supervisory control and directional cam switch S156 correspond (i. e., off-circuit tap-changer and motor-drive are in the same operating position).

CAUTION

Before commissioning, check the safety measures for effectiveness!

11 Maintenance

Off-circuit tap-changers which are installed in network transformers and are operated only rarely need not be inspected at regular intervals, because mechanical operation of the off-circuit tap-changer does not involve any significant contact wear.

If after several years of service in one position, an off-circuit tap-changer is to be operated in another position, several switching operations must first be performed. In order to remove possible tarnish on the contacts, switch the off-circuit tap- changer from the previous position to the new one and also to the adjacent positions.

Experience shows that up to 25 switching operations on each contact are necessary for this purpose.

It is recommended that the efficiency of this measure is verified by resistance measurement.

Off-circuit tap changers, however, operating in furnace transfomers up to a large number of switching operations per year, must be inspected after each 50,000 operations at the latest. This measure includes checks of the fixed connecting contacts, the movable switching contacts, the drive shafts with bevel gear, the motor-drive unit and the supervisory control of the off-circuit tap-changer.

WARNING

Do not operate the off-circuit tap-changer unless the transformer has been disconnected on the high-voltage and on the low voltage side.
Check the new operating position against the transformer rating plate and the position indicator of off-circuit tap-changer and drive unit each time before reconnecting the transformer.
The safety measures must be strictly observed.
Disregarding these rules endangers lives and may cause severe damage or destroy the off-circuit tap-changer and the transfomer.

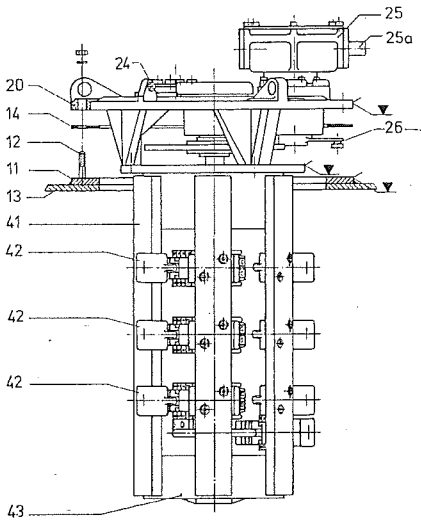
12 Appendix

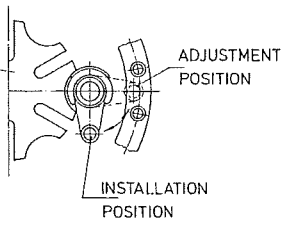
Off-circuit tap-changer DEETAP® U

Installation drawing, contact circle diameter 350 mm

OFF-CIRCUIT TAP-CHANGER

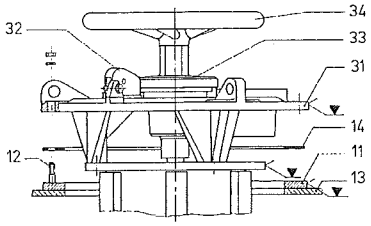
OFF-CIRCUIT TAP-CHANGER HEAD WITH GEAR UNIT

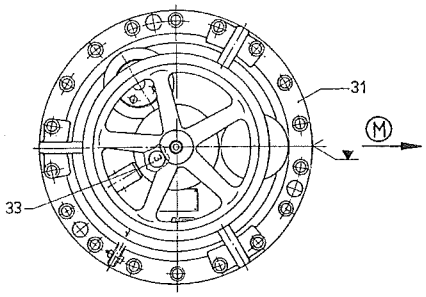


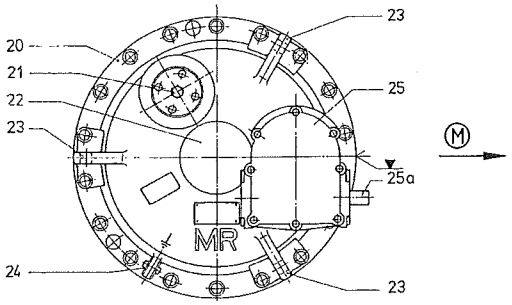


OFF-CIRCUIT TAP-CHANGER HEAD

WITH HAND WHEEL

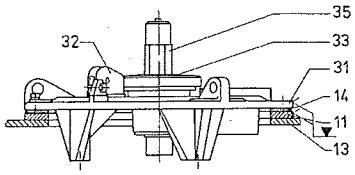


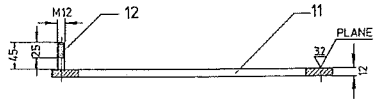


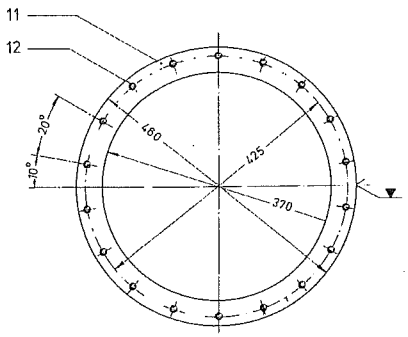


OFF-CIRCUIT TAP-CHANGER HEAD

WITH HEXAGON







▼ MARKING TRIANGLES STAMPED

Ⓜ – DRIVE SIDE

11 MOUNTING FLANGE OF TRANSFORMER COVER
12 FIXING SCREW M12
13 TRANSFORMER COVER
14 GASKET FOR OFF-CIRCUIT TAP-CHANGER HEAD

