

## Order data sheet explanations for tap-changer type UZ

### Scope

This product information gives some more explanations to the order data sheet for tap-changer type UZ.

The documents that references are made to, can be found on the documentation CD or at the ABB web site ([www.abb.com/electricalcomponents](http://www.abb.com/electricalcomponents)).



Selections inside of this bracket are included in the base price and require no extra delivery time.

## AA Type

<b>AA</b> Type	<input type="checkbox"/> Network	<input type="checkbox"/> Shunt reactor
	<input type="checkbox"/> Generator step-up (GSU)	<input type="checkbox"/> Rectifier / Converter
	<input type="checkbox"/> Booster	<input type="checkbox"/> Phase shifting transformer
	<input type="checkbox"/> Arc furnace	<input type="checkbox"/> Other: <input type="text"/>
<input type="checkbox"/> 3-phase		<input type="checkbox"/> 1-phase
		<input type="checkbox"/> 1-phase (solitary)

- Arc furnace  
Use Info no. 5492 0031-89 for calculation and dimensioning rules.
- Shunt reactor  
Calculation & selection to be performed by ABB Components.
- GSU  
Regulating on HV-side = output side. Pay attention to definition of “raise / lower”
- Rectifier/Converter  
Rectifier: Use Info no. 5492 0031-89 for calculation and dimensioning rules.  
Converter: Calculation & selection to be performed by ABB Components.
- Booster (series transformers)  
Many times used in USA where the regulating is made at the LV-side of the transformer. A booster transformer is then used to transform the current to a suitable level for the tap-changer. It is important to remember that the step voltage and current filled in should be the one that the tap-changer will be subject to.

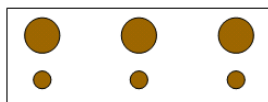
1-phase (solitary); single-phase stand alone unit as for instance a traction feeder unit.

## AB Rated power

<b>AB</b> Rated power	Rated power <input type="text" value="P"/> MVA
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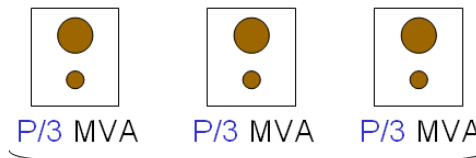
This should be the rated power of the transformer that the tap-changer is placed in. (A single-phase transformer placed in a bank should have the rated power of the complete bank.)

### Three-phase transformer



P MVA

### Single-phase in three-phase bank



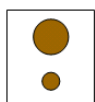
P/3 MVA

P/3 MVA

P/3 MVA

Bank: P MVA

### Single-phase (solitary)



P MVA

## AC Electrical data

<b>AC</b> Electric data	System voltage (HV / LV): <input type="text" value="HV"/> / <input type="text" value="LV"/> kV	Frequency <input type="text" value="60"/> Hz
	Regulating range: +/- <input type="text" value="a"/> / <input type="text" value="b"/> x <input type="text" value="p"/> % of <input checked="" type="checkbox"/> HV <input type="checkbox"/> LV winding	
	Connections (HV): <input checked="" type="checkbox"/> Y <input type="checkbox"/> D	
	Connections (LV): <input checked="" type="checkbox"/> Y <input type="checkbox"/> D	
	Auto <input type="checkbox"/> LV regulated <input type="checkbox"/> HV regulated <input type="checkbox"/> Flux regulated	

a = steps that will add voltage (from the nominal position) to the winding that is connected to the regulating winding.

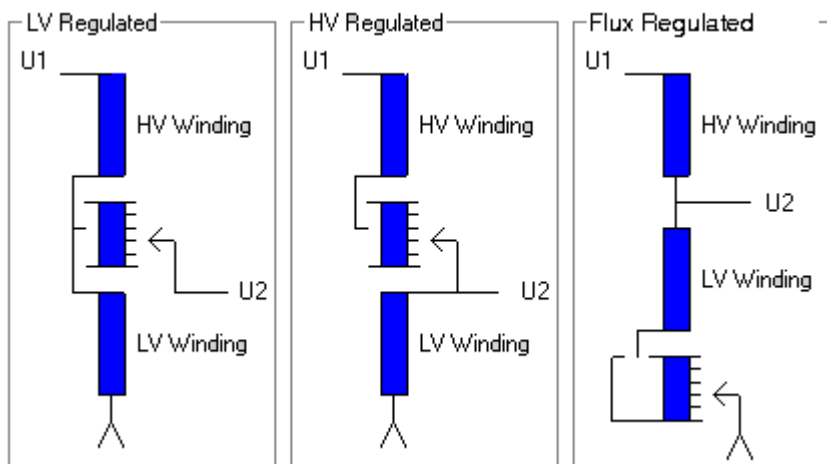
b = steps that will subtract voltage (from the nominal position) to the winding that is connected to the regulating winding.

p = steps in % of the winding HV or LV winding that is connected to the regulating winding. For flux regulated auto transformer, fill in the average step.

### Booster transformers (series transformers)

For booster transformers, pay attention to the step voltage and current. They should be the one that the tap-changer will be subject to.

### Auto transformers

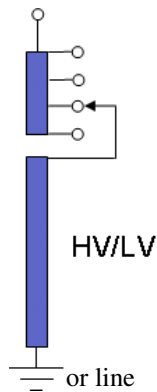


For flux regulated (regulation at the neutral point) the connection table (with tap-changer position and voltages) should be sent to ABB Components.

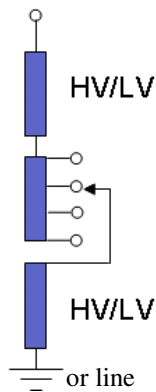
### AD OLTC is placed

<b>AD</b> OLTC is placed	The OLTC is placed	<input type="checkbox"/> in the line end of	<input type="checkbox"/> in the middle of	<input type="checkbox"/> in the neutral point of
		<input type="checkbox"/> the HV winding	<input type="checkbox"/> the LV winding	

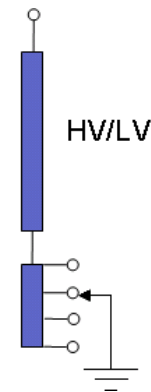
- Fill in placement of OLTC/regulating winding.



