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<td>36</td>
</tr>
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</table>
1 Introduction

This technical file contains detailed descriptions on the safe and proper installation, connection, commissioning and monitoring of the product.

It also includes safety instructions and general information about the product.

This technical file is intended solely for specially trained and authorized personnel.

1.1 Manufacturer

The product is manufactured by:
Maschinenfabrik Reinhausen GmbH
Falkensteinstraße 8
93059 Regensburg, Germany
Tel.: (+49) 9 41/40 90-0
Fax: (+49) 9 41/40 90-7001
E-mail: sales@reinhausen.com

Further information on the product and copies of this technical file are available from this address if required.

1.2 Completeness

This technical file is incomplete without the supporting documents.

The following documents also apply in addition to this technical file:
- Unpacking instructions
- Quick reference guide
- Connection diagrams
- Routine test report

Also observe generally valid legislation, standards, and guidelines as well as specifications on accident prevention and environmental protection in the respective country of use.

1.3 Safekeeping

Keep this technical file and all supporting documents ready at hand and accessible for future use at all times.

1.4 Notation conventions

This section contains an overview of the symbols and textual emphasis used.
1.4.1 Hazard communication system

Warnings in this technical file are displayed as follows.

1.4.1.1 Warning relating to section

Warnings relating to sections refer to entire chapters or sections, sub-sections or several paragraphs within this technical file. Warnings relating to sections use the following format:

**Type of danger!**
Source of the danger and outcome.
► Action
► Action

1.4.1.2 Embedded warning information

Embedded warnings refer to a particular part within a section. These warnings apply to smaller units of information than the warnings relating to sections. Embedded warnings use the following format:

**DANGER!** Instruction for avoiding a dangerous situation.

1.4.1.3 Signal words and pictograms

The following signal words are used:

<table>
<thead>
<tr>
<th>Signal word</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>DANGER</td>
<td>Indicates a hazardous situation which, if not avoided, will result in death or serious injury.</td>
</tr>
<tr>
<td>WARNING</td>
<td>Indicates a hazardous situation which, if not avoided, could result in death or serious injury.</td>
</tr>
<tr>
<td>CAUTION</td>
<td>Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.</td>
</tr>
<tr>
<td>NOTICE</td>
<td>Indicates measures to be taken to prevent damage to property.</td>
</tr>
</tbody>
</table>

Table 1: Signal words in warning notices
Pictograms warn of dangers:

<table>
<thead>
<tr>
<th>Pictogram</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Pictogram" /></td>
<td>Warning of a danger point</td>
</tr>
<tr>
<td><img src="image" alt="Pictogram" /></td>
<td>Warning of dangerous electrical voltage</td>
</tr>
<tr>
<td><img src="image" alt="Pictogram" /></td>
<td>Warning of combustible substances</td>
</tr>
<tr>
<td><img src="image" alt="Pictogram" /></td>
<td>Warning of danger of tipping</td>
</tr>
<tr>
<td><img src="image" alt="Pictogram" /></td>
<td>Warning of danger of crushing</td>
</tr>
</tbody>
</table>

Table 2: Pictograms used in warning notices

### 1.4.2 Information system

Information is designed to simplify and improve understanding of particular procedures. In this technical file it is laid out as follows:

*>Important information.*

### 1.4.3 Instruction system

This technical file contains single-step and multi-step instructions.

**Single-step instructions**

Instructions which consist of only a single process step are structured as follows:
Aim of action
✓ Requirements (optional).
► Step 1 of 1.
◇ Result of step (optional).
◇ Result of action (optional).

Multi-step instructions
Instructions which consist of several process steps are structured as follows:

Aim of action
✓ Requirements (optional).
1. Step 1.
   ◇ Result of step (optional).
2. Step 2.
   ◇ Result of step (optional).
   ◇ Result of action (optional).
2 Safety

2.1 Appropriate use

The manual drive adjusts the operating position of de-energized tap-changers in regulating transformers to the individual operating requirements. The manual drive is designed solely for use in electrical energy systems and facilities. If used as intended and in compliance with the requirements and conditions specified in this technical file as well as the warning notices in this technical file and attached to the product, then the manual drive does not present any danger to people, property or the environment. This applies throughout service life of the product, from delivery to installation and operation through to disassembly and disposal.