20 OFF-CIRCUIT TAP-CHANGER HEAD WITH GEAR UNIT
21 BLEEDER SCREW FOR OFF-CIRCUIT TAP-CHANGER HEAD
22 POSITION INDICATION
23 LIFTING LUGS
24 EARTH CONNECTION M12
25 UPPER GEAR UNIT WITH DRIVE SHAFT 25a
26 GENEVA WHEEL CRANK

31 OFF-CIRCUIT TAP-CHANGER HEAD WITH HAND WHEEL OR HEXAGON
32 LOCKING
33 POSITION INDICATION
34 HAND WHEEL
35 HEXAGON, SPANNER WIDTH 46

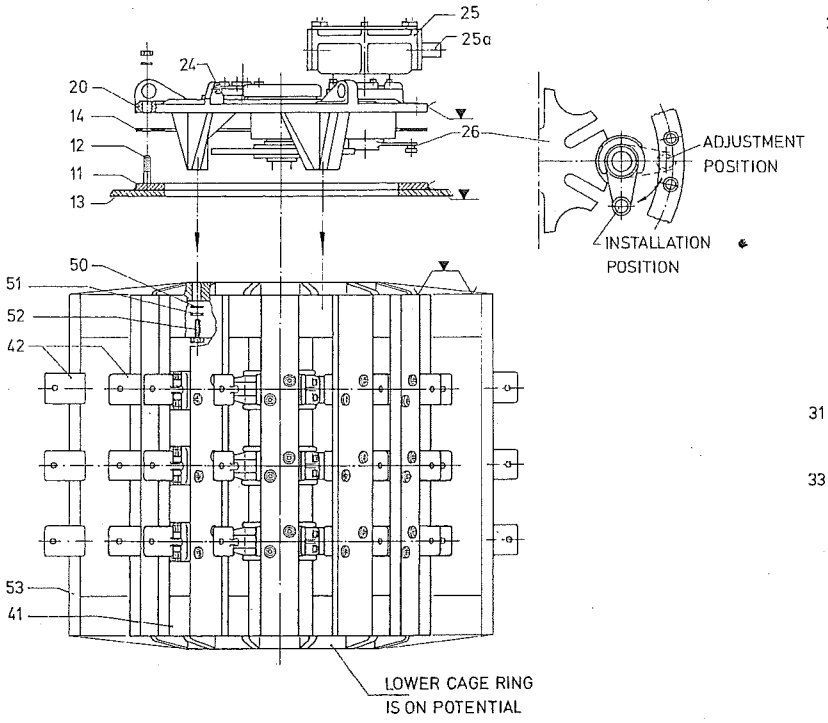
41 INSULATING BAR CAGE ⌀350
42 TERMINAL CONTACTS OR CONNECTING CONTACTS
43 LOWER CAGE RING (IS ON POTENTIAL)

Off-circuit tap-changer DEETAP® U

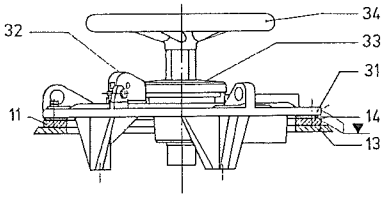
Installation drawing, contact circle diameter 550 mm und 750 mm

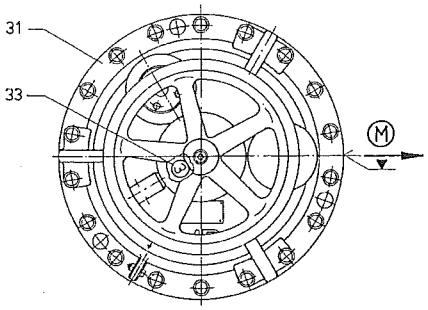
OFF-CIRCUIT TAP-CHANGER

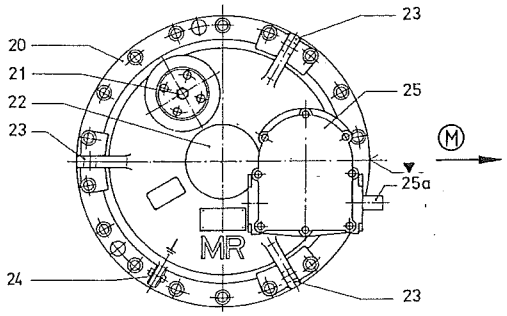
OFF-CIRCUIT TAP-CHANGER HEAD WITH GEAR UNIT