Line end



Middle of



Neutral point

- Fill in which main winding the regulating winding is connected to.

### AE OLTC insulation levels

<b>AE</b> OLTC insulation level	Note: Values given in the Technical Guide for the chosen OLTC must not be exceeded		
	Fill in LI - AC		
	Insulation level to earth:	Between phases:	Across regulating winding:
	g2 <input type="text" value="LI"/> - <input type="text" value="AC"/> kV	b1 <input type="text"/> - <input type="text"/> kV	a2 <input type="text"/> - <input type="text"/> kV

Also check the insulation distances in the figure under point AG.

- In the first box fill in the LI=Lightning impulse level.
- In the second box fill in the AC level

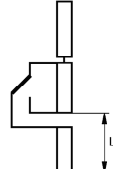
Observe that the values shall be your calculated values which the tap-changer will see, including for instance up-swings and stresses during tests.

### AG Type of switching

<b>AG</b> Type of switching	
	<input type="checkbox"/> Linear <input type="checkbox"/> Plus / Minus <input type="checkbox"/> Coarse / Fine

Linear, Plus/Minus or Coarse/Fine

## AH Leakage inductance

<b>AH</b> Leakage inductance	Specify the leakage inductance through the coarse and fine windings in series (L) <input type="text"/> mH	
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Fill in the leakage inductance for coarse/fine connection when the tap-changer is placed in mid position.

An alternative is to send the winding layout with dimensions and current direction and also the connection to ABB Components. In that case ABB Components will calculate the leak inductance with the help of a FEM program that will give the most accurate result.

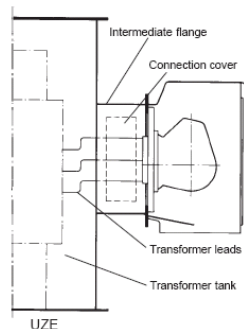
See product information 5492 0031-100, for more information.

## BA OLTC type designation

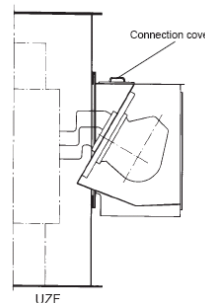
<b>BA</b> OLTC type designation	UZ <i>Example</i> <input type="text" value="ERN"/> <input type="text" value="380"/> / <input type="text" value="600"/> A (According to Technical Guide)
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Fill in the following:

1.1 First square firstly fill in the type, **UZE** or **UZF**, see below.



**UZE** Insert upright



**UZF** Insert inclined

1.2. First square, secondly fill in the type of switch:

- L=Linear
- R= Plus/Minus
- D= Coarse/Fine

1.3. First square, thirdly fill in the type of connection:

- N=Three-phase star point
- T=Three-phase fully insulated

2. Second square, fill in impulse withstand (LI, BIL) to earth that the tap-changer shall withstand:

200kV, 250kV, 380kV, 550kV or 650kV

3. Third square fill in the maximum rated through current 150, 300 or 600A

## BC Electrical positions

<b>BC</b> Electrical positions	Number of electrical positions: <input type="text"/>
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Electrical positions = Number of tap-changer positions gives different winding ratios.

- Linear, max 17 positions
- Plus/Minus, max 33 positions
- Coarse/Fine, max 29 positions

## BD Rated voltage

<b>BD</b> Rated voltage	Rated phase step voltage: <input type="text"/> V
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If the phase step voltage is varying over the range the connection table (with tap-changer position and voltages) should be sent to ABB Components.

## BE Rated current.

<b>BE</b> Rated current	Rated through-current (=max phase current in the OLTC winding) <input type="text"/> A
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Highest current in any position under rated power conditions.

## BF Overload requirements

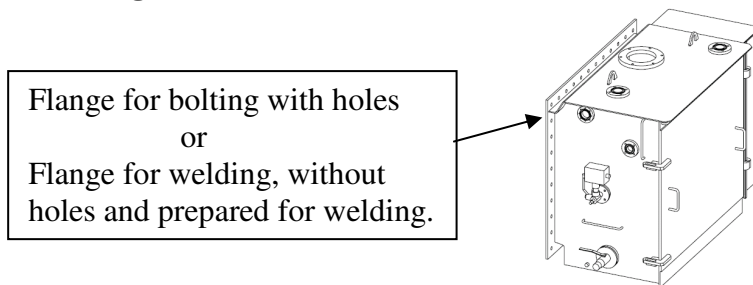
<b>BF</b> Overload requirements	<input type="checkbox"/> According to IEC 60076-7 <input type="checkbox"/> According to IEEE C57.91-1995 <input type="checkbox"/> Other requirement <input type="text"/>
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ABB tap-changers fulfil IEC 60214 and IEEE C 57.131.1995. (The temperature rise test is performed at 1,2 times the maximum rated through current). This means that the tap-changer with its rated through current also fulfil overloading of a transformer with the same rating according to the transformer standard IEC 60076-7 and ANSI/IEEE C57.91.