The following is considered appropriate use:

- Only use the manual drive with the transformer specified in the order.
- Only operate the motor-drive unit in combination with the shielding housing provided.
- The serial numbers of on-load tap-changer / de-energized tap-changer and on-load tap-changer accessories / de-energized tap-changer accessories (drive, drive shaft, bevel gear, protective relay, etc.) must match if these products are supplied as a set for one order.
- You will find the standard valid for the manual drive and the year of issue on the nameplate.
- Only operate the manual drive in accordance with this technical file and the agreed delivery conditions and technical data.
- Ensure that all necessary work is performed by qualified personnel only.
- Use the equipment and special tools supplied solely for the intended purpose and in accordance with the specifications of this technical file.

2.2 Fundamental safety instructions

To prevent accidents, disruptions and damage as well as unacceptable adverse effects on the environment, those responsible for transport, installation, operation, maintenance and disposal of the product or parts of the product must ensure the following:

Personal protective equipment

Loosely worn or unsuitable clothing increases the danger of becoming trapped or caught up in rotating parts and the danger of getting caught on protruding parts. This increases the danger to life and limb.

- All necessary devices and personal protective equipment required for the specific task, such as a hard hat, safety footwear, etc. must be worn. Observe the section "Personal protective equipment" [Section 2.4, Page 12].
- Never wear damaged personal protective equipment.
• Never wear rings, necklaces, or other jewelry.
• If you have long hair, wear a hairnet.

Work area
Untidy and poorly lit work areas can lead to accidents.
• Keep the work area clean and tidy.
• Make sure that the work area is well lit.
• Observe the applicable laws for accident prevention in the relevant country.

Drying transformer
Drying the drive with the transformer in an autoclave will cause damage to property and drive malfunctions.
• Never dry the drive in an autoclave.

Working during operation
The product may only be operated in a sound, operational condition. Otherwise it poses a danger to life and limb.
• Regularly check the operational reliability of safety equipment.
• Comply with the inspection work, maintenance work and maintenance intervals described in this technical file.

Explosion protection
Highly flammable or explosive gases, vapors and dusts can cause serious explosions and fire. This increases the danger to life and limb.
• Do not install, operate or perform maintenance work on the product in areas where a risk of explosion is present.

Safety markings
Warning signs and safety information plates are safety markings on the product. They are an important aspect of the safety concept.
• Observe all safety markings on the product.
• Make sure all safety markings on the product remain intact and legible.
• Replace safety markings that are damaged or missing.

Ambient conditions
To ensure reliable and safe operation, the product must only be operated under the ambient conditions specified in the technical data.
• Observe the specified operating conditions and requirements for the installation location.
Auxiliary materials and operating materials

Auxiliary materials and operating materials not approved by the manufacturer can lead to personal injury, damage to property and malfunctions of the product.

▪ Only use conductive and grounded hoses, pipes, and pump equipment that are approved for flammable liquids.
▪ Only use lubricants and auxiliary materials approved by the manufacturer.
▪ Contact the manufacturer.

Modifications and conversions

Unauthorized or inappropriate changes to the product may lead to personal injury, material damage and operational faults.

▪ Only modify the product after consultation with the manufacturer.

Spare parts

Spare parts not approved by the manufacturer may lead to physical injury, damage to the product and operational faults.

▪ Only use spare parts approved by the manufacturer.
▪ Contact the manufacturer.

2.3 Personnel qualification

The person responsible for assembly, commissioning, operation, maintenance and inspection must ensure that the personnel are sufficiently qualified.