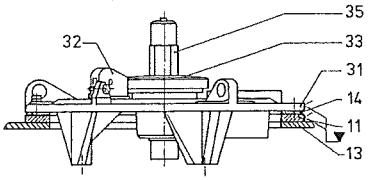
OFF-CIRCUIT TAP-CHANGER HEAD WITH HAND WHEEL

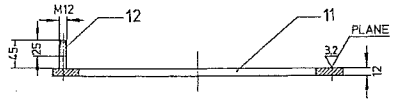


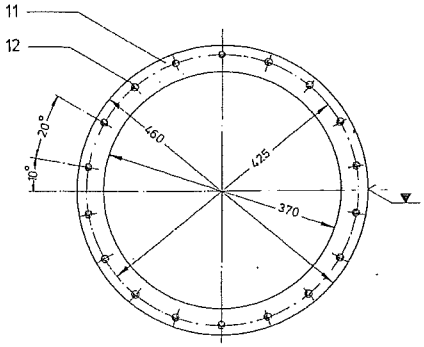




OFF-CIRCUIT TAP-CHANGER HEAD WITH HEXAGON







▼ MARKING TRIANGLES STAMPED

Ⓜ – DRIVE SIDE

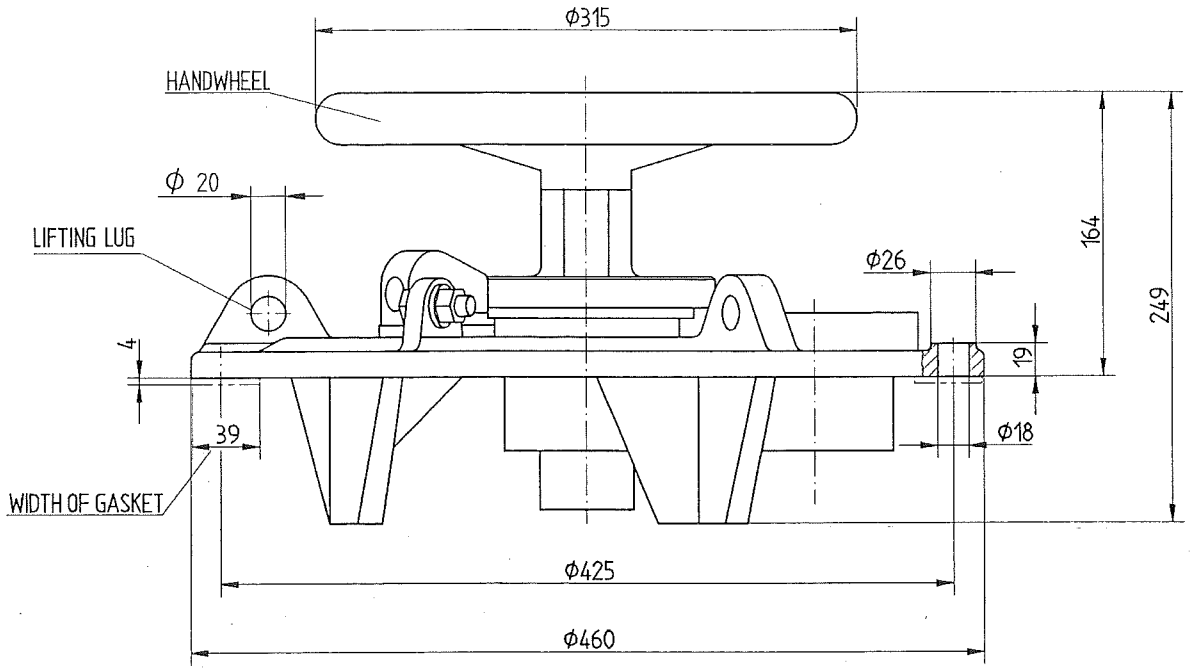
11 MOUNTING FLANGE ON TRANSFORMER COVER
12 FIXING SCREW M12
13 TRANSFORMER COVER
14 GASKET FOR OFF-CIRCUIT TAP-CHANGER HEAD