**BG Tap-changer tank data**

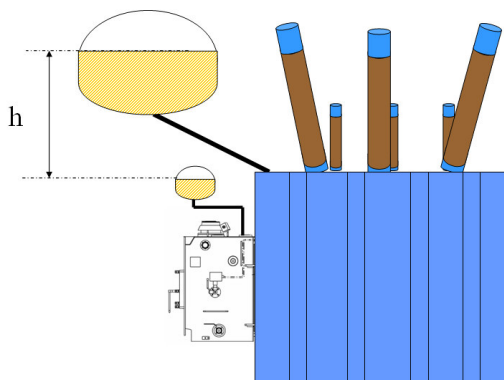
<b>BG</b> Tap-changer tank data	Flange connected to the transformer <input type="checkbox"/> by bolting <input type="checkbox"/> by welding
	Reinforced barrier <input type="checkbox"/> No <input type="checkbox"/> Yes
Note: Required if the difference between the oil level in the tap-changer conservator and the oil level in the transformer conservator exceeds 2.8 m.	
<input type="checkbox"/> Only flange for separate oil conservator (UZE/UZF)	
<input type="checkbox"/> Oil conservator in tap-changer tank (UZE), oil level indicator included	
<input type="checkbox"/> Oil conservator on tap-changer roof (UZF), oil level indicator included	
Selection when the conservator is placed in the tap-changer tank (UZE) or when a separate conservator is delivered (UZF):	
Breather <input type="checkbox"/> Dehydrating breather <input type="checkbox"/> One-way breather	

• **Flange to the transformer**



• **Reinforced barrier**

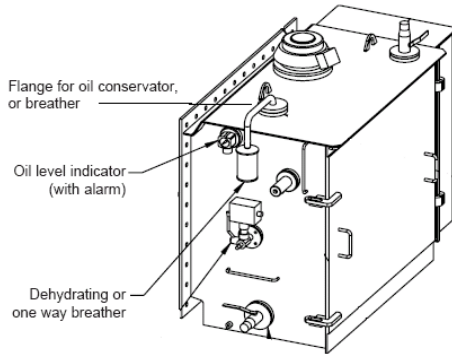
The barrier is the part that separates the tap-changer oil from the transformer oil. The reinforced version is needed when there is a pressure difference of more than 25kPa between the transformer and tap-changer. This is equal to an oil level difference of  $h > 2,8m$  between the transformer and tap-changer conservator. The reinforced barrier can withstand a pressure difference of 70kPa.



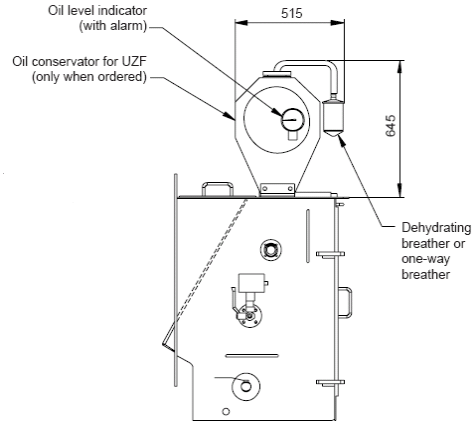
Oil level difference  $h$  at 20°C between the conservators

- **Flange for separate conservator**  
See UZE tank under “Oil conservator” below.

- **Oil Conservator**  
See it on UZF below.



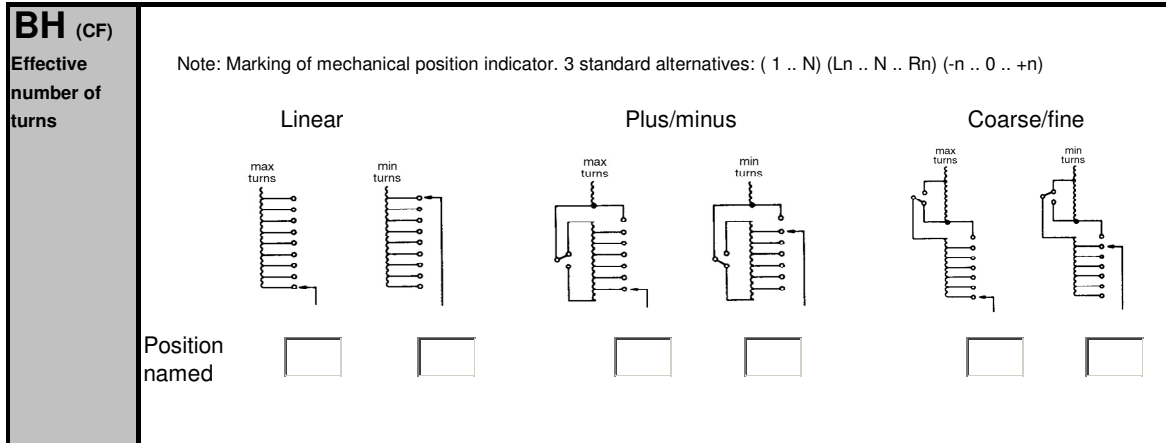
UZE with oil conservator in the tank and with an oil level indicator.



UZF with oil conservator on the roof and with an oil level indicator.

- **Breather**  
Dehydration breather= Silica gel breather  
One-way breather= Opens at an internal overpressure in the UZ tank of 35-40kPA.

**BH Effective number of turns**



The name of the position in which maximum and minimum turns are connected to the main winding shall be filled in for the appropriate type of switching chosen. Compare with the CF.

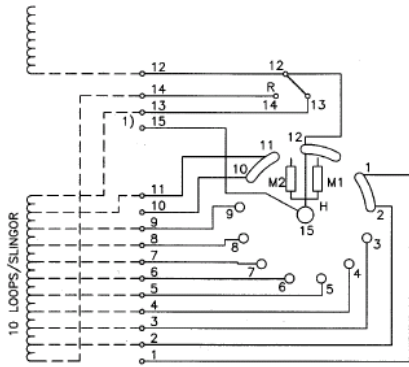


**Example**

This connection diagram is named “Max turns” as position 1 has a max turns connected to the main winding.

This connection diagram is named “Min turns” as position 1 has a min turns connected to the main winding.

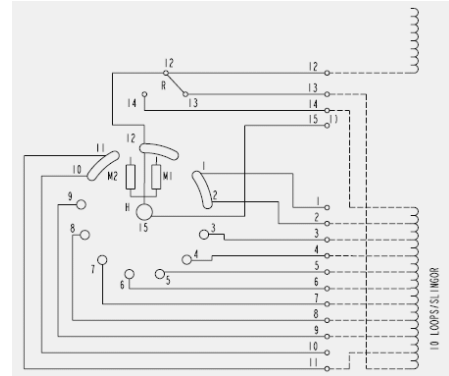
**Max turns**



Max turns in position 1.  
Min turns in position 19.

