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NOTE
These technical data are intended for the calculator and designer of the transformer. These type-specific data are only
valid in connection with the information contained in the general section (TD 61) since this section contains important
information on such subjects as potential connection, leakage inductance, current division, and so on.
Dimensional drawings and connection diagrams are subject to change without prior notice.
Drawings submitted during bidding and ordering are always binding.

Since the on-load tap-changer is delivered to the specifications of the transformer manufacturer, the transformer
manufacturer is responsible for selecting the correct properties of the on-load tap-changer so that the requirements
of the transformer are met.
1 General

1.1 Summary of the technical data

<table>
<thead>
<tr>
<th>On-load tap-changer</th>
<th>MS III 300 Y</th>
<th>MS I 301</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of poles and application</td>
<td>3 (neutral point)</td>
<td>1</td>
</tr>
<tr>
<td>Max. rated through-current $I_{um}$ (in A)</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>Rated short-time withstand current (in kA)</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Rated short-circuit duration (in s)</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Rated peak withstand current (in kA)</td>
<td>12.5</td>
<td>20</td>
</tr>
<tr>
<td>Max. rated step voltage $U_{im}$ (in V)</td>
<td>3300</td>
<td>3300</td>
</tr>
<tr>
<td>Step capacity ($P_{StN}$) (in kVA)</td>
<td>1000</td>
<td>1000</td>
</tr>
<tr>
<td>Rated frequency (in Hz)</td>
<td></td>
<td>50 to 60</td>
</tr>
<tr>
<td>Operating positions</td>
<td>Without change-over selector: max. 14</td>
<td>With change-over selector: max. 27</td>
</tr>
<tr>
<td>Rated insulation level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highest voltage for equipment $U_m$ (in kV)</td>
<td>72.5</td>
<td>123</td>
</tr>
<tr>
<td>Highest operating voltage $U_0$ (phase-phase) on diverter switch (in kV)</td>
<td>55</td>
<td>79</td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage (in kV, 1.2</td>
<td>50))</td>
<td>350</td>
</tr>
<tr>
<td>AC withstand voltage (in kV, 50 Hz, 1 min.)</td>
<td>140</td>
<td>230</td>
</tr>
<tr>
<td>Rated withstand voltages of internal insulation</td>
<td>see table 3</td>
<td></td>
</tr>
<tr>
<td>Oil compartment</td>
<td>Pressure-proof up to 0.3 bar continuous difference pressure (test pressure 0.6 bar), head and cover of the on-load tap-changer are vacuum-proof.</td>
<td></td>
</tr>
<tr>
<td>Oil suction pipe</td>
<td>Installed as standard (for details, see BA 18)</td>
<td></td>
</tr>
<tr>
<td>Temperature range</td>
<td>The on-load tap-changer OILTAP® MS can be operated in the rated load range with oil temperatures of -25 °C to +105 °C.</td>
<td></td>
</tr>
</tbody>
</table>

Tabelle 1 a
## 1 General

On-load tap-changer MS III 300 Y MS I 301

<table>
<thead>
<tr>
<th>Weight (in kg) ca.</th>
<th>Without change-over selector</th>
<th>With change-over selector</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>220</td>
<td>200</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Displacement volume (in dm³) ca.</th>
</tr>
</thead>
<tbody>
<tr>
<td>72.5 kV</td>
</tr>
<tr>
<td>123 kV</td>
</tr>
<tr>
<td>170 kV</td>
</tr>
<tr>
<td>245 kV</td>
</tr>
<tr>
<td>190</td>
</tr>
<tr>
<td>220</td>
</tr>
<tr>
<td>240</td>
</tr>
<tr>
<td>260</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Oil filling quantity $V_s$ and minimum volume $DV$ of the diverter switch oil compartment in dm³ (ca.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>72.5 kV</td>
</tr>
<tr>
<td>123 kV</td>
</tr>
<tr>
<td>170 kV</td>
</tr>
<tr>
<td>245 kV</td>
</tr>
<tr>
<td>130</td>
</tr>
<tr>
<td>150</td>
</tr>
<tr>
<td>170</td>
</tr>
<tr>
<td>190</td>
</tr>
</tbody>
</table>

### Table 1 b

Notes for tables 1a and 1b:

1) The maximum rated step voltage may be exceeded by 10% due to overexcitation of the transformer if the step capacity is limited to its rated value.

2)Rated withstand voltages comply with IEC 60214: 1989; unrestricted tests possible up to 1050 kV 1.2/50 or 460 kV, 50 Hz, 1 min..