Electrically skilled person

The electrically skilled person has a technical qualification and therefore has the required knowledge and experience, and is also conversant with the applicable standards and regulations. The electrically skilled person is also proficient in the following:

▪ Can identify potential dangers independently and is able to avoid them.
▪ Is able to perform work on electrical systems.
▪ Is specially trained for the working environment in which (s)he works.
▪ Must satisfy the requirements of the applicable statutory regulations for accident prevention.

Electrically trained persons

An electrically trained person receives instruction and guidance from an electrically skilled person in relation to the tasks undertaken and the potential dangers in the event of inappropriate handling as well as the protective devices and safety measures. The electrically trained person works exclusively under the guidance and supervision of an electrically skilled person.
Operator

The operator uses and operates the product in line with this technical file. The operating company provides the operator with instruction and training on the specific tasks and the associated potential dangers arising from improper handling.

Technical Service

We strongly recommend having maintenance, repairs and retrofitting carried out by our Technical Service department. This ensures that all work is performed correctly. If maintenance is not carried out by our Technical Service department, please ensure that the personnel who carry out the maintenance are trained and authorized by Maschinenfabrik Reinhausen GmbH to carry out the work.

Authorized personnel

Authorized personnel are trained by Maschinenfabrik Reinhausen GmbH to carry out special maintenance.

2.4 Personal protective equipment

Personal protective equipment must be worn during work to minimize risks to health.

- Always wear the personal protective equipment required for the job at hand.
- Never wear damaged personal protective equipment.
- Observe information about personal protective equipment provided in the work area.

Personal protective equipment to be worn at all times

<table>
<thead>
<tr>
<th>Protective clothing</th>
<th>Safety shoes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Close-fitting work clothing with a low tearing strength, with tight sleeves and with no protruding parts. It mainly serves to protect the wearer against being caught by moving machine parts.</td>
<td>To protect against falling heavy objects and slipping on slippery surfaces.</td>
</tr>
</tbody>
</table>
### Special personal protective equipment for particular environments

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety glasses</td>
<td>To protect the eyes from flying parts and splashing liquids.</td>
</tr>
<tr>
<td>Visor</td>
<td>To protect the face from flying parts and splashing liquids or other dangerous substances.</td>
</tr>
<tr>
<td>Hard hat</td>
<td>To protect from falling and flying parts and materials.</td>
</tr>
<tr>
<td>Hearing protection</td>
<td>To protect from hearing damage.</td>
</tr>
<tr>
<td>Protective gloves</td>
<td>To protect from mechanical, thermal, and electrical hazards.</td>
</tr>
</tbody>
</table>
3 Product description

This chapter contains an overview of the design and function of the product.

3.1 Scope of delivery

The manual drive is packaged with protection against moisture and is delivered as follows:
- Manual drive
- Shielding housing
- Product documentation

Please note the following:
1. Check the shipment for completeness using the shipping documents.
2. Store the parts in a dry place until installation.
3. The product must remain in its airtight, protective wrapping and may only be removed immediately before installation.

3.2 Function description

The manual drive works by adjusting the operating position of off-circuit tap-changers in regulating transformers to the individual operating requirements.

The tap-change operation is initiated by actuating the manual drive. Once a tap-change operation is complete, the manual drive is forcibly locked. Another tap-change operation is only possible once the manual drive is manually unlocked.
3.3 Attachment

Figure 1: TAPMOTION® DD

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Protective housing cover</td>
</tr>
<tr>
<td>2</td>
<td>Tap-change indicator</td>
</tr>
<tr>
<td>3</td>
<td>Operations counter</td>
</tr>
<tr>
<td>4</td>
<td>Tap position indicator</td>
</tr>
<tr>
<td>5</td>
<td>Output shaft</td>
</tr>
<tr>
<td>6</td>
<td>Hand crank</td>
</tr>
<tr>
<td>7</td>
<td>Fixing lug</td>
</tr>
<tr>
<td>8</td>
<td>Dummy plug for cable bushing</td>
</tr>
<tr>
<td>9</td>
<td>Ventilation unit</td>
</tr>
<tr>
<td>10</td>
<td>Drive shaft</td>
</tr>
<tr>
<td>11</td>
<td>Name plate</td>
</tr>
<tr>
<td>12</td>
<td>Operating lever</td>
</tr>
<tr>
<td>13</td>
<td>Padlock</td>
</tr>
<tr>
<td>14</td>
<td>End stop for operating lever</td>
</tr>
</tbody>
</table>
3.4 Safety markings on the product

Safety markings for the manual drive are located on the outside of the housing.

