



1ZSC000562-AAF en, Rev. 1

# Oil filter unit for on-load tap-changers Manual

### Original instruction

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The information provided in this document is intended to be general and does not cover all possible applications. Any specific application not covered should be referred directly to ABB, or its authorized representative.

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**Manufacturer: CC Jensen A/S, Svendborg, Denmark**

### Recommended practices

ABB recommends careful consideration of the following factors when installing on-load tap-changers:

Before you install or commission a unit, make sure that the personnel doing the job have read and fully understood the installation and commissioning guide provided with the unit.

To avoid damaging the unit, never exceed the operating limits stated in delivery documents and on rating plates.

Do not alter or modify a unit without first consulting ABB.

Follow local and international wiring regulations at all times.

Use only factory authorized replacement parts and procedures.

### Safety warnings

The following warnings and notes are used in the manual:



#### WARNING

WARNING indicates an imminently hazardous situation, which if not avoided will result in death or serious injury. This signal word is to be limited to the most extreme situations.

WARNING also indicates a potentially hazardous situation, which if not avoided could result in death or serious injury.



#### CAUTION

CAUTION indicates a potentially hazardous situation, which if not avoided may result in minor or moderate injury. It may also be used to alert of unsafe practices.

CAUTION may also indicate property-damage-only hazards.



INFO provides additional information to assist in carrying out the work described and to provide trouble-free operation.

### Safety precautions



#### WARNING

Almost all types of oil are potential threats to the environment and as such they should not be drained into ordinary sewers and "dumped" in nature. Always check that all oil carrying components are sealed and tight before operating the oil filter unit.



#### WARNING

Be aware that oil spillage on the floor around the filter unit is a safety risk!



#### WARNING

Used filter elements very often contain harmful substances separated from the oil. Always pack and seal used elements thoroughly until they can be disposed of in accordance with local regulations.



#### WARNING

Switch off the electrical power supply to the filter unit when carrying out maintenance, and especially before opening the terminal box of the electric motor and the terminal box of the pressure switch.



#### WARNING

The oil filter unit may be hot. Be careful!



#### CAUTION

Do not expose the filter unit to ambient temperatures higher than 60 °C (140 °F) as this may harm electrical wires, hoses and other rubber or synthetic components!



#### CAUTION

The fluid temperature inside the filter unit must never exceed 110 °C (230 °F). Higher fluid temperatures may cause damage to the seals and packings on and in the filter unit.

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# 1 General information

## 1.1 Advantages with an oil filter unit

All on-load tap-changers manufactured by ABB are designed and tested for service in transformer oil without any kind of filtration. Filtration of the oil is necessary only when normal maintenance is carried out.

However, some advantages can be derived by using an oil filter unit. When the on-load tap-changer is working under onerous conditions such as high switching frequency, especially under full load, overloads, etc a lot of dirt is generated in the oil with an increase in mechanical wear as a consequence. An oil filter unit removes this dirt and the mechanical wear is considerably reduced. This is of special importance, for instance in furnace transformers.

The clean oil which is the result of the filtration, on the assumption that the filter insert is in good condition, will also keep the insulation withstand level of the oil very high which gives a large safety margin against flashovers. This might be especially important when the on-load tap-changer is installed in the line end in high voltage networks.

The oil filter unit allows continuous service of the transformer during filtration. The wiring diagrams in figures 2a-2c show the wiring for the oil filter unit.

The oil filter unit and the filter insert are delivered by ABB. The on-load tap-changer is also prepared for connection to the oil filter unit. All electrical equipment is installed in a separate connection box. The tubes for connection between the oil filter unit and the on-load tap-changer are not delivered by ABB.

This manual gives information for one oil filter unit. In case of two or more units on the same transformer, all procedures are the same for each one of the units.

## 1.2 The oil filter unit

See Fig. 1.

The filter unit consists of a filter base, a filter housing, a sampling valve, a motor and a pump.

A drain valve for draining the housing during filter insert replacement, is mounted on the filter base. The oil pump is also mounted on the filter base. The pump is of the gear type.

A sample valve and the motor are mounted on the pump housing. There is also a pressure switch, which gives a signal when the pressure drop over the filter is such that a filter insert replacement is necessary.

The filter housing is also mounted on the filter base. At delivery, it contains no filter insert. It must be installed before the first start. A vent screw and a pressure gauge are mounted on the housing.

The inlet connection thread is on the pump housing and the outlet connection thread is on the filter base.

## 1.3 Electrical equipment

See Fig. 2.

The oil filter unit needs a power supply to the motor. The pressure switch has three connections which are connected to the terminals in the electric connection box. A motor protective switch with a trip coil for the oil filter unit motor is also placed in the connection box. The motor protective switch has a status indication contact which shows if the motor circuit breaker is off. It is recommended to connect the "low level contact" signal from the oil level indicator on the conservator, so it trips the motor protective switch by the trip coil. Since the oil filter is working continuously, no other electrical components are necessary.