3) Minimum volume of oil conservator for oil temperature $\vartheta = -30 ^\circ C$ to $+100 ^\circ C$: $DV = 0.1 V_s + 4$ (dm³).

---

**TD 60/03**
1.2 Survey

**without change-over selector**

**with change-over selector**

Installation length $h$ in mm

**MS III 300 Y**

<table>
<thead>
<tr>
<th>$U_m$</th>
<th>Tap selector size B</th>
</tr>
</thead>
<tbody>
<tr>
<td>72,5</td>
<td>1942</td>
</tr>
<tr>
<td>123</td>
<td>2072</td>
</tr>
<tr>
<td>170</td>
<td>2202</td>
</tr>
<tr>
<td>245</td>
<td>2302</td>
</tr>
</tbody>
</table>

**MS I 301**

<table>
<thead>
<tr>
<th>$U_m$</th>
<th>Tap selector size B</th>
</tr>
</thead>
<tbody>
<tr>
<td>72,5</td>
<td>1542</td>
</tr>
<tr>
<td>123</td>
<td>1672</td>
</tr>
<tr>
<td>170</td>
<td>1802</td>
</tr>
<tr>
<td>245</td>
<td>1902</td>
</tr>
</tbody>
</table>

**MS II 302**

<table>
<thead>
<tr>
<th>$U_m$</th>
<th>Tap selector size B</th>
</tr>
</thead>
<tbody>
<tr>
<td>72,5</td>
<td>1742</td>
</tr>
<tr>
<td>123</td>
<td>1872</td>
</tr>
<tr>
<td>170</td>
<td>2002</td>
</tr>
<tr>
<td>245</td>
<td>2102</td>
</tr>
</tbody>
</table>

*Fig. 1* Survey of the on-load tap-changer designs (no. of poles, change-over selector, and installation length)
Survey of the basic connection diagrams (fig. 2) with designation of the tap selector terminal contacts in accordance with MR standards.
This terminal contact designation corresponds to the specifications of the on-load tap-changer dimensional drawings.

Fig. 2
Examples of connection diagrams (contact designation in acc. w. MR standards)

**Fig. 3** Example: On-load tap-changer **MS III 300 Y**, basic connection diagram 10 19 1 W
fig. 4  Example: On-load tap-changer MS III 300 Y, basic connection diagram 10 19 3 W
Bild 5  Example: On-load tap-changer MS III 300 Y, basic connection diagram 14 27 1 G
Example: On-load tap-changer MS III 300 Y, basic connection diagram 14 27 3 G
2 Technical Data

2.1 Rated through-current ($I_u$), rated step voltage ($U_i$) and step capacity ($P_{StN}$)

<table>
<thead>
<tr>
<th>On-load tap-changer</th>
<th>MS III 300 Y</th>
<th>MS I 301</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. rated through-current $I_{um}$ (in A)</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>Max. rated step voltage $U_{im}$ (in V)</td>
<td>3300</td>
<td>3300</td>
</tr>
<tr>
<td>Step capacity ($P_{StN}$) in kVA</td>
<td>1000</td>
<td>1000</td>
</tr>
</tbody>
</table>

Table 2 Rated through-currents ($I_u$), related rated step voltages ($U_i$) and step capacities ($P_{StN}$), at highest and lowest rated step voltage of the step capacity curve (see fig. 7)

![Fig. 7](Image)

Fig. 7 Step capacities (rated step voltages $U_i$, rated through-currents $I_u$)

2.2 Contact life

The mean expected contact life of the arcing diverter switch contacts can be estimated based on the relative load ($I_u / I_{um}$) as shown in fig. 8. Since actual contact life in individual cases depends on many influencing factors while in service, only estimations can be given (not applicable to constant current service).

The inspection regulations must be observed.

![Fig. 8](Image)

Fig. 8

Expected mean contact life under average load

- $n$ = Number of operations
- $I_u$ = Rated through-current
- $I_{um}$ = Max. rated through-current
Fig. 9 shows diagrams of the voltage stress present on the tap winding of the three primary basic connections of three-pole on-load tap-changers and single-pole on-load tap-changers. When selecting the on-load tap-changer, a check must be made to determine whether the highest stress on the tap selector does not exceed the related rated withstand voltages.

Without change-over selector

With reversing switch

With coarse tap selector in (+) - position

With coarse tap selector in (-) - position

Note for coarse tapping arrangement in (-) - position of the change-over selector:
When stressed with impulse voltage, the permissible withstand voltage \( a \) must be adhered to between the end of a coarse tap winding connected with the \( K \) tap selector contact and the tap selector contact at the end of the tapped winding of the same phase.