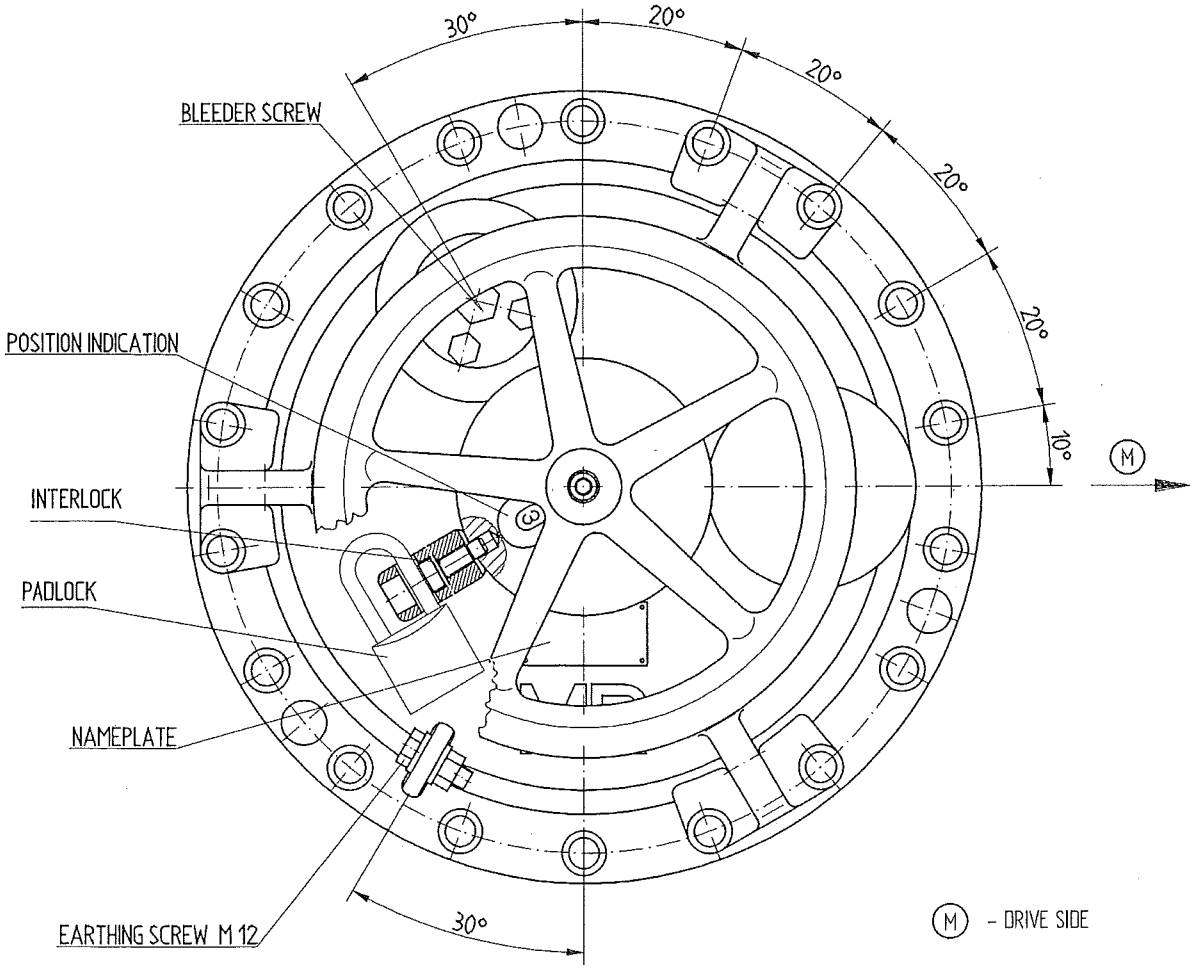
20 OFF-CIRCUIT TAP-CHANGER HEAD WITH GEAR UNIT
21 BLEEDER SCREW FOR OFF-CIRCUIT TAP-CHANGER HEAD
22 POSITION INDICATION
23 LIFTING LUGS
24 EARTH CONNECTION M12
25 UPPER GEAR UNIT WITH DRIVE SHAFT 25a
26 GENEVA WHEEL CRANK

31 OFF-CIRCUIT T-C. HEAD WITH HAND WHEEL OR HEXAGON
32 LOCKING
33 POSITION INDICATION
34 HAND WHEEL
35 HEXAGON , SPANNER WIDTH 46

