Order data sheet explanations for tap-changer type UC

Scope

This product information gives some more explanations to the order data sheet for tap-changer type UC.
The documents that references are made to can be found on the documentation CD or at the ABB web site (www.abb.com/electricalcomponents).

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

Postal adress
ABB AB, Components
SE-771 80 LUDVIKA, Sweden

Telecopier
Nat 0240 – 121 57
Int +46 240 121 57

AA Type

AA Type		
	☐ Network	☐ Shunt reactor
	☐ Generator step-up (GSU)	☐ Rectifier / Converter
	☐ Booster	☐ Phase shifting transformer
	☐ Arc furnace	☐ Other
	☐ 3-phase ☐ 1-phase ☐ 1-phase (solitary)	

- **GSU**
  Regulating on HV-side = output side. Pay attention to definition of "raise / lower" as the OLTC is placed on the "up side".

- **Booster**
  Pay attention to the step voltage and current. They should be the one that the tap-changer will be subject to.

- **Arc furnace**
  Use Info no. 5492 0031-89 for calculation and dimensioning rules.

- **Shunt reactor**
  Calculation & selection to be performed by ABB Components.

- **Rectifier/Converter**
  Rectifier: Use Info no. 5492 0031-89 for calculation and dimensioning rules.
  Converter: Calculation & selection to be performed by ABB Components.

- **Phase shifters**
  Calculation & selection to be performed by ABB Components.

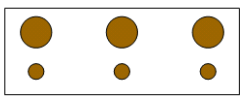
1-phase (solitary); single-phase stand alone unit as for instance a traction feeder unit.

AB Rated power

AB Rated power	
	Rated power C MVA

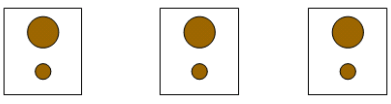
This should be the rated power of the transformer that the tap-changer is placed in. (A single-phase transformer placed in a bank should have the rated power of the complete bank.)

Three-phase transformer



C MVA

Single-phase in three-phase bank



C/3 MVA C/3 MVA C/3 MVA

Bank: C MVA

Single-phase (solitary)

C MVA

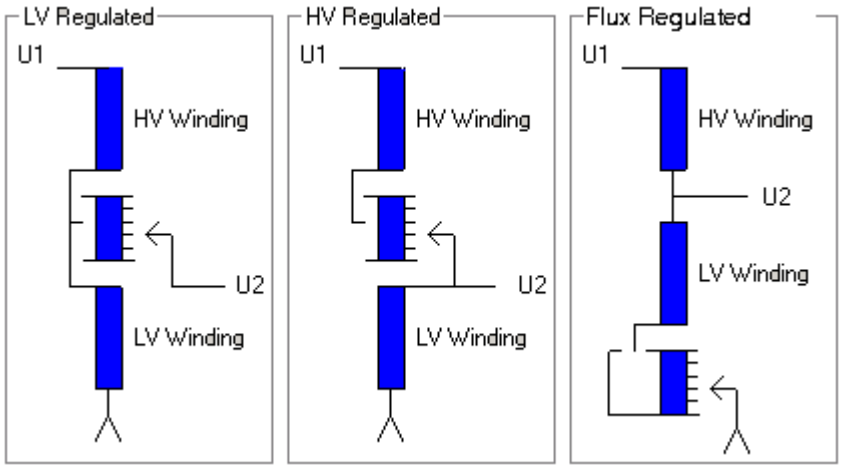
AC Electrical data

AC Electric data	
	System voltage (HV / LV): HV / LV kV Frequency 60 Hz
	Regulating range: +/- a / b x p % of [x] HV [ ] LV winding
	Connections (HV): [x] Y [ ] D
	Connections (LV): [ ] Y [x] D
	Auto [ ] LV regulated [ ] HV regulated [ ] 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) that is connected to the regulating winding.
For flux regulated auto transformer, fill in the average step length.

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

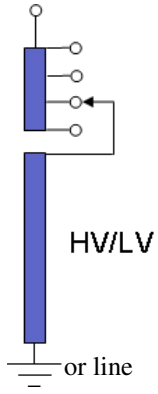


For flux regulated (regulation at the neutral point) the connection table (with tap-changer position and voltages) should be sent to ABB Components.

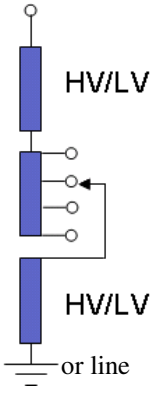
AD OLTC is placed

AD OLTC is placed	The OLTC is placed: ☐ in the line end of ☐ in the middle of ☐ in the neutral point of ☐ the HV winding ☐ the LV winding

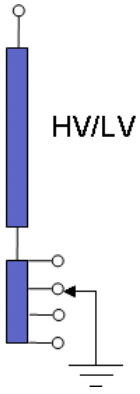
- Fill in placement of OLTC/regulating winding.