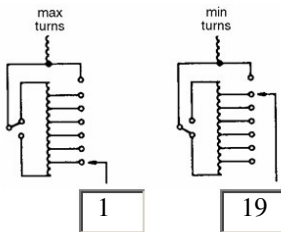
Pos. Lage	R connects förbinder	H connects förbinder
1		2-15
2		3-15
3		4-15
4		5-15
5		6-15
6		7-15
7		8-15
8		9-15
9A		10-15
9		11-15
10		12-15
10A		
11	12-13	1-15
11A		2-15
12		3-15
13		4-15
14		5-15
15		6-15
16		7-15
17		8-15
18		9-15
19	12-14	10-15

**Min turns**

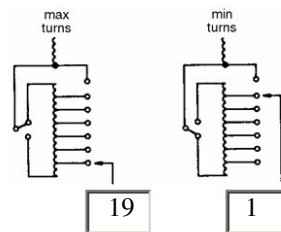


Max turns in position 19.  
Min turns in position 1.

**Plus/minus**



**Plus/minus**



**BJ Short circuit current**

<b>BJ</b> Short circuit current	Rms value
	<input type="checkbox"/> Max. 7 kA, 3 s (150 A, 300 A)
	<input type="checkbox"/> Max. 8 kA, 3 s (600 A)
	<input type="checkbox"/> Max. 12 kA, 2 s (600 A)
	Peak value: <input type="text"/> kA

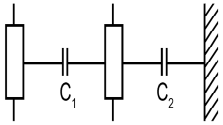
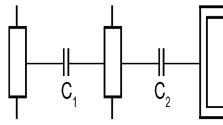
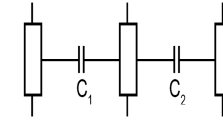
For UZ with rated current 150A and 300A the peak value is max 17,5kA, for 600A 8kA the max peak value is 20kA and for 600A 12kA the max peak value is 30kA. For short circuits under a longer time  $t_2$  a calculation can be made to find out the maximum current  $I_2$  using:

$$I_2^2 \cdot t_2 = I_1^2 \cdot t_1$$

$I_1$  and  $t_1$  shall be taken from the table above.

$$t_2 > t_1$$

## BL Tie-in resistor

<b>BL</b> Tie-in resistor	<p>Note: Tie-in resistor is needed only if recovery voltage of the change-over selector exceeds 40 kV.  The tie-in resistor is placed in the transformer tank</p>	
	<input type="checkbox"/> No <input type="checkbox"/> Yes	<p>Note: With other arrangement than figures below. Remember to attach winding layout, winding connections and capacitances between windings in order to get tie-in resistance calculated by ABB</p>
	Capacitance C <sub>1</sub> (nF) <input style="width: 100px;" type="text"/>	Capacitance C <sub>2</sub> (nF) <input style="width: 100px;" type="text"/>
	Regulating winding is placed:	
<input type="checkbox"/> Between winding and tank wall	<input type="checkbox"/> Between winding and core	<input type="checkbox"/> Between two windings
		
<input type="checkbox"/> HV <input type="checkbox"/> LV <input type="checkbox"/> Other winding	<input type="checkbox"/> HV <input type="checkbox"/> LV <input type="checkbox"/> Other winding	<input type="checkbox"/> HV <input type="checkbox"/> HV <input type="checkbox"/> LV <input type="checkbox"/> LV <input type="checkbox"/> Other winding <input type="checkbox"/> Other winding
<input style="width: 60px;" type="text"/> kV	<input style="width: 60px;" type="text"/> kV	<input style="width: 60px;" type="text"/> kV <input style="width: 60px;" type="text"/> kV
<input type="checkbox"/> Y <input type="checkbox"/> D	<input type="checkbox"/> Y <input type="checkbox"/> D	<input type="checkbox"/> Y <input type="checkbox"/> D <input type="checkbox"/> Y <input type="checkbox"/> D

When using Plus/Minus and Coarse/Fine connection the regulating winding will be “floating” during the time when the pre-selector is open. The regulating winding will receive a potential that is determined by the surrounding capacitances and voltages and in some cases also of the leads. If the recovery voltage over the change-over selector exceeds 40kV, a tie-in resistor is needed to reduce the recovery voltage.

### Program

To check if a tie-in resistor is needed, the “Tie-in Resistor Calculation Program” provided on the documentation CD can be used.

### Calculation of tie-in resistor value

If a tie-in resistor is needed, all information in the BL section must be filled in so ABB can make the calculation.

**BN Surface treatment**

<b>BN</b> Surface treatment	Environmental class according to ISO/DIS 12944-2 <input checked="" type="checkbox"/> C3 <input type="checkbox"/> C4 <input type="checkbox"/> Only primer outside (White finish paint inside tank and motor-drive)
	Finish paint outside: <input type="checkbox"/> RAL 7032 <input type="checkbox"/> Munsel 5,5B 5,5/1,25 <input type="checkbox"/> Other <input style="width: 50px;" type="text"/> <input type="checkbox"/> RAL 7033 <input type="checkbox"/> Munsel 8B 4,5/3,2 <input type="checkbox"/> RAL 7035 <input type="checkbox"/> ANSI 70 <input type="checkbox"/> RAL 7038
	Colour inside motor-drive <input type="checkbox"/> Same colour as outside <input type="checkbox"/> White (RAL 9010) <input type="checkbox"/> Anti-condensation coverage (white)

- Guide to environmental classes

Category and corrosivity	Example of typical environments in a temperate climate.
<b>C3 Medium</b>	<p><b>Outdoor</b> Atmosphere with low salinity or moderate pollution. Urban and lightly industrialised areas. Areas with some coastal influence.</p> <p><b>Indoor</b> <i>Spaces with moderate condensation frequency and some pollution from production processes, e.g. food processing plants, breweries, dairies, and laundries.</i></p>
<b>C4 High</b>	<p><b>Outdoor</b> Atmosphere with moderate salinity or high pollution. Industrial and costal areas.</p> <p><b>Indoor</b> <i>Spaces with high condensation frequency and high pollution from production processes, e.g. chemical, swimming halls, coastal ship- and boat yards</i></p>

- Finish paint outside, also fill in the colour.