41 INSULATING BAR CAGE ϕ550 FOR 12-PITCH OFF-CIRCUIT T-C.
42 TERMINAL CONTACTS OR CONNECTING CONTACTS

50 WASHER
51 LOCK TAB
52 HEX SCREW SW 19
53 INSULATING BAR CAGE ϕ750 FOR 18-PITCH OFF-CIRCUIT T-C.

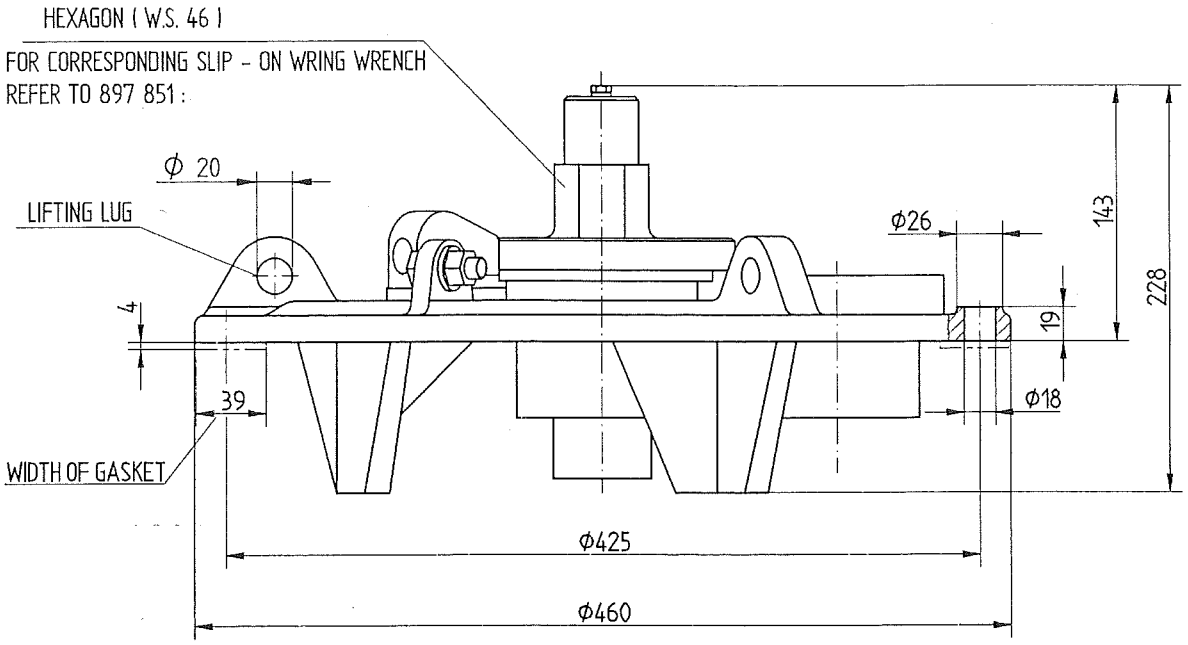

ϕ315
HANDWHEEL
ϕ 20
LIFTING LUG
ϕ26
164
249
4
19
39
ϕ18
WIDTH OF GASKET
ϕ425
ϕ460

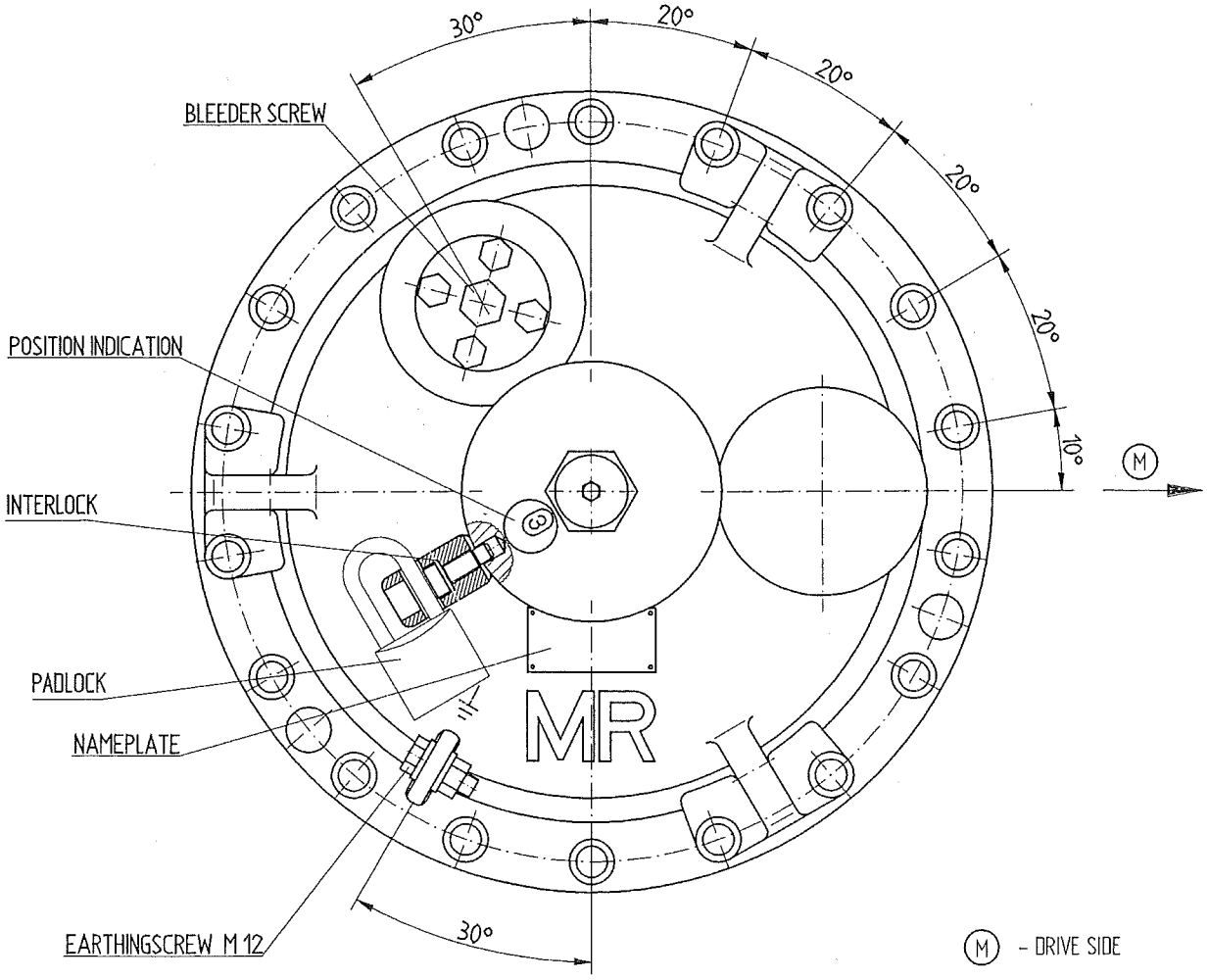

30°
20°
20°
20°
20°
10°
BLEEDER SCREW
POSITION INDICATION
INTERLOCK
PADLOCK
NAMEPLATE
EARTHING SCREW M 12
30°