Line end



Middle of



Neutral point

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

AE OLTC insulation levels

AE OLTC insultaion level

Note: Values given in the Technical Guide for the chosen OLTC must not be exceeded.
For distances, see section AG or Technical Guide.

Fill in LI - AC

Insulation level to earth

g1 [LI] - [AC] kV

Between open contacts in diverter switch

b2 [ ] - [ ] kV

e1 [ ] - [ ] kV

Between phases

b1 [ ] - [ ] kV

d1 [ ] - [ ] kV

Across regulating winding

a2 [ ] - [ ] kV

c1 [ ] - [ ] kV

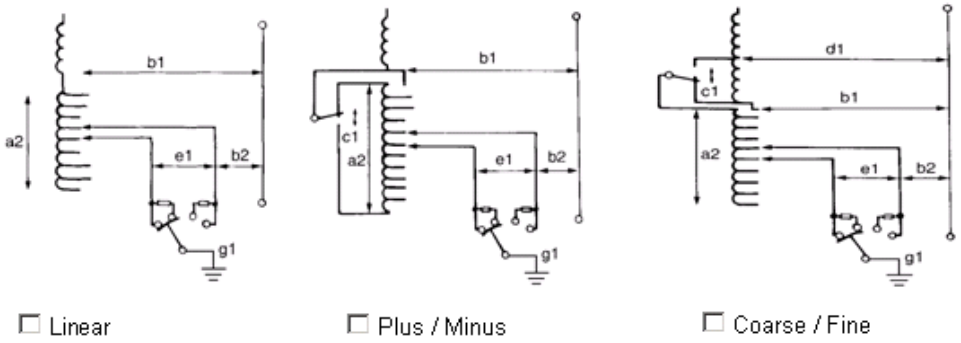
Also check the insulation distances in the figure under point AG.

- In the first box fill in the required LI=Lightning impulse level.
- In the second box fill in the required power frequency withstand level (AC).

Observe that the withstand values for the tap-changer shall be the one that the tap-changer shall withstand, including for instance up-swings and stresses during tests.

AG Type of switching

AG
Type of switching

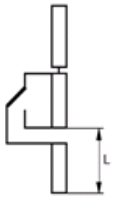


Linear, Plus/Minus or Coarse/Fine: Self explanatory from the ordering data sheet.

AH Leakage inductance

AH
Leakage inductance

Specify the leakage inductance through the coarse and fine windings in series (L) _____ mH



Fill in the leakage induction 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

BA OLTC type designation	(According to Technical Guide)	Example				Short version (According to Technical Guide)
	UC	GRN	650 / 500	A /	III	[x] No [ ] Yes

Fill in the following

1.1 First square, first position is the type of diverter switch:

- G for UCG
- L for UCL
- D for UCD
- C for UCC

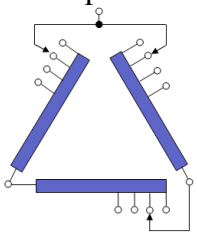
1.2 First square, second position is the type of switch:

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

1.3 First square, third position is the type of connection:

- N=Three-phase star point (one unit)
- E= Single-phase (one unit)
- T=Three-phase fully insulated (three units)
- B=Three-phase delta (two units, single-phase and two phase)

B=Three-phase delta
2-Pole + 1-Pole
Line-End Arrangement



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

- UCG (380kV, 650kV, 750kV or 1050kV)
- UCL (380kV, 650kV, or 1050kV)
- UCD (380kV, 650kV, or 1050kV)
- UCC (380kV, 650kV, or 1050kV)

3 Third square, fill in the maximum rated through current:

- UCG.N, UCG.B: 300A, 400A, 500A, 600A
- UCG.E, UCG.T: 300A, 400A, 500A, 600A, 700A, 900A, 1050A, 1200A, 1500A
- UCL.N, UCL.B: 600A, 900A
- UCL.E, UCL.T: 600A, 900A, 1800A, 2400A
- UCD.N: 1000A, 1200A
- UCD.E: 1000A, 1200A, 1800A, 2000A, 2400A, 3000A, 3600A[1)]
- UCC.N: 800A, 1200A, 1600A
- UCC.E: 3600A, 4500A

[1)] With enforced current splitting

4 Fourth square, fill in the chosen tap-selector:

- C = UCG tap selector
- I = UCG tap-selector
- III = UCG, UCL and UCD tap selector

For UCC nothing need to be filled in here.