- RAL 7032 is silicon grey
- RAL 7033 is concrete grey
- RAL 7035 is light grey
- RAL 7038 is agate grey

- Munsell 5.5B5.5/1.25 is grey blue.
- Munsell 8B4.5/3.2 is blue
- ANSI 70 is grey.

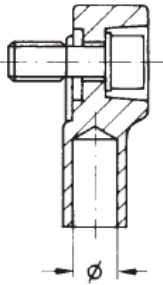
Other paint will give a further price increase and a prolonged delivery time

- Anti-condensation coverage is a layer of insulating material that will insulate the cabinet better at cold ambient conditions. It will also further prevent condensation of moisture in the cabinet. Anti condensation coverage is required if the ambient temperature is colder than -45 °C.

## BO Cable lugs

BO Cable lugs	Hole diameter (mm)	For cable area (mm <sup>2</sup> )	Catalogue No.
	7	25	<input type="checkbox"/> LL 114 003-K
	9	35	<input type="checkbox"/> LL 114 003-L
	11	50	<input type="checkbox"/> LL 114 003-A
	13	70	<input type="checkbox"/> LL 114 003-B
	15	95	<input type="checkbox"/> LL 114 003-C
	17	120	<input type="checkbox"/> LL 114 003-D
	19	150	<input type="checkbox"/> LL 114 003-E
	21	185	<input type="checkbox"/> LL 114 003-F
	24	240	<input type="checkbox"/> LL 114 003-H
	Undrilled	-	<input type="checkbox"/> LL 114 003-M

For the connection of the regulating winding leads to the tap-changer terminals.



Cable lug with hole diameter  $\varnothing$



Mounting of cables with cable lugs to the tap-changer terminals

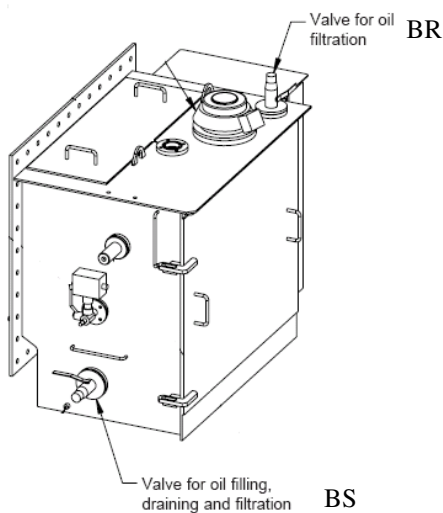
## BR and BS tank outlets

<b>BR</b> Flange for oil filtration, placed on tap-changer roof	<div style="border: 1px dashed black; padding: 5px; margin-bottom: 10px;"> <input type="checkbox"/> Only cover                 </div> <input type="checkbox"/> Valve with R1½" outside thread <input type="checkbox"/> Valve with R1" outside thread <input type="checkbox"/> Valve with flange (BS) bolt circle diameter 98.4 mm <input type="checkbox"/> Valve with 1½" NPT inside thread (ANSI) <input type="checkbox"/> Flange for connection of oil filter unit, see Technical Guide
<b>BS</b> Draining valve	<div style="border: 1px dashed black; padding: 5px; margin-bottom: 10px;"> <input type="checkbox"/> Only cover                 </div> <input type="checkbox"/> R1½" outside thread <input type="checkbox"/> R1" outside thread <input type="checkbox"/> Valve with flange (BS) bolt circle diameter 98.4 mm <input type="checkbox"/> 1½" NPT inside thread (ANSI) without test valve <input type="checkbox"/> 1½" NPT inside thread (ANSI) with test valve <input type="checkbox"/> Valve with flange for oil filter unit, see Technical Guide

R1 ½" is the same as G1 ½"

R1" is the same as G1"

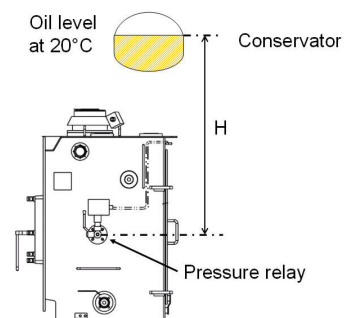
See picture below for the placement of the connections



## BT Supervision devices

<b>BT</b> Supervisor y devices	Vertical distance H between the pressure relay device and the oil level in the conservator _____ m
	Note: One-way breather influence the set point level on our safety devices. Please add theoretically 4m to real distance H if one-way breather is used.
	Pressure relay <input type="checkbox"/> No <input checked="" type="checkbox"/> Yes, double contacts
	Oil flow relay <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes Note: Pressure relay and/or oil flow relay must be choosen.
	Pressure relief device <input checked="" type="checkbox"/> No (prepared for 130 mm is standard) Yes, 130 mm <input type="checkbox"/> Single contact <input type="checkbox"/> Double contacts Yes, 50 mm <input type="checkbox"/> Single contact <input type="checkbox"/> Double contacts
	Temperature switch <input checked="" type="checkbox"/> No <input type="checkbox"/> Only housing <input type="checkbox"/> Temperature switch +90 degrees C <input type="checkbox"/> Temperature switch +80 degrees C <input type="checkbox"/> Temperature switch -25 degrees C <input type="checkbox"/> Temperature switch -40 degrees C
Prepared for TEC (Pt100) <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes	

- For the distance H, everything refers to the tap-changer, between oil level in conservator and pressure relay device.