M
M - DRIVE SIDE

SCALE 1 : 2

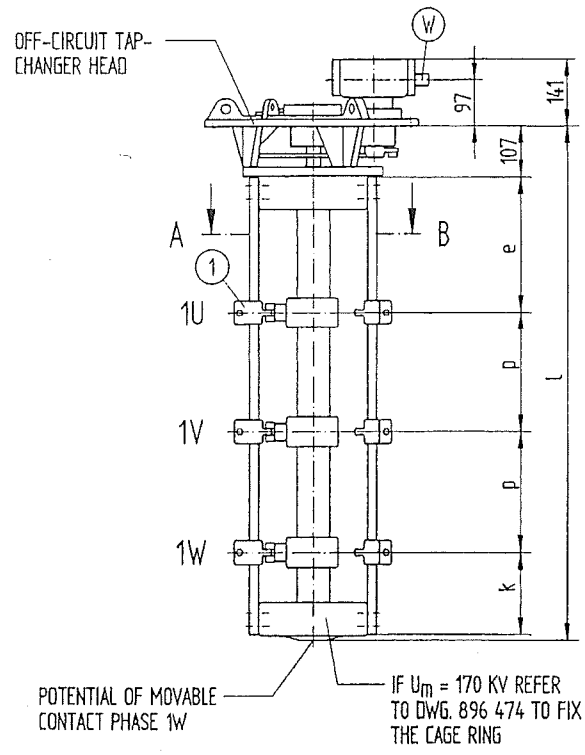
Off-circuit tap-changer DEETAP® U

Tap-changer head with hexagon

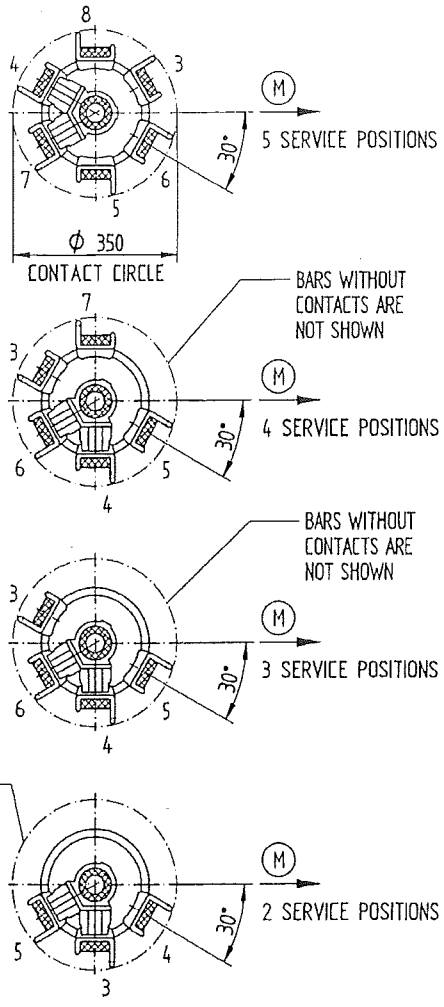


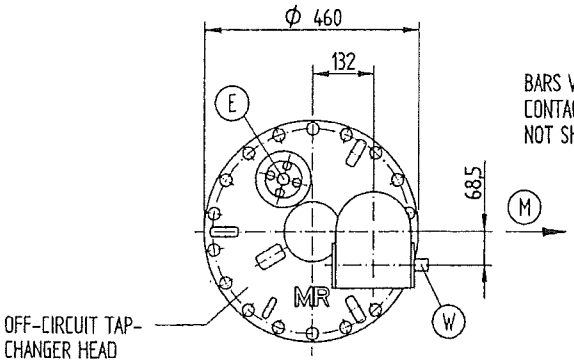


SCALE 1 : 2



SECTIONS A - B





RATED THROUGH-CURRENT : 300 / 600 / 800 / 1000 A SERVICE POSITIONS MAX. 5				
U_m IN KV	e	p	k	l
	DIMENSIONS IN MM			
17,5	150	120	150	659
36	280	250	170	1069
72,5	280	250	170	1069
123	400	370	180	1439
170	600	580	190	2069