Standard OLTC types with UCG diverter switch

Short version (shorter diverter switch length, but also lower step voltage)

Diverter switch	Impulse withstand to earth (kV)	Current rating (A)	Tap selector	Max impulse across range (kV)	Max positions
UCGLN	380, 650, 750, 1050	300	C	350	14
UCGRN	380, 650, 750, 1050	300	C	350	27
UCGDN	380, 650, 750, 1050	300	C	350	27
UCGLE, UCGLT	380, 650, 750, 1050	300, 600, 900	C	350	14
UCGRE, UCGRT	380, 650, 750, 1050	300, 600, 900	C	350	27
UCGDE, UCGDT	380, 650, 750, 1050	300, 600, 900	C	350	27
UCGLB	380, 650, 750, 1050	300	C	300	14
UCGRB	380, 650, 750, 1050	300	C	350	27
UCGDB	380, 650, 750, 1050	300	C	350	27
UCGLN	380, 650, 750, 1050	300	I	300	18
UCGRN	380, 650, 750, 1050	300	I	300	35
UCGDN	380, 650, 750, 1050	300	I	300	35
UCGLE, UCGLT	380, 650, 750, 1050	300, 600, 900	I	300	18
UCGRE, UCGRT	380, 650, 750, 1050	300, 600, 900	I	300	35
UCGDE, UCGDT	380, 650, 750, 1050	300, 600, 900	I	300	35
UCGLB	380, 650, 750, 1050	300	I	300	18
UCGRB	380, 650, 750, 1050	300	I	300	35
UCGDB	380, 650, 750, 1050	300	I	300	35
UCGLN	380, 650, 750, 1050	300	III	550	18
UCGRN	380, 650, 750, 1050	300	III	550	35
UCGDN	380, 650, 750, 1050	300	III	550	35
UCGLE, UCGLT	380, 650, 750, 1050	300, 600, 900	III	550	35
UCGRE, UCGRT	380, 650, 750, 1050	300, 600, 900	III	550	35
UCGDE, UCGDT	380, 650, 750, 1050	300, 600, 900	III	550	35
UCGLB	380, 650, 750, 1050	300	III	550	35
UCGRB	380, 650, 750, 1050	300	III	550	35
UCGDB	380, 650, 750, 1050	300	III	550	35

Standard OLTC types with UCG diverter switch

Normal version

Diverter switch	Impulse withstand to earth (kV)	Current rating (A)	Tap selector	Max impulse across range (kV)	Max positions
UCGLN	380, 650, 750, 1050	400	C	350	14
UCGRN	380, 650, 750, 1050	400	C	350	27
UCGDN	380, 650, 750, 1050	400	C	350	27
UCGLE, UCGLT	380, 650, 750, 1050	400, 700, 1050	C	350	14
UCGRE, UCGRT	380, 650, 750, 1050	400, 700, 1050	C	350	27
UCGDE, UCGDT	380, 650, 750, 1050	400, 700, 1050	C	350	27
UCGLB	380, 650, 750, 1050	400	C	300	14
UCGRB	380, 650, 750, 1050	400	C	350	27
UCGDB	380, 650, 750, 1050	400	C	350	27
UCGLN	380, 650, 750, 1050	600	I	300	18
UCGRN	380, 650, 750, 1050	600	I	300	35
UCGDN	380, 650, 750, 1050	600	I	300	35
UCGLE, UCGLT	380, 650, 750, 1050	600, 1200, 1500	I	300	18
UCGRE, UCGRT	380, 650, 750, 1050	600, 1200, 1500	I	300	35
UCGDE, UCGDT	380, 650, 750, 1050	600, 1200, 1500	I	300	35
UCGLB	380, 650, 750, 1050	600	I	300	18
UCGRB	380, 650, 750, 1050	600	I	300	35
UCGDB	380, 650, 750, 1050	600	I	300	35
UCGLN	380, 650, 750, 1050	600	III	550	18
UCGRN	380, 650, 750, 1050	600	III	550	35
UCGDN	380, 650, 750, 1050	600	III	550	35
UCGLE, UCGLT	380, 650, 750, 1050	600, 1200, 1500	III	550	35
UCGRE, UCGRT	380, 650, 750, 1050	600, 1200, 1500	III	550	35
UCGDE, UCGDT	380, 650, 750, 1050	600, 1200, 1500	III	550	35
UCGLB	380, 650, 750, 1050	600	III	550	35
UCGRB	380, 650, 750, 1050	600	III	550	35
UCGDB	380, 650, 750, 1050	600	III	550	35

Standard OLTC types with UCL diverter switch

Diverter switch	Impulse withstand to earth (kV)	Current rating (A)	Tap selector	Max impulse across range (kV)	Max positions
UCLLN	380, 650, 750, 1050	900	III	550	18
UCLRN	380, 650, 750, 1050	900	III	550	35
UCLDN	380, 650, 750, 1050	900	III	550	35
UCLLE, UCLLT	380, 650, 1050	900, 1800, 2400	III	550	18
UCLRE, UCLRT	380, 650, 1050	900, 1800, 2400	III	550	35
UCLDE, UCLDT	380, 650, 1050	900, 1800, 2400	III	550	35
UCLLB	380, 650, 1050	900	III	550	18
UCLRB	380, 650, 1050	900	III	550	35
UCLDB	380, 650, 1050	900	III	550	35