\( a = \) Between beginning and end of a tapped winding and, with coarse tap winding, between beginning and end of a coarse tap winding.

Note for coarse tapping arrangement in (-) - position of the change-over selector:
When stressed with impulse voltage, the permissible withstand voltage \( a \) must be adhered to between the end of a coarse tap winding connected with the \( K \) tap selector contact and the tap selector contact at the end of the tapped winding of the same phase.

\( f = \) Between diverter switch terminal and ground

Additional for coarse tapping arrangement in (+) - position of the change-over selector:
\( c_1 = \) From one (-) - change-over selector contact to terminal of the same phase

\( c_2 = \) Between (-) - change-over selector contacts of different phases

CAUTION
Adhere to maximum rated lightning impulse withstand voltage stress on \( a_0 \) in mid-position.

\( a_0 = \) Between preselected and selected tapping on the diverter switch
2  Technical Data

Rated withstand voltages of the internal on-load tap-changer insulation

<table>
<thead>
<tr>
<th>Insulation distances</th>
<th>MS III 300 Y</th>
<th>MS I 301</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>kV 1.2150</td>
<td>kV 50 Hz, 1 min.</td>
</tr>
<tr>
<td>a0</td>
<td>90</td>
<td>20</td>
</tr>
<tr>
<td>a</td>
<td>300</td>
<td>70</td>
</tr>
<tr>
<td>b</td>
<td>300</td>
<td>70</td>
</tr>
<tr>
<td>c1</td>
<td>400</td>
<td>120</td>
</tr>
<tr>
<td>c2</td>
<td>400</td>
<td>120</td>
</tr>
</tbody>
</table>

Table 3  Rated withstand voltages of the internal on-load tap-changer insulation
The maximum permissible operating voltage along the individual tap selector paths is half the value of the AC withstand voltages listed in table 3.

2.3 Two-pole, on-load tap-changer
OILTAP® MS II 302
The on-load tap-changer MS II 302 is available as a two-pole on-load tap-changer for single-phase, mid-point connection with the same technical data as the on-load tap-changer MS III 300 Y. See dimensional drawings in section 3.

On-load tap-changer combination for delta connection (example)
The on-load tap-changer MS II 302 can also be used with the single-pole, on-load tap-changer MS I 301 as a two-column on-load tap-changer combination (MS I 301/MS II 302) for the voltage adjustment of transformer windings in the delta connection.
The tap windings shown in fig. 10 must be provided.

2.4 Single-pole, on-load tap-changer OILTAP®
MS I 300 with diverter switch as special design
The MS I 300 on-load tap-changer is available for special applications (e.g., with industrial transformers) with a 3-sector diverter switch.
This increases the contact life of the arcing diverter switch contacts.
3 Appendix

Dimensions drawings
On-load tap-changer OILTAP® MS III 300 Y-0/W/G ................................................................. 898038
On-load tap-changer OILTAP® MS II 302-0/W/G ................................................................. 898039
On-load tap-changer OILTAP® MS I 301-0/W/G ................................................................. 898040
On-load tap-changer OILTAP® MS, tap selector cross sections ............................................. 898041

Installation drawings
On-load tap-changer OILTAP® MS, centric drive ..................................................................... 893900

Arrangements of tap selector terminals
Arrangement of tap selector terminals .................................................................................. 891114

Additional drawings for on-load tap-changer
On-load tap-changer head ....................................................................................................... 893899
Special design for installation in bell-type tanks ................................................................. 896762
On-load tap-changer cover with mounting flange for pressure relief valve ................................ 895168
Versions of the on-load tap-changer head, swiveling range of gear unit ................................ 893996
Horizontal drive shaft .......................................................................................................... 893896
Tie-in resistors ....................................................................................................................... 898695, 898694, 898693
Related drawings for on-load tap-changer dimensional drawings ........................................ 898026
### On-load tap-changer OILTAP® MS III 300 Y- 0/W/G