![Safety markings](image)

Figure 2: Safety markings

1 Safety markings

3.5 Protective devices

The following protective devices are fitted in the drive:

- Mechanical locking (padlock)
- Electrical locking (cam switch)
4 Packaging, transport and storage

4.1 Packaging

The products are sometimes supplied with sealed packaging and sometimes in a dry state, depending on requirements.

Sealed packaging surrounds the packaged goods with plastic foil on all sides.

Products that have also been dried are identified by a yellow label on the sealed packaging. In the dry state, delivery is also possible in a transport container.

The information in the following sections should be applied as appropriate.

4.1.1 Suitability

**NOTICE**

Property damage due to incorrectly stacked crates!

Stacking the crates incorrectly can lead to damage to the packaged goods.

▶ The outer marking on the packaging states if, for example, the on-load tap-changer or selector has been packed upright. Never stack these crates.

▶ General rule: Do not stack crates above a height of 1.5 m.

▶ For other crates: Only stack up to 2 equally sized crates on top of one another.

The packaging is suitable to ensure undamaged and fully functional means of transportation in compliance with local transportation laws and regulations.

The packaged goods are packed in a sturdy crate. This crate ensures that, when in the intended transportation position, the packaged goods are stabilized to prevent impermissible changes in position, and that none of the parts touch the loading surface of the means of transport or touch the ground after unloading.

Sealed packaging surrounds the packaged goods with plastic foil on all sides. The packaged goods are protected from humidity using a desiccant. The plastic foil was bonded after the desiccant is added.
4.1.2 Markings

The packaging bears a signature with instructions for safe transport and correct storage. The following symbols apply to the shipment of non-hazardous goods. Adherence to these symbols is mandatory.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protect against moisture</td>
<td>Top</td>
</tr>
<tr>
<td>Fragile</td>
<td>Attach lifting gear here</td>
</tr>
<tr>
<td>Center of mass</td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Shipping pictograms

4.2 Transportation, receipt and handling of shipments

**WARNING**

Danger of death and damage to property!

Danger of death and damage to property due to tipping or falling load.

- Only transport the crate when closed.
- Do not remove the securing material used in the crate during transport.
- If the product is delivered on a pallet, secure it sufficiently.
- Only trained and authorized persons may select the sling gear and secure the load.
- Do not walk under the hanging load.
- Use means of transport and lifting gear with a sufficient carrying capacity in accordance with the weight stated on the delivery slip.

In addition to oscillation stress, jolts must also be expected during transportation. In order to prevent possible damage, avoid dropping, tipping, knocking over and colliding with the product.

If a crate tips over, falls from a certain height (e.g. when slings tear) or is subject to an unbroken fall, damage must be expected regardless of the weight.

Every delivered shipment must be checked for the following by the recipient before acceptance (acknowledgment of receipt):

- Completeness based on the delivery slip
- External damage of any type

The checks must take place after unloading when the crate or transport container can be accessed from all sides.
Visible damage

If external transport damage is found upon receipt of the shipment, proceed as follows:

- Immediately record the identified transport damage in the shipping documents and have this countersigned by the carrier.
- In the event of severe damage, total loss or high damage costs, immediately notify the manufacturer and the relevant insurance company.
- After identifying damage, do not modify the condition of the shipment further and retain the packaging material until an inspection decision has been made by the transport company or the insurance company.
- Record the details of the damage immediately on site together with the carrier involved. This is essential for any claim for damages.
- Photograph damage to packaging and packaged goods. This also applies to signs of corrosion on the packaged goods due to moisture inside the packaging (rain, snow, condensation).