Standard OLTC types with UCD diverter switch

Diverter switch	Impulse withstand to earth (kV)	Current rating (A)	Tap selector	Max impulse across range (kV)	Max positions
UCDLN	380, 650, 1050	1000	III	550	18
UCDRN	380, 650, 1050	1000	III	550	35
UCDDN	380, 650, 1050	1000	III	550	35
UCDLE, UCDLT	380, 650, 1050	1000, 1800, 2400, 3000[1)]	III	550	18
UCDRE, UCDRT	380, 650, 1050	1000, 1800, 2400, 3000[1)]	III	550	35
UCDDE, UCDDT	380, 650, 1050	1000, 1800, 2400, 3000[1)]	III	550	35
UCDLB	380, 650, 1050	1000	III	550	18
UCDRB	380, 650, 1050	1000	III	550	35
UCDDB	380, 650, 1050	1000	III	550	35

Standard OLTC types with UCD diverter switch

Diverter switch	Impulse withstand to earth (kV)	Current rating (A)	Tap selector	Max impulse across range (kV)	Max positions
UCCLN[2)]	380, 650, 1050	800, 1200, 1600	UCC	500	23
UCCRN[2)]	380, 650, 1050	800, 1200, 1600	UCC	500	35
UCCDN[2)]	380, 650, 1050	800, 1200, 1600	UCC	500	35
UCCLE[2)]	380, 650, 1050	3600, 4500	UCC	500	23
UCCRE[2)]	380, 650, 1050	3600, 4500	UCC	500	35
UCCDE[2)]	380, 650, 1050	3600, 4500	UCC	500	35

1) With enforced current splitting

2) UCC requires one motor-drive mechanism for each unit and is therefore not available in connection B and T. UCD is diverter switch UCC with tap selector III

BC Electrical positions

BC Electrical positions	Number of electrical positions:

Electrical positions =Number of tap-changer positions that gives a winding ratio change. See point BA for standard maximum amount of electrical positions.

BD Rated voltage

BD Rated voltage	Rated phase step voltage: V

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.

BE Rated current	Rated through current (=max phase current in the OLTC winding) A

Highest current in any position under rated power conditions.

BF Overload requirements

BF Overload requirements	☐ According to IEC 60076-7 ☐ According to IEEE C57.91-1995	☐ Other requirement:

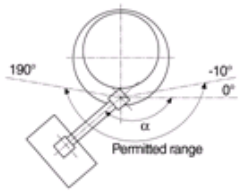
ABB tap-changers fulfil IEC 60214 and IEEE C 57.131.1995. (The temperature rise test is performed at 1,2 times the maximum rated through current). This means that the tap-changer with its rated through current also fulfil overloading of a transformer with the same rating according to the transformer standard IEC 60076-7 and ANSI/IEEE C57.91.