**Dimension drawing**

**TAP SELECTOR SIZE**

<table>
<thead>
<tr>
<th>$U_{tr}$ in kV</th>
<th>72, 5</th>
<th>123</th>
<th>170</th>
<th>245</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIMENSIONS IN MM</td>
<td>$h$</td>
<td>1942</td>
<td>2072</td>
<td>2202</td>
</tr>
<tr>
<td></td>
<td>$i$</td>
<td>863</td>
<td>993</td>
<td>1123</td>
</tr>
<tr>
<td>OIL VOLUME (m³)</td>
<td>130</td>
<td>150</td>
<td>170</td>
<td>190</td>
</tr>
<tr>
<td>DISPLACEMENT (m³)</td>
<td>190</td>
<td>220</td>
<td>240</td>
<td>260</td>
</tr>
<tr>
<td>WEIGHT (kg)</td>
<td>220</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**FOR INHERENT DRAWINGS REFER TO 898026.**

**FOR BINDING DESIGNATIONS OF TERMINALS AND PHASES REFER TO THE CONNECTION DIAGRAM OF THE TAP CHANGER.**

**Diagram Details:**

- A: On-load tap-changer current take-off terminal (neutral)
- B: Bleeding of on-load tap-changer head
- C: Bleeding of transformer tank
- D: Tap selector gear (on potential A)
- E: Connecting flange for oil return (with filter unit only)
- F: Connecting flange for protective relay
- G: Connecting flange for suction pipe
- H: Drive shaft
- I: Drive side of tap selector

**Notes:**

- Bottom of tap selector is on potential A
- Tap selector without change-over selector
- Invert switch
- Draining rings (with 110 kV & 245 kV only)
- With 121 kV only
- Reversing switch
- Coarse tap selector

**References:**

- ON-LINE TAP-CHANGER OILTAP® MS III 300 Y- 0/W/G
- Dimension drawing
On-load tap-changer OILTAP® MS II 302- 0/W/G
Dimension drawing

A - ON-LOAD TAP-CHANGER CURRENT TAKE-OFF TERMINAL
B - BLEEDING OF ON-LOAD TAP-CHANGER HEAD
C - BLEEDING OF TRANSFORMER TANK
D - TAP SELECTOR GEAR ON POTENTIAL
E - CONNECTING FLANGE FOR OIL RETURN (WITH FILTER UNIT ONLY)
F - CONNECTING FLANGE FOR PROTECTIVE RELAY
G - CONNECTING FLANGE FOR SUCTION PIPE
H - DRIVE SHAFT
I - DRIVE SIDE OF TAP SELECTOR

FOR IDENTIFICATION DRAWINGS REFER TO 898 076.
FOR BINDING DESIGNATIONS OF TERMINALS AND PHASES REFER TO THE CONNECTION DIAGRAM OF THE TAP CHANGER.

<table>
<thead>
<tr>
<th>TAP SELECTOR SIZE</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>$U_{m}$ in KV</td>
<td>72.5 123 170 245</td>
</tr>
<tr>
<td>DIMENSIONS IN MM</td>
<td>h 1742 1872 2002 2102</td>
</tr>
<tr>
<td>i 863 993 1123 1223</td>
<td></td>
</tr>
<tr>
<td>OIL VOLUME m³</td>
<td>130 150 170 190</td>
</tr>
<tr>
<td>DISPLACEMENT m³</td>
<td>160 210 230 250</td>
</tr>
<tr>
<td>WEIGHT KG</td>
<td>2000</td>
</tr>
</tbody>
</table>

TD 60/03 17
On-load tap-changer OILTAP® MS
Tap selector cross sections

DESIGNATION OF TAP SELECTOR TERMINALS:
PLAN VIEW:
- E: 6: Upper contact plane
- I: 13: Lower contact plane

FOR BINDING DESIGNATIONS OF TERMINALS AND PHASES REFER TO THE RELEVANT CONNECTION DIAGRAM
On-load tap-changer OILTAP® MS

Arrangement of tap selector terminals
On-load tap-changer OILTAP® MS, M, R, RM
On-load tap-changer head, centric drive

E1 = BLEEDING FACILITY FOR ON-LOAD TAP-CHANGER HEAD
E2 = BLEEDING FACILITY FOR SPACE UNDER THE HEAD OUTSIDE

THE TAP-CHANGER OIL COMPARTMENT (SAME PIPE CONNECTION AS R, Q OR BLEEDER SCREW CAN BE USED)
Q = CONNECTION FOR OIL RETURN PIPE 1 ONLY FOR OIL FILTER 1 - CONNECTIONS ORIENTABLE THROUGH 360°
S = CONNECTION FOR SUCTION PIPE - CONNECTIONS ORIENTABLE THROUGH 360°
R = CONNECTION FOR PROTECTIVE RELAY 1 EXCHANGEABLE WITH CONNECTION Q 1 - CONNECTIONS ORIENTABLE THROUGH 360°
T = THERMOMETER BAG
SR = INSPECTION WINDOW, RIGHT
SL = INSPECTION WINDOW, LEFT