**NOTICE!** If the product is delivered in sealed packaging, inspect this immediately. If the sealed packaging is damaged, do not under any circumstances install or commission the packaged goods. Either re-dry the dried packaged goods as per the operating instructions, or contact the manufacturer to agree on how to proceed. Failure to do so may result in damage to the packaged goods.

- Identify the damaged parts.

Hidden damage

When damages are not determined until unpacking after receipt of the shipment (hidden damage), proceed as follows:

- Make the party responsible for the damage liable as soon as possible by telephone and in writing, and prepare a damage report.
- Observe the time periods applicable to such actions in the respective country. Inquire about these in good time.

With hidden damage, it is very hard to make the transportation company (or other responsible party) liable. Any insurance claims for such damages can only be successful if relevant provisions are expressly included in the insurance terms and conditions.

4.3 Storage of shipments

Packaged goods dried by Maschinenfabrik Reinhausen

Upon receipt of the shipment, immediately remove the packaged goods dried by Maschinenfabrik Reinhausen from the sealed packaging and store air-tight in dry insulating oil until used if the packaged goods were not supplied in oil.

Non-dried packaged goods

Non-dried packaged goods but with a functional sealed packaging can be stored outdoors when the following conditions are complied with.
When selecting and setting up the storage location, ensure the following:

▪ Protect stored goods against moisture (flooding, water from melting snow and ice), dirt, pests such as rats, mice, termites and so on, and against unauthorized access.

▪ Store the crates on timber beams and planks as a protection against rising damp and for better ventilation.

▪ Ensure sufficient carrying capacity of the ground.

▪ Keep entrance paths free.

▪ Check stored goods at regular intervals. Also take appropriate action after storms, heavy rain or snow and so on.

Protect the packaging foil from direct sunlight so that it does not disintegrate under the influence of UV rays, which would cause the packaging to lose its sealing function.

If the product is installed more than 6 months after delivery, suitable measures must be taken without delay. The following measures can be used:

▪ Correctly regenerate the drying agent and restore the sealed packaging.

▪ Unpack the packed goods and store in a suitable storage space (well ventilated, as dust-free as possible, humidity < 50% where possible).

4.4 Unpacking shipments and checking for transportation damages

▪ \textbf{NOTICE!} Transport the packaged crate to the place where installation will take place. Do not open the sealed packaging until just before installation. If this is not done, damage to the packaged goods may occur due to ineffectively sealed packaging.

▪ \textbf{WARNING!} When unpacking, check the condition of the packaged goods. Secure packaged goods in an upright crate from tipping out. If this is not done, the packaged goods may be damaged and serious injuries may result.

▪ Check completeness of supplementary parts on the basis of the delivery slip.
5 Mounting

This chapter describes how to correctly install and connect the device.

**WARNING**  
Danger of death or severe injury!  
An energized transformer and energized on-load tap-changer components can cause death or serious injuries during installation of the drive!  
► Ensure the de-energized state of the transformer and on-load tap-changer components during installation of the drive.

5.1 **Fitting shielding housing and manual drive on the transformer**

Ensure the maximum permissible offset between the vertical shaft of the bevel gear and the output shaft of the manual drive as well as the dimension V1 when fitting the shielding housing and the manual drive.