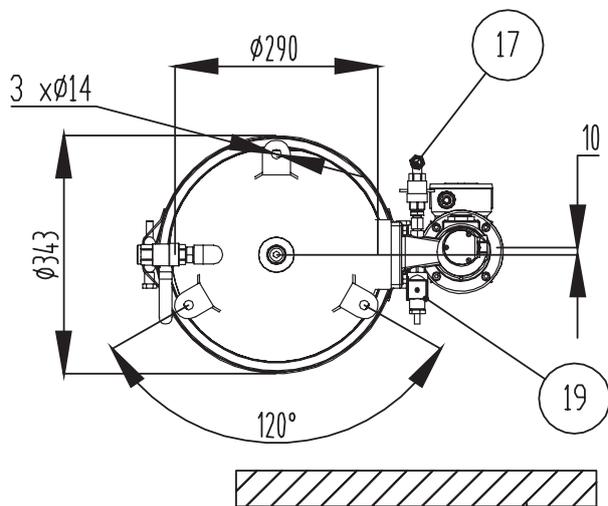
## 1.4 Oil filter circuit

See Fig. 3.

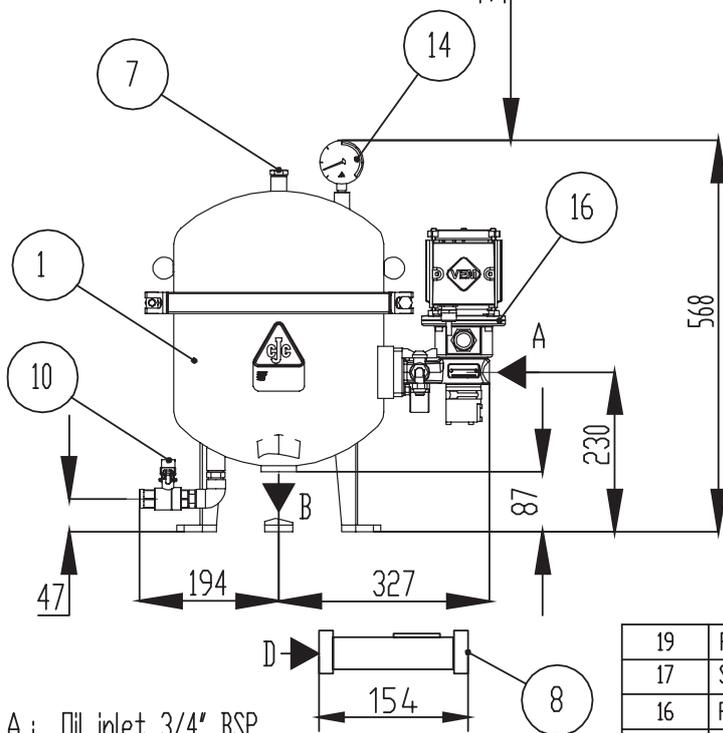
The inlet tube should have a valve close to the oil filter unit to make it possible to shut off the oil flow in case of filter insert replacement, repair work, etc.

The outlet tube on the UC types of on-load tap-changers is connected to the free flange on the head of the on-load tap-changer. Dimensions according to Fig. 4. The position of this free flange may vary, depending on where the pressure-relay and the tube to the conservator are connected.

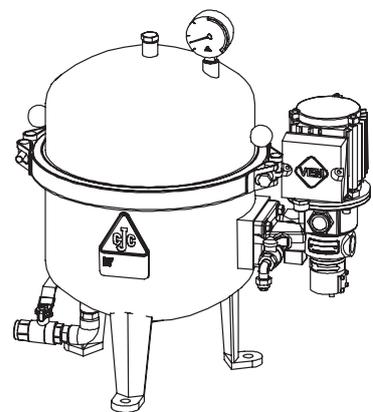
In the outlet tube, immediately after the oil filter unit, a valve should be connected as in the inlet tube.



Free height for filter insert replacement



A : Oil inlet 3/4" BSP  
 B : Oil outlet 3/4" BSP  
 D : Both ends G 1/2" Female



Dimension drawing: Sheet 1  
 Connection diagram: Sheet 2  
 Pipe connection: Sheet 3

19	Pressure switch	1
17	Sampling point	1
16	Pump/motor assembly	1
14	Pressure gauge	1
10	Drain valve 1/2" BSP	1
8	Oil-flow switch G 1/2"	1
7	Air vent 1/4" BSP	1
1	Filter housing	1
Pos.	Article	Qty.

Fig. 1. Oil filter unit.