WEIGHT MAX. APPROX. 89 KG

(M) - DRIVE SIDE
(W) - DRIVE SHAFT
(E) - BLEEDING FACILITY
(1) - TERMINAL

THE CONNECTION DIAGRAM APPLICABLE TO THE ORDER IS BINDING FOR THE DESIGNATION OF THE TERMINALS AND PHASES.

FOR CORRESPONDING DRAWINGS REFER TO 898 847:

CAUTION :
AFTER THE OFF-CIRCUIT TAP-CHANGER HAS BEEN PUT INTO SERVICE, IT MUST BE OPERATED ONLY, WHEN THE TRANSFORMER HAS BEEN DISCONNECTED ON THE HIGH-VOLTAGE AND ON THE LOW-VOLTAGE SIDE.
THE SAFETY MEASURES MUST BE STRICTLY OBSERVED. DISREGARDING ENDANGERS LIVES AND MAY CAUSE SEVERE DAMAGE TO THE OFF-CIRCUIT TAP-CHANGER AND THE TRANSFORMER.

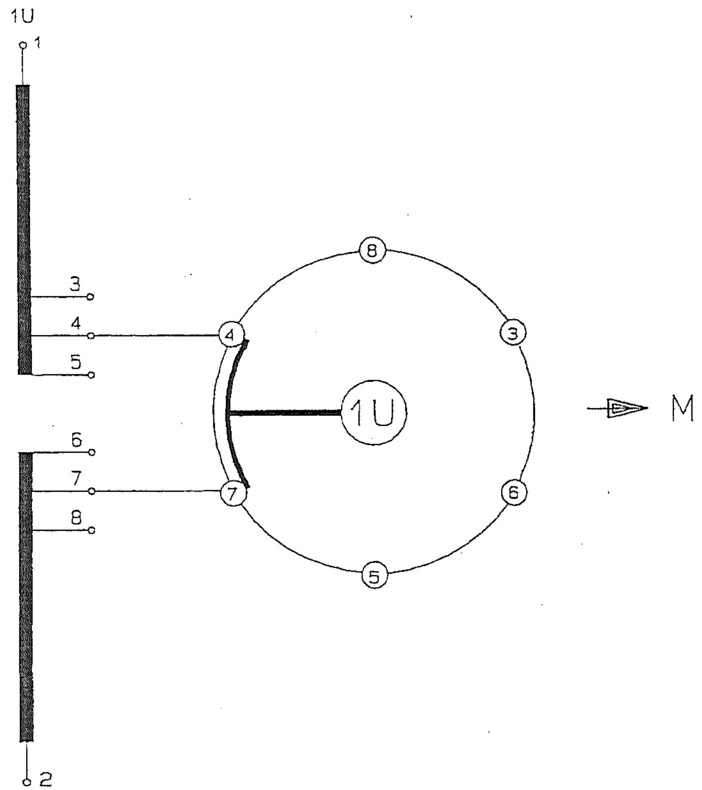
SCALE 1:5

MR REINHAUSEN GERMANY

OFF-CIRCUIT TAP-CHANGER TYPE U
U III 300 / 600 / 800 / 1000 ME
DIMENSION DRAWING

8976251E

ANTRIEBSSEITE DRIVE SIDE	COTE D´ENTRAINEMENT LATO COMANDO	M



5	3 - 8	5
4	4 - 8	4
3	4 - 7	3
2	5 - 7	2
1	5 - 6	1

BETRIEBSSTELLUNGEN SERVICE POSITIONS	POSITIONS DE SERVICE POSIZIONI DI FUNZIONAMENTO	
VERBINDUNGEN CONNECTIONS	CONNEXIONS COLLEGAMENTI 1U	(1V, 1W)
BEZEICHNUNG DER STELLUNGEN DESIGNATION OF POSITIONS	DESIGNATION DES POSITIONS NUMERAZIONE DELLE POSIZIONI	
BETRIEBSSTELLUNGEN SERVICE POSITIONS	POSITIONS DE SERVICE POSIZIONI DI FUNZIONAMENTO	5
VERSCHIEDENE SPANNUNGEN DIFFERENT VOLTAGES	DIFFERENTES TENSIONS TENSIONI DIVERSE	5
JUSTIERSTELLUNG AJUSTING POSITION	POSITION D AJUSTEMENT POSIZIONE D AGGIUSTAGGIO	3