SCALE 1:25
M) DRIVE SIDE OF THE TAP SELECTOR
On-load tap-changer OILTAP® MS, M, R, RM
Special design for installation in bell-type tanks

- Lifting device
- Suction pipe
- Drilling hole in sectional plane
- O-Ring 44.2 - 5.7
- Level traverse
- Guiding ring with $U_{m} = 170$ kV, 245 kV, 300 kV
- Supporting flange
- Drive side of the tap selector

Z = Guiding pin
On-load tap-changer OILTAP® MS, M, R, RM

With flange for pressure relief
On-load tap-changer OILTAP® MS, M, RM

Versions of the on-load tap-changer head, swiveling range and drive direction of the gear unit

**SWIVELLING RANGES**

For adapting the horizontal part of the drive shaft to the transformer tank, a considerable number of variants of the on-load T-C head are on disposal.

The mounting position of the tap selector A and diverter switch oil compartment B is determined by the drive side of tap selector E.

The on-load T-C head C together with its pipe connection (D) may be turned through 360 degrees clockwise or anti-clockwise. This results in the variants 1, 2 and 3.

The upper gear unit D may be turned continuously round its axis.

Please indicate desired position of inspection window. Usage key letters show the right (O) or left side (F).

* The values in brackets apply if pipe connections are mounted to G and E.

**HEAD VARIANTS WITH MOUNTING FLANGE FOR PRESSURE RELIEF VALVE**

Drive shaft left G

Drive shaft right G

**POSITION OF DRIVE SHAFT OF GEAR UNIT**

Left

Right

**SWIVELLING RANGE FOR CENTRIC DRIVE**

Drive shaft left G

Head variants

Drive shaft right G
On-load tap-changer OILTAP® MS, M, RM
Horizontal drive shaft (limit dimensions), centric drive

### ARRANGEMENT

<table>
<thead>
<tr>
<th></th>
<th>G4</th>
<th>G9,G10</th>
<th>G11,G12</th>
<th>G13,G14</th>
</tr>
</thead>
<tbody>
<tr>
<td>STANDARD DESIGN</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPECIAL DESIGN</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| MINIMUM
DIMENSIONS
(MECHANICAL
READINGS
NECESSARY
INSULATING
DISTANCES
NOT
CONSIDERED)
H1     | 535| 545    | -       | 545     |
H2     | -  | 318    | 515     | 318     |
H3     | -  | -      | 640     | 640     |
H4     | -  | -      | 840     | 840     |

**NOTE:** 1) IN GENERAL DETERMINED BY THE INSULATING
DISTANCE BETWEEN POLES A,B,C.

### INTERMEDIATE BEARING FOR

<table>
<thead>
<tr>
<th></th>
<th>H1</th>
<th>H2</th>
<th>H3</th>
<th>H4</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTERMEDIATE BEARING FOR</td>
<td>2254</td>
<td>2309</td>
<td>-</td>
<td>2309</td>
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<td>2249</td>
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<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>2249</td>
<td>2249</td>
</tr>
</tbody>
</table>

1 2 3 - HEAD VARIANT
4 - DRIVE SIDE OF TAP SELECTOR
On-load tap-changer OILTAP® MS
Design: MS III, tie-in resistors without potential switch

The connection diagram is binding for the designation of the terminals and phases.

- Drive side

The connection diagram is binding for the designation of the terminals and phases.
On-load tap-changer OILTAP® MS
Design: MS II, tie-in resistors without potential switch

The connection diagram is binding for the designation of the terminals and phases.
On-load tap-changer OILTAP® MS
Design: MS I, tie-in resistors without potential switch

Arrangement of leads
(tie-in resistor - tap selector)
For contact location see relevant dimension drawing

Without potential switch for max. 8 resistor elements
(as shown)

M - Drive side

The connection diagram is binding for the designation of the terminals
CONTACT ARRANGEMENT ON TAP SELECTOR .................. 898041

BASIC CONNECTION DIAGRAMS ...................................... 893819

ARRANGEMENT OF TAP SELECTOR CONTACTS .................... 891114

ON-LOAD TAP-CHANGER HEAD ...................................... 893899

VARIANTS OF ON-LOAD TAP-CHANGER HEAD ...................... 893996

INSTALLATION DRAWING ........................................... 893900

HORIZONTAL DRIVE SHAFT .......................................... 893896