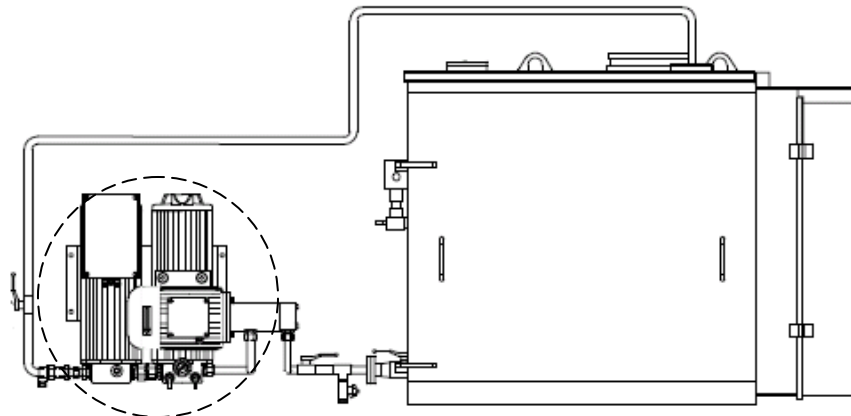


- Standard option is a pressure relay with a double contact
- The tap-changer must be equipped with either a pressure relay or an oil flow relay that should be connected to trip the transformer.
- Single contact means that the device has one dry contact for output signal. Double contact means that the device has two dry contacts that act simultaneously.
- Temperature switch has two dry contacts acting at the specific temperature.
- The dry contacts can be connected either as NO or NC.

- Prepared for TEC means that the tap-changer will be delivered with Pt100 temperature sensor in the tank. TEC (Transformer Electronic Control) is ABB's monitoring & diagnostic and control system for transformers and components.

## BU Oil filter unit

<b>BU</b> Oil filter unit	<input type="checkbox"/> No	<input type="checkbox"/> Yes
	Voltage for motor: <ul style="list-style-type: none"> <li><input type="checkbox"/> 3~ 50 Hz 220-250 V</li> <li><input type="checkbox"/> 3~ 50 Hz 380-433 V</li> <li><input type="checkbox"/> 3~ 50 Hz 500 V</li> <li><input type="checkbox"/> 3~ 60 Hz 208-277 V</li> <li><input type="checkbox"/> 3~ 60 Hz 360-480 V</li> <li><input type="checkbox"/> 1~ 50/60 Hz 110-127 V</li> <li><input type="checkbox"/> 1~ 50/60 Hz 220-240 V</li> </ul>	