![Figure 3: Vertical drive shaft without cardan joints with/without insulator, permissible offset](image)

---

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6028996/00 EN  
TAPMOTION® DD
Figure 4: Vertical drive shaft with cardan joints with/without insulator, permissible offset

<table>
<thead>
<tr>
<th>Vertical drive shaft version</th>
<th>V1 min</th>
<th>Intermediate bearing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without cardan joints, without insulator</td>
<td>536 mm</td>
<td>V1 &gt; 2472 mm: intermediate bearing necessary</td>
</tr>
<tr>
<td>Without cardan joints, with insulator</td>
<td>706 mm</td>
<td>V1 &gt; 2472 mm: intermediate bearing necessary</td>
</tr>
<tr>
<td>With cardan joints, without insulator</td>
<td>798 mm</td>
<td>V1 &gt; 2564 mm: intermediate bearing necessary</td>
</tr>
<tr>
<td>With cardan joints, with insulator</td>
<td>978 mm</td>
<td>V1 &gt; 2772 mm: intermediate bearing necessary</td>
</tr>
</tbody>
</table>

Table 4: Dimension V1
To fit the shielding housing and the motor-drive unit, proceed as follows:

1. Fit 4 stud bolts (not supplied by MR) to the transformer tank. The arrangement and diameter of the fixing lugs can be found in the drawings in the Appendix [► Section 9.1, Page 36].

2. Attach to shielding housing without cover or base vertically to the transformer tank.

3. **NOTICE!** Attach the manual drive vertically and without warping or deforming to the transformer tank. Otherwise, the manual drive and drive shaft may be damaged and increased noise may be produced.
The assembly holes for this purpose are located externally on the protective housing's fixing lugs.

4. Attach the cover and base of the shielding housing.

5. Connect the grounding screw on the manual drive to the transformer tank.
5 Mounting

6. Connect the grounding screw on the manual drive to the shielding housing and check the linkage to the manual drive.

7. Connect the main protective conductor to the protective conductor terminal on terminal bar X1 (minimum connection cross-section 2.5 mm²).
5.2 Mounting drive shafts and bevel gear

The process of mounting the drive shafts and bevel gear is described in the installation and commissioning instructions for the on-load tap-changer / de-energized tap-changer.

5.3 Centering the de-energized tap-changer and manual drive

Center the de-energized tap-changer and manual drive in accordance with the de-energized tap-changer installation and commissioning instructions.

5.4 Connecting the manual drive to the tap-change supervisory device

The tap-change supervisory device is installed in a housing on the de-energized tap-changer head.

To connect the manual drive to the tap-change supervisory device, proceed as follows:

1. Ensure that the manual drive and de-energized tap-changer are in the adjustment position.
2. Remove the terminal box cover of tap-change supervisory device by loosening the 8 hexagonal socket screws.
3. Connect the manual drive to the tap-change supervisory device.
4. Close terminal box cover with 8 hexagonal socket screws (tightening torque 6 Nm).
5.5 Performing function tests

After the manual drive is attached and coupled, perform function tests to ensure the correct function of the manual drive and de-energized tap-changer.

**WARNING**

**Danger of death or severe injury!**

An energized transformer could cause death or serious injuries during a tap-change operation!

► Ensure that the transformer is switched off on the high and low voltage sides before performing a tap-change operation.

**NOTICE**

**Damage to the off-circuit tap-changer!**

Operating the off-circuit tap-changer without oil will cause damage to the off-circuit tap-changer!

► Fill transformer completely with new mineral insulating oil before operating the off-circuit tap-changer.

1. Completely fill the transformer with fresh MIDEL 7131.
2. Ensure that the manual drive and de-energized tap-changer are in the adjustment position.
3. If present, unlock locking magnets (Y1) before the tap-change operation by applying the corresponding voltage (depending on version 110...125 V DC, 220 V DC, 95...140 V AC or 230 V AC).
4. Undertake trial tap-change operations across entire range of settings. Ensure that manual drive and de-energized tap-changer are in the same operating position after every tap-change operation.
5. Ensure that the tap-change supervisory device is functioning correctly.
6 Commissioning

6.1 Transporting transformer to the operating site

If the drive must be removed in order to transport the transformer, proceed as follows:

1. Ensure that the drive and the on-load tap-changer / de-energized tap-changer / ARS are in the adjustment position.
2. Remove the drive.
3. Do not actuate the drive while the on-load tap-changer / de-energized tap-changer / ARM is decoupled and do not turn the output shaft.
4. Do not actuate the decoupled on-load tap-changer / de-energized tap-changer / ARM and do not turn its drive shaft.
5. Transport the drive to the installation site in the MR delivery packaging.
6. Fit the drive and drive shaft to the transformer at the installation site in accordance with the respective instructions and check for correct coupling and centering.