BG Position of motor-drive

BG
Position of motor-drive

Compare Technical Guide regarding lengths L1, L2, L3 and L4

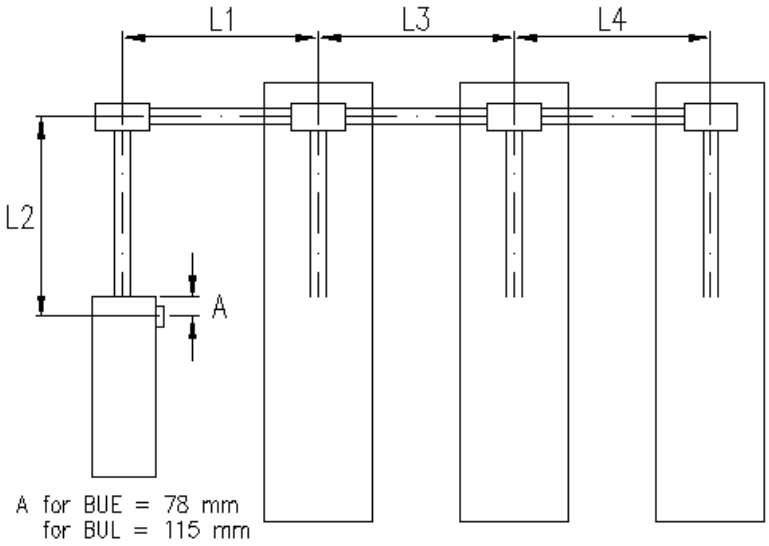
☐ α =



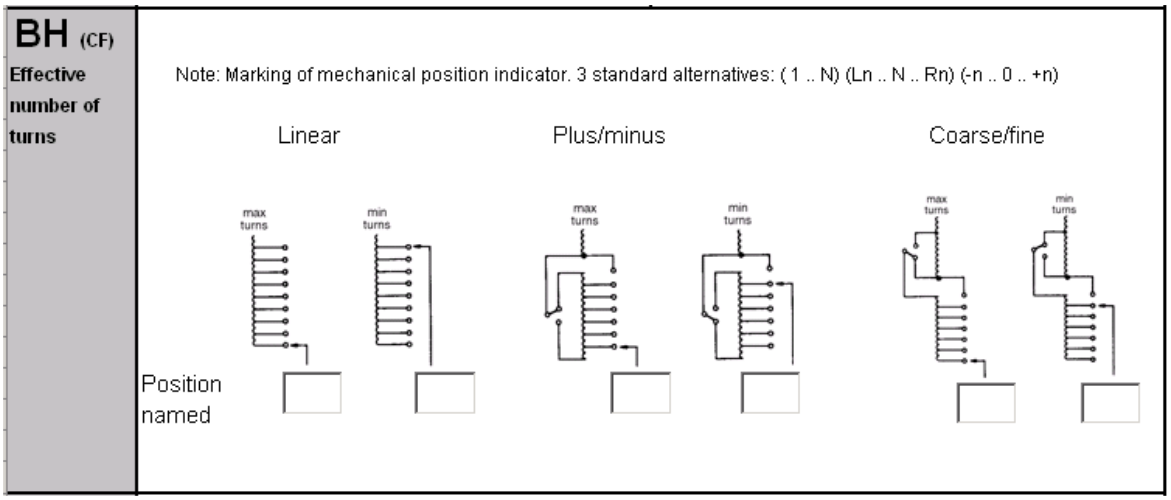
☐ 500 < L1 <= 1700	☐ 1700 < L1 <= 3200	☐ Special shaft system on request
☐ 525 < L2 <= 1800	☐ 1800 < L2 <= 3300	
☐ 500 < L3 <= 1700	☐ 1700 < L3 <= 3200	
☐ 500 < L4 <= 1700	☐ 1700 < L4 <= 3200	

The dimensions L1, L2, L3 and L4 are shown below. Observe that L3 and L4 are only required for UCG and UCL in case of:

- T=Three-phase fully insulated (three units)
- B=Three-phase delta (two units, single-phase and two phase)



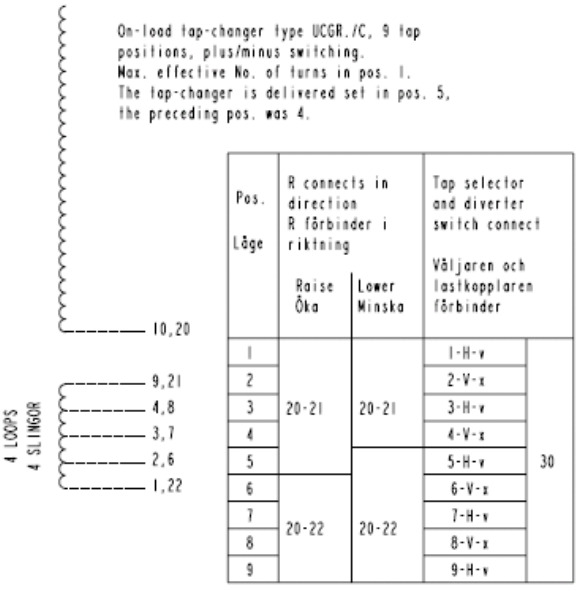
BH Effective number of turns



The name of the position when a maximum and minimum turns are connected to the main winding shall be filled in for the appropriate type of switch chosen.