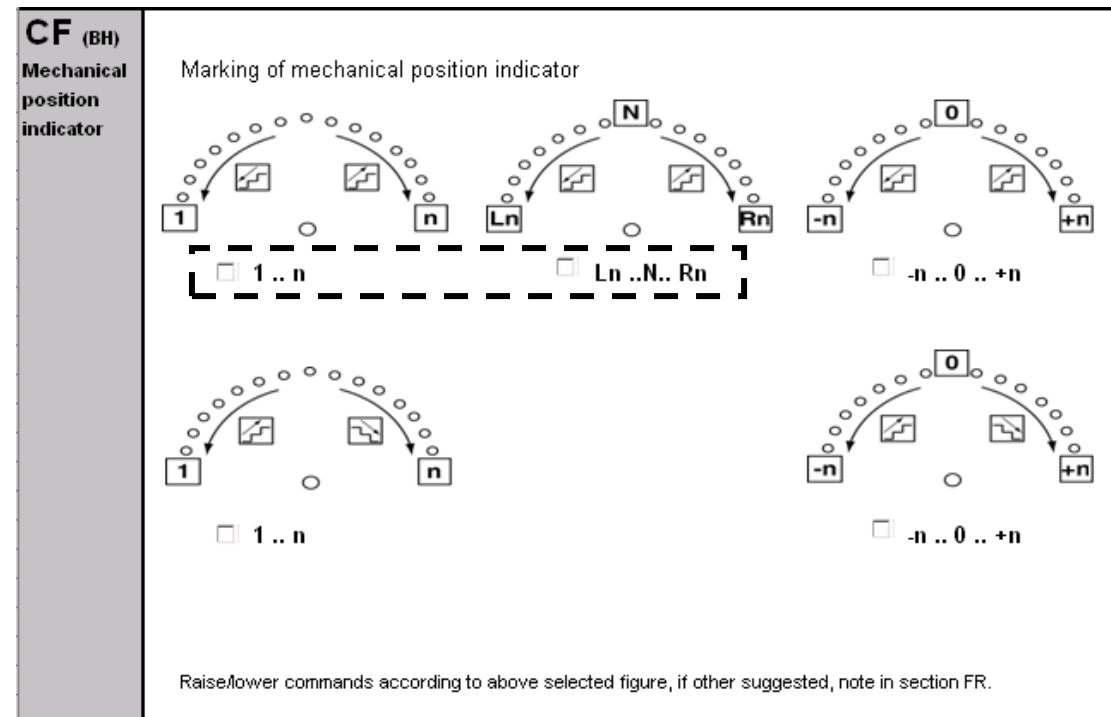


Oil filter unit for UZ tap-changer

## CC-CD Voltages

<b>CC</b> Motor voltage	<input type="checkbox"/> 3~50 Hz 220-240 V <input type="checkbox"/> 3~50 Hz 380-420 V <input type="checkbox"/> 3~50 Hz 433 V <input type="checkbox"/> 3~50 Hz 500 V <input type="checkbox"/> 3~60 Hz 208 V <input type="checkbox"/> 3~60 Hz 220-240 V <input type="checkbox"/> 3~60 Hz 360 V <input type="checkbox"/> 3~60 Hz 380-420 V <input type="checkbox"/> 3~60 Hz 440-480 V <input type="checkbox"/> 1~50 Hz 110 V	<input type="checkbox"/> 1~50 Hz 220 V <input type="checkbox"/> 1~60 Hz 120 V <input type="checkbox"/> 1~60 Hz 220 V <input type="checkbox"/> 1~60 Hz 240 V <input type="checkbox"/> DC 110-127 V <input type="checkbox"/> DC 220 V
<b>CD</b> Control voltage	<input type="checkbox"/> 50 Hz 110 V <input type="checkbox"/> 50 Hz 120 V <input type="checkbox"/> 50 Hz 220-230 V <input type="checkbox"/> 50 Hz 240 V <input type="checkbox"/> 50 Hz 250 V <input type="checkbox"/> 60 Hz 110-120 V	<input type="checkbox"/> 60 Hz 127 V <input type="checkbox"/> 60 Hz 208 V <input type="checkbox"/> 60 Hz 220 V <input type="checkbox"/> 60 Hz 230-240 V <input type="checkbox"/> 60 Hz 250-260 V <input type="checkbox"/> DC 24 V <input type="checkbox"/> DC 48 V <input type="checkbox"/> DC 110 V <input type="checkbox"/> DC 125-127 V <input type="checkbox"/> DC 220 V
<b>CE</b> Heater voltage	<input type="checkbox"/> 208-240 V <input type="checkbox"/> 110-127 V	

## CF Mechanical position indicator



Compare with the tap-changer BH and the example with attached connection diagrams. Other alternatives are also possible, but will have an extra cost and prolonged delivery time.



**CG Terminal blocks**

CG Terminal blocks	Manufacturer	Type	Description
<input type="checkbox"/>	Phönix	UK 5N	Screw clamp terminal
<input type="checkbox"/>	Weidmüller	SAK4	Screw clamp terminal
<input type="checkbox"/>	Phönix	URTK/S Ben 10	Screw clamp terminal, disconnectable
<input type="checkbox"/>	Phönix	URTK/S	Screw clamp terminal, disconnectable
<input type="checkbox"/>	Weidmüller	RSF1	Hook lug terminal, spring loaded
<input type="checkbox"/>	Phönix	OTTA 6T	Ringlug terminal, disconnectable
<input type="checkbox"/>	Phönix	OTTA 6	Ringlug terminal
<input type="checkbox"/>	General electric	EB-25	Ringlug terminal

These are the standard options. Other can also be supplied, but they will increase the price and could also prolong the delivery time.

**CK Extra heater**

CK Extra heater	<input type="checkbox"/> No <input type="checkbox"/> Yes, with <input type="checkbox"/> Thermostat <input type="checkbox"/> Humidistat <input type="checkbox"/> Switch in series with the thermostat and/or humidistat
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One heater that is permanently energised is supplied as standard. Both for temperature and to avoid moisture in the cabinet.

If an extra heater is required, it has the following options to be controlled by a thermostat and/or humidistat (moisture). It is also possible to have a manual switch in series with the thermostat and humidistat.

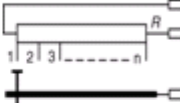
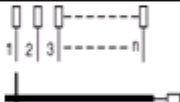
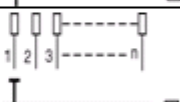



For ambient temperatures colder than -40°C an extra heater is required. It shall be controlled by a thermostat.

**CL Socket Outlet**

CL Conv. Outlet	<input type="checkbox"/> No <input type="checkbox"/> Yes, DIN (16 A) 50Hz 230V <input type="checkbox"/> Yes, ANSI(15A) 60Hz 120V (NEMA 5-15R) <input type="checkbox"/> Yes, ANSI(15A) 60Hz 220V (NEMA 6-15R) <input type="checkbox"/> Yes, ANSI(20A) 60Hz 120V (NEMA 5-20R)
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Ground fault interruption is included for all sockets.

## CN Multi-position switches

<b>CN</b> Multi-pos. switches			
Total number of required multi-position switches must be noted			
Type	Symbol	Occupies space for contact rows	Required number of switches
Potentiometer position transmitter		<b>1</b>	<input type="checkbox"/> <input style="width: 50px; height: 15px;" type="text"/>
Break before make		<b>1</b>	<input type="checkbox"/> <input style="width: 50px; height: 15px;" type="text"/>
Make before break		<b>1</b>	<input type="checkbox"/> <input style="width: 50px; height: 15px;" type="text"/>
Potentiometer for TEC use		<b>1</b>	<input type="checkbox"/> <input style="width: 50px; height: 15px;" type="text"/>
Odd/even (step switch)		<b>2</b>	<input type="checkbox"/> <input style="width: 50px; height: 15px;" type="text"/>
Follower switch for parallel control		<b>2</b>	<input type="checkbox"/> <input style="width: 50px; height: 15px;" type="text"/>

Max number of contact rows:

- 12 without through position (UZ.L)
- 11 with through position (UZ.R, UZ.D)
- 10 with through position and running-through protection.

UZ.R with through position

Positions 9, 11, 13, 15, 17, 25, 27

Observe that when a coder is ordered under CT a BBM-switch will also be supplied. This BBM-switch occupies one contact row.

If more than 4 extra contact rows are ordered an extra price will be added on top of the price for the contact row.

### Potentiometer position transmitter

This is a resistor bridge that has an increasing resistance in one tap-changer direction. The first ordered potentiometer position transmitter is included in the base price.

### Break before make

Has one contact from each tap-changer position. During switch from one position to another it will have no contact for a while.

### Make before break

Has one contact from each tap-changer position. During switch from one position to another it will have contact with both positions for a while.

### Potentiometer for TEC

This is a resistor bridge suited for TEC that has an increasing resistance in one tap-changer direction. It is connected directly to TEC to indicate the tap-changer position.

### Odd/even (step switch) for parallel control

It gives a signal when the tap-changer is in odd position and another signal when it is in even position

The switches are used for master/follower control scheme also named master/slave or simultan method. It gives a signal when the tap-changer is in odd position and another signal when it is in even position. On transformer controls one or more other transformers. The tap-changers must also be standing in the same position when the transformers are energised.