U 06050ME
U 12050ME

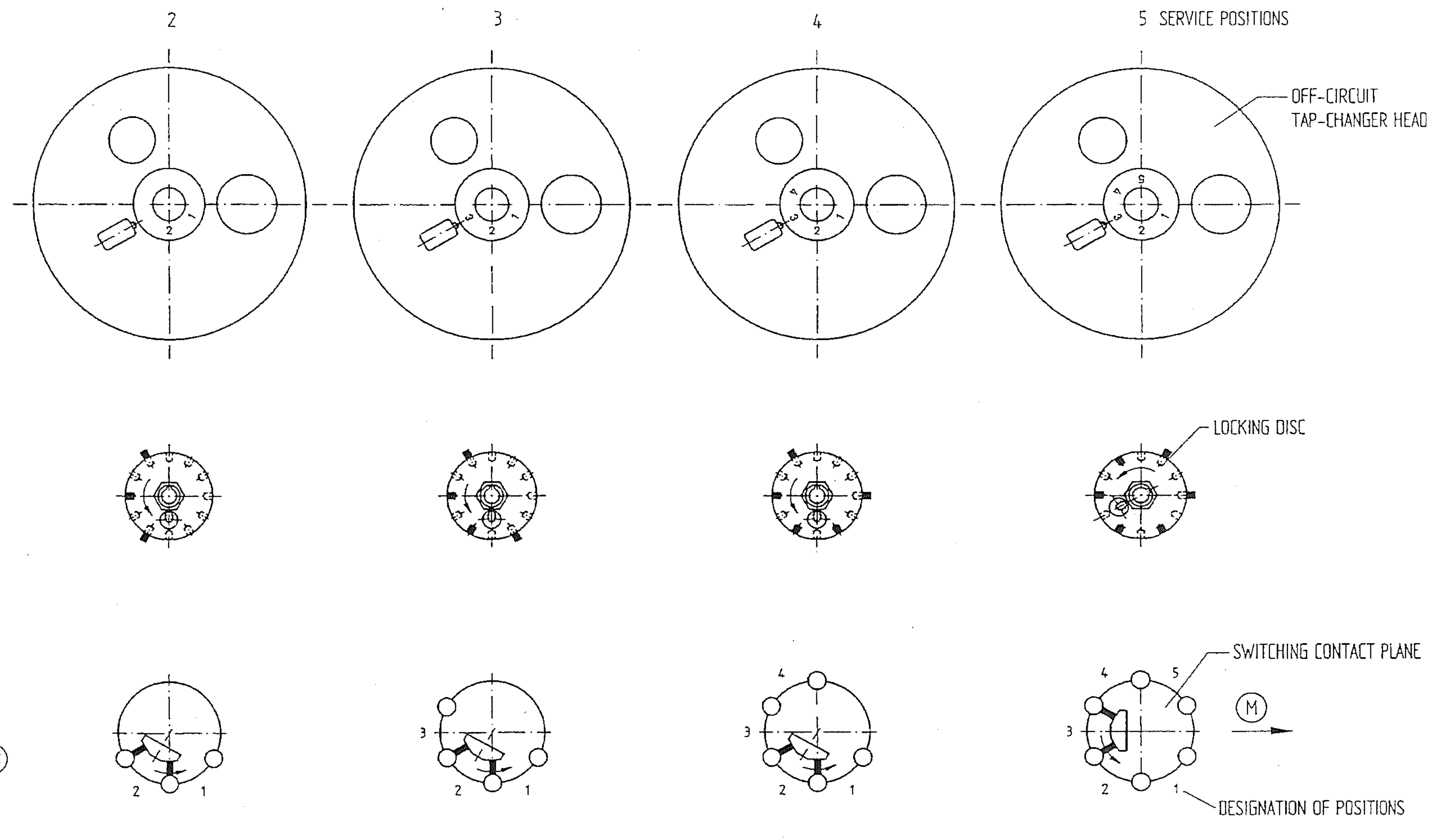
MR

UMSTELLER
OFF-CIRCUIT TAP CHANGER
COMMUTATEUR HORS TENSION
COMMUTATORE A VUOTO

DE/EN/FR/IT

897645: 2M/TUU1

CAD erstellte Zeichnung
keine manuellen Aenderungen



THE CONNECTION DIAGRAM APPLICABLE TO THE ORDER IS BINDING FOR THE DESIGNATION OF THE POSITIONS.

(M) - DRIVE SIDE

2...5 SERVICE POSITIONS

4E	1001135						
An In	Änd.-Nr	Tag	Name				
gez. JBR 20.01.05							
gepr. WED							

ROTARY OFF-CIRCUIT TAP-CHANGER DEETAP® U

ADJUSTMENT PLAN FOR U06 ME+MD HANDWHEEL

8956874E

DIN A2

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