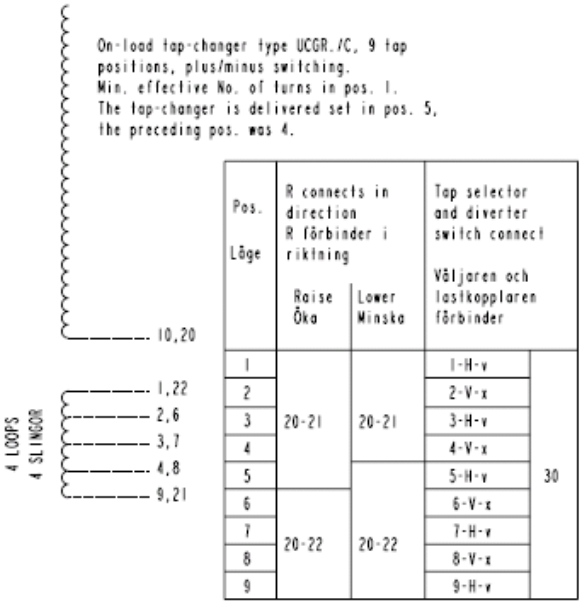
Example

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

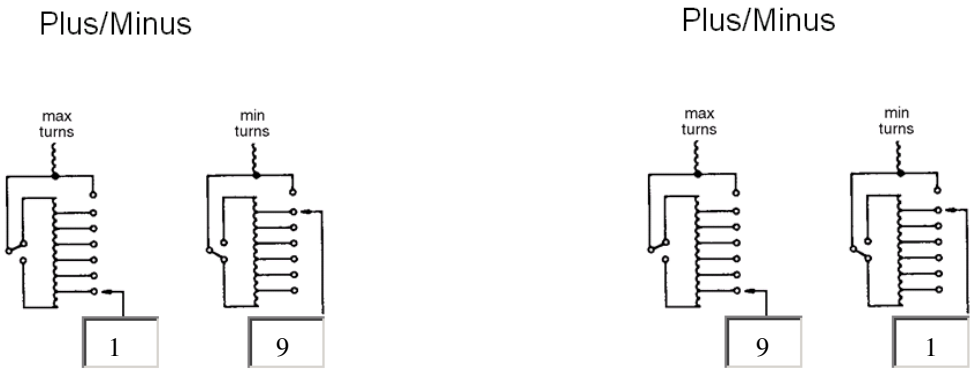


Max turns in position 1.
Min turns in position 9.

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



Max turns in position 9.
Min turns in position 1.



BJ Short circuit current

BJ Short circuit current	RMS value: [ ] kA Peak value: [ ] kA

- Check that the requirements are fulfilled for the OLTC type below.

Type	Max rated through current, rms	Three applications of 2 seconds duration [1], rms	Reinforced
UCG	300 A	7.0 kA	
	400 A	7.0 kA	
	500 A, 600 A	7.0 kA	
	700 A	7.0 kA	
	900 A	9.0 kA	
	1050 A	10.5 kA	
	1200 A, 1500 A	15.0 kA	
UCL	600 A	9.0 kA	
	900 A	9.0 kA	
	1800 A	26.0 kA	
	2400 A	26.0 kA	
UCD	1000 A	13.0 kA	
	1200 A	12.0 kA	
	1800 A	26.0 kA	
	2000 A	24.0 kA	
	2400 A	32.0 kA	
	3000 A	36.0 kA	
UCC	800 A	13.4 kA	
	1200 A	13.4 kA	
	1600 A	16.6 kA	21 kA
	3600 A	30.0 kA	
	4500 A	36.0 kA	66 kA

[1] With an initial peak current of 2.5 times the rms value and without moving the contacts between the three applications.

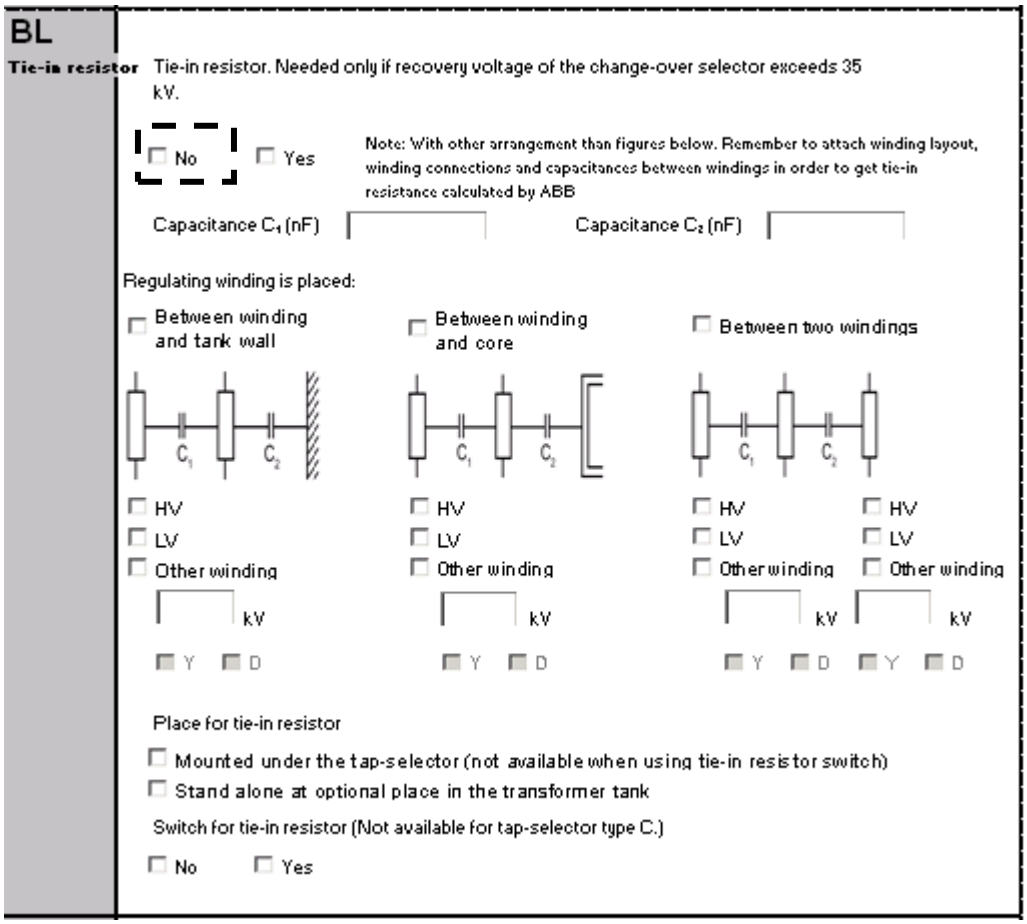
For short circuits under a longer time t_2 a calculation can be made to finding out the maximum current I_2 using:

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

I_1 and t_1 shall be taken from the table above.

$t_2 > t_1$

BL Tie-in resistor



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 35kV, a tie-in resistor is needed to reduce the recovery voltage.

Tie-in resistor switch
To reduce the losses in the tie-in resistor a switch can be connected in the circuit to the tie-in resistor. The switch only connects the tie-in resistor during the switching operation of the tap-changer change-over selector.
Tie in resistor switch is not available for tap-selector C.
(The losses in the tie-in resistor, without a switch, is generated as the tie-in resistor is connected between the middle of the regulating winding and the moving arm in the tap-selector. This will create a current in the tie-in resistor except for when the arm is placed in the middle of the regulating winding.)

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

BN Surface treatment	Note: Environmental class C3 according to ISO/DIS 12944 for color Munsell 5.5B 5.5/1.25

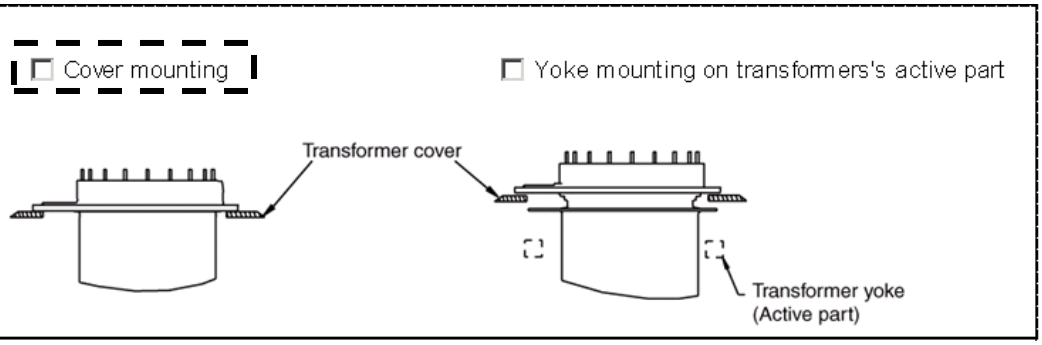
- Guide to environmental class

Category and corrosivity	**Example of typical environments in a temperate climate.** Normal font outdoor *Italic font, indoor.*
C3 Medium	Atmosphere with low salinity or moderate pollution. Urban and lightly industrialised areas. Areas with some coastal influence. *Spaces with moderate condensation frequency and some pollution from production processes, e.g. food processing plants, breweries, dairies, and laundries.*

Munsell 5.5B5.5/1.25 is gray blue.

Other colour or painting system will prolong the delivery time and increase the price.

BO Top section

BO Top section	

- Cover mounting need the cover as support all the time.
- Yoke mounting is supported by the active part during process, but shall then be supported by the cover in service.

BT Supervision devices

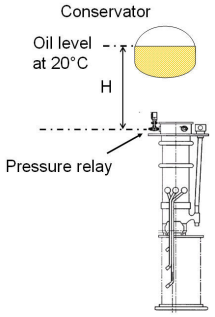
BT
Supervisory devices

Vertical distance H between the pressure relay/pressure relief device and the oil level in the conservator ____ m

Note: One-way breather influence the set point level on our safety devices.
Add theoretically 4m to real distance H if one-way breather is used.

Pressure relay	☐ No	☐ Yes, double contacts	
Oil flow relay	☐ No	☐ Yes	Note: Pressure relay and/or oil flow relay must be choosen.
Pressure relief device	☐ No		
	Yes, 130 mm	☐ Single contact	☐ Double contacts
	Yes, 50 mm	☐ Single contact	☐ Double contacts
Temperature switch	☐ No		
	☐ Temperature switch +115 degrees C		
	☐ Temperature switch +105 degrees C		
	☐ Temperature switch -25 degrees C		
	☐ Temperature switch -40 degrees C		
Prepared for TEC (Pt100)	☐ No	☐ Yes	

- For the distance H everything refers to the tap-changer, 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 a 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 diverter switch housing. TEC (Transformer Electronic Control) is ABB's monitoring & diagnostic and control system for transformers and tap-changers.