*This step switch is not needed for the a-eberle voltage regulator.*

- **Special follower switch for parallel control**

This is a special version of master/follower method that has been used by some customers. Normally all motor-drive mechanisms have both a control and one follower contact. The control contact is BBM. The follower contact has all positions closed except for the actual position and one position higher. At energising of the transformer, all tap-changers will position then self in the same position as the master.

## CO Resistance position transmitter

<b>CO</b> Resistance position transmitter	Resistance in ohms per step for potentiometer position transmitter  <input type="checkbox"/> 10 $\Omega$ , 2 W <input type="checkbox"/> 50 $\Omega$ , 5 W <input type="checkbox"/> 400 $\Omega$ , 5 W
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### Potentiometer position transmitter

If a measuring transducer shall be used, see below CP, 10 $\Omega$ , 2W shall be chosen.

### Resistance for TEC potentiometer

Will automatically be delivered with a suitable resistance for TEC

## CP Measuring transducer

<b>CP</b> Measuring transducer	Select 10 ohms/step in section CO and select output from measuring transducer(s) If yes
	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes, one <input type="checkbox"/> Yes, two
	Output first measuring transducer
	<input type="checkbox"/> 0-1 mA <input type="checkbox"/> 0-5 mA <input type="checkbox"/> 0-10 mA <input type="checkbox"/> 0-20 mA <input type="checkbox"/> 4-20 mA
	Output second measuring transducer
<input type="checkbox"/> 0-1 mA <input type="checkbox"/> 0-5 mA <input type="checkbox"/> 0-10 mA <input type="checkbox"/> 0-20 mA <input type="checkbox"/> 4-20 mA	
Note: Auxiliary voltage 24-240 V AC/DC	

Converts the resistance from the potentiometer to a current. (It is not needed for TEC applications.) The resistance 10Ω per step, shall be selected at CO.

## CT Coder

<b>CT</b> Coder	<input checked="" type="checkbox"/> No
	<input type="checkbox"/> Yes, BCD coded 1, 2, 4, 8, 10, 20
	<input type="checkbox"/> Yes, Binary Coder (BC) 1, 2, 4, 8, 16, 32
	Note: One BBM-switch for the coder will also be supplied

The coder occupies 1 contact row. The coder includes all necessary devices to generate an output code. It is also protected by varistors.

## CU Remote position indicator

<b>CU</b> Remote position indicator	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes, number of indicators: <input type="text"/>
	Analog position indicator <input type="checkbox"/> Size 96x96 <input type="checkbox"/> Size 144x144
	OR:
	<input type="checkbox"/> Digital with analog input (from measuring transducer, section CP), size 96x48
	Auxiliary voltage      Output
	<input type="checkbox"/> AC 110-240 V <input type="checkbox"/> No
	<input type="checkbox"/> DC 12-48 V <input type="checkbox"/> BCD Open collector <input type="checkbox"/> BCD TTL
	<input type="checkbox"/> Analog 0-1 V <input type="checkbox"/> Analog 0-5 V <input type="checkbox"/> Analog 0-10 V
	<input type="checkbox"/> Analog 1-5 V <input type="checkbox"/> Analog 4-20 mA
	OR WITH:
<input type="checkbox"/> Digital with BCD input (section CT) size 96x24. Auxiliary voltage: DC 24 V	

If yes is filled in, you should either connect a:

- Analogue position indicator
- or
- Digital with analogue input
- or
- Digital with BCD input

## Analogue position indicator

- Requires that a potentiometer position transmitter is selected under CN.
- Requires that a 10Ω resistor is selected under CO.
- Requires that a measuring transducer is selected under CP.

## Digital with analogue input

- Select supply voltage of AC 110-240V AC or DC 12-48V.
- Requires that a potentiometer position transmitter is selected under CN.
- Requires that a 10Ω resistor is selected under CO.
- Requires that a measuring transducer is selected under CP.

## Digital with BCD input

- Requires that a BCD coder is selected under CT
- Requires a supply voltage of DC 24V

## CV Circuit breaker

<b>CV</b> Circuit breaker	<input type="checkbox"/> No <input type="checkbox"/> Yes, in control circuit <input type="checkbox"/> Yes, in heater circuit <input type="checkbox"/> Yes, for outlet	Note: One signal contact included
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The circuit breaker is a re-settable fuse.

The signal contact gives a signal when the circuit breaker has been tripped.

## CX Extra signals

<b>CX</b> Extra signals	<input type="checkbox"/> No <input type="checkbox"/> Yes, tap-change incomplete <input type="checkbox"/> Yes, extra NO/NC for protective motor switch	Note: Tap-change in progress signal is included as standard and one signal from protective motor switch.
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- Tap-change incomplete gives a signal if the motor-drive is not in position after a preset time.
- Extra NO/NC for protective motor switch, gives an extra signal from the motor protection. (One signal contact is included)

### CY Under voltage relay

<b>CY</b> Undervoltage relay	<input type="checkbox"/> No <input type="checkbox"/> Yes, for motor supply <input type="checkbox"/> Yes, for control supply
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As the motor and control circuits are separate an under voltage relay can be placed in each of the circuits as an option. This will give a signal in case of a voltage lower than the limit for the motor or devices or at a complete loss of voltage.

### DA Documentation, BUE and BUL

<b>DA</b> Documents	Documents required in <input type="text"/> sets.  Note: More than 3 sets will be charged for!
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Observe that up to 3 sets are delivered free of charge

### FR Further requirements

<b>FR</b> Further requirements and revision specifications	All extras must be noted! <div style="border: 1px solid black; height: 300px; width: 100%;"></div>
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All extras must be noted here. In many cases it will be extra cost and/or delivery time. Please also note that there is a physical limitation in the cabinet if too many options are chosen.