6.2 Commissioning the transformer at the operating site

The drive may only be connected to circuits that are equipped with an external and all-pole isolating device, in order that the unit can be fully de-energized if required (service, maintenance etc.).

Suitable equipment includes isolating devices in accordance with IEC 60947-1 and IEC60947-3 (e.g. circuit breaker). When selecting the circuit breaker type, the properties of the relevant circuits (voltage, maximum currents) must be observed. The following should also be noted during installation:

- It must be easy for the operator to access the isolating device
- The isolating device must be labeled for the device and circuits to be isolated
- The isolating device may not be a part of the power line
- The isolating device may not interrupt the main protective conductor

Unless otherwise specified, the connections for the supply current circuits must have a conductor cross-section of at least 1.5 mm².

The drive may also only be connected to circuits which are shown in the connection diagram.

Before you commission the transformer at the operating site, you have to connect cam switch S48 to the tripping circuit of the transformer’s circuit breakers. This will ensure that the transformer is switched off on the high and low voltage sides when the manual drive is actuated. The transformer can also only be started up again once a tap-change operation has been fully completed and the manual drive and de-energized tap-changer are in the same operating position.
Proceed as follows to connect cam switch S48:
1. Open protective housing cover of manual drive.
2. Connect cam switch S48 to tripping circuit of transformer’s circuit breaker.

Cam switch S48 can be designed as a normally closed contact or a normally open contact.

3. Close protective housing cover of manual drive.
4. If present, unlock locking magnets (Y1) before the tap-change operation by applying the corresponding voltage (depending on version 110...125 V DC, 220 V DC, 95...140 V AC or 230 V AC).
5. Perform trial tap-change operation to trigger the circuit breakers.

Once this work is complete, you can commission the transformer.
7 Operation

This chapter describes how to perform a tap-change operation with the de-energized tap-changer with manual drive.

7.1 Carrying out tap-change operation

**NOTICE**

Damage to the de-energized tap-changer!

Performing tap-change operations when the temperature of the insulating fluid is too high can cause damage to the de-energized tap-changer.

- Only perform tap-change operations at insulating fluid temperatures of <105°C

Before you undertake a tap-change operation, you need to switch off and lock the transformer to prevent it switching back on.

Proceed as follows:

1. **DANGER!** Switch off transformer on high and low-voltage side. Failure to do so may result in severe injuries and property damage.
2. Lock transformer to prevent unintentional restart.
3. Make sure everything is de-energized.
4. Visibly connect all transformer terminals to ground (grounding leads, grounding disconnectors) and short circuit them.
5. Cover or cordon off adjacent energized parts.
6. Ensure that cam switch S48 has been connected to the tripping circuit of the transformer’s circuit breakers.
   - Once you have switched off and locked the transformer, you can perform tap-change operations.

Carrying out tap-change operation

1. If present, unlock locking magnets (Y1) before the tap-change operation by applying the corresponding voltage (depending on version 110...125 V DC, 220 V DC, 95...140 V AC or 230 V AC).
2. Remove the padlock.
   - The operating lever now moves 90° counter-clockwise into the neutral position.

If requested by the customer, an electrical signal can be issued in this position by cam switch S49 to indicate that the padlock was removed.
3. Turn the operating lever by a further 90° counter-clockwise to the limit stop and into the switching position.
   ⇒ The operating lever engages and the manual drive is unlocked for the tap-change operation.

The circuit breaker of the transformer is actuated by cam switch S48 as soon as the operating lever is moved counter-clockwise from the neutral position.

4. Pull hand crank off spring clips and place on drive shaft.
**NOTICE**

**Damage to manual drive!**

Damage to manual drive due to incorrect operation!

► Do not hold onto operating lever during the tap-change operation.

► Do not turn operating lever into starting position during tap-change operation.

5. Turn the hand crank 8 times. During the tap-change operation the operating lever moves downwards by a few degrees.

☞ After 8 hand crank revolutions the de-energized tap-changer is switched one operating position further, the automatic locking mechanism engages, and the operating lever returns to the neutral position.

A tap-change operation is only complete once the tap-change indicator faces upwards to the black shaded area, the tap position indicator displays the next operating position and the operating lever is in the neutral position.
6. Either again turn the operating lever into the switching position to perform another tap-change operation or turn the operating lever to the starting position and lock with a padlock.

7. Pull hand crank off drive shaft and fasten to spring clips.

8. Before commissioning the transformer, ensure that the manual drive and de-energized tap-changer are in the same operating position.
8 Technical data

8.1 Technical data for TAPMOTION® DD

**NOTICE**

Damage to manual drive!

Damage to manual drive due to incorrect cable types!

► If the manual drive is used at temperatures > 60 °C, you must use special cables which are designed for the relevant temperature.

<table>
<thead>
<tr>
<th>Manual drive</th>
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</thead>
<tbody>
<tr>
<td>Protective housing</td>
</tr>
<tr>
<td>Gearing</td>
</tr>
<tr>
<td>Maximum transferable torque</td>
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<tr>
<td>Number of operating positions</td>
</tr>
<tr>
<td>Rotations of the hand crank per tap-change operation</td>
</tr>
<tr>
<td>Tap position indicator</td>
</tr>
<tr>
<td>Tap-change indicator</td>
</tr>
</tbody>
</table>
| Safety devices                | Mechanical locking  
                               | Padlock, release needed for every tap-change operation (enforced latch)  
                               | Electrical locking  
                               | Cam switch, switched over when unlocked by the operating lever  
                               | Switching capacity: 24...250 V = 100 W AC/DC  
                               | Electro-mechanical lock (optional)  
                               | Locking magnet; the locking magnet (Y1) must be unlocked before the tap-change operation by applying the corresponding voltage (depending on version 110...125 V DC, 220 V DC, 95...140 V AC or 230 V AC). |
| Housing dimensions            | 420 x 434 x 199 mm (W x H x D) |
| Weight                        | approx. 25 kg |
| Temperature range             | -45°C…+70°C |

Table 5: Technical data for TAPMOTION® DD

8.2 Technical data for position transmitter equipment

**Resistance-type position transmitter module**

Standard resistance: 10.0 Ω (0.6 W, +/-1 %) per tap position

The number of desired operating positions determines the number of loaded resistors.
The decisive power loss of the position transmitter module is 0.6 W because in the worst-case scenario only one resistor is energized. The supply voltage should not exceed DC 220 V. If your setup is more demanding, please contact Maschinenfabrik Reinhausen.

**Position transmitter module with N/O contact range (break-before-make contact)**

- AC: 250 V, 0.5 A (resistive loading)
- DC: 220 V, 0.2 A (resistive loading)

Minimum voltage level for signal and data processing: 24 V

**Position transmitter module with N/O contact range, (make-before-break-type)**

- AC, DC: 250 V, 0.02 A (resistive loading)
- AC, DC: 24 V, 0.20 A (resistive loading)

Minimum voltage level for signal and data processing: 24 V

**Position transmitter module with N/O contact range, 10 A (make-before-break-type) for controlling current matching transformer in industrial applications.**

- AC, DC: 250 V, 10 A (resistive loading)

**Position transmitter module, diode matrix**

- DC: 220 V, 0.2 A (resistive loading)

Minimum voltage level for signal and data processing: 24 V
9 Drawings

9.1 Manual drive TAPMOTION® DD, standard design, dimensional drawing (736530)
MANUAL DRIVE TAPMOTION® DD
SHIELDING HOUSING DD HT DESIGN

DIMENSION DRAWING

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