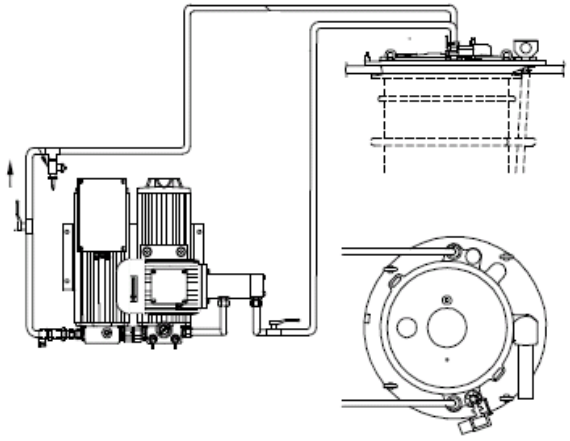
BU Oil filter unit

BU Oil filter unit

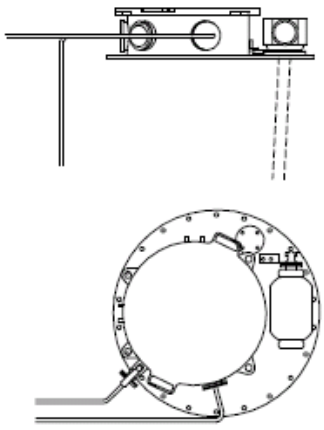
☐ No ☐ Yes Note: Not in combination with temperature switch

Voltage for motor:

- ☐ 3~ 50 Hz 220-250 V
- ☐ 3~ 50 Hz 380-433 V
- ☐ 3~ 50 Hz 500 V
- ☐ 3~ 60 Hz 208-277 V
- ☐ 3~ 60 Hz 360-480 V
- ☐ 1~ 50/60 Hz 110-127 V
- ☐ 1~ 50/60 Hz 220-240 V



Oil filter connection on UCC and UCD



Oil filter connection on UCG and UCL

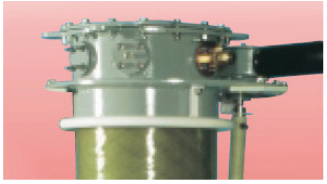
BX Drain valve

BX Drain valve

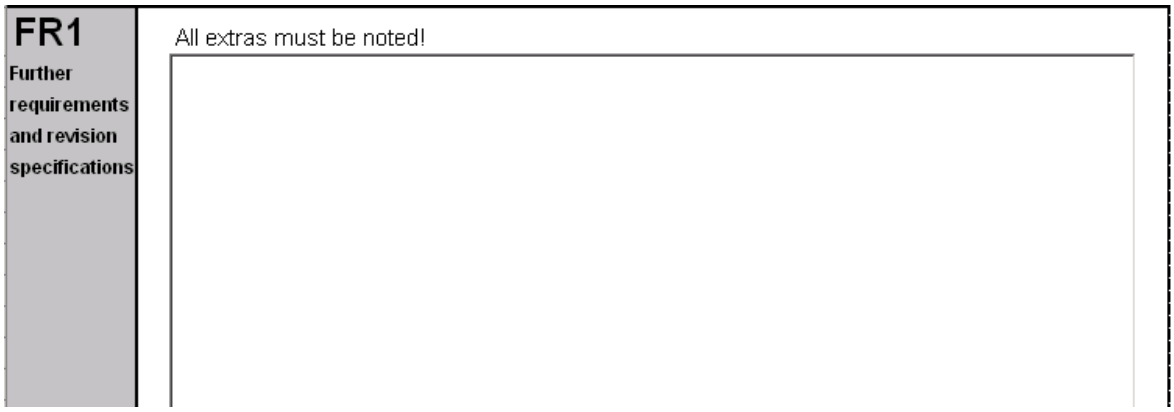
- ☐ No, only cover
- ☐ Yes, R1" inside thread
- ☐ Yes, R1" outside thread
- ☐ Yes, NPT1" inside thread
- ☐ Yes, with flange for oil filter unit (see technical guide)

R1" is the same as G1".

The tap-changer is as standard equipped with covers on the diverter switch housing. These covers can be replaced with valves or flanges for oil filters for instance.



FR1 Further requirements and revision specification



Extras will have an additional cost and in many cases prolonged delivery time. One option is the possibility to prolong the time between service, see “Use of tap-changer beyond 500 000 operations” information 5492 0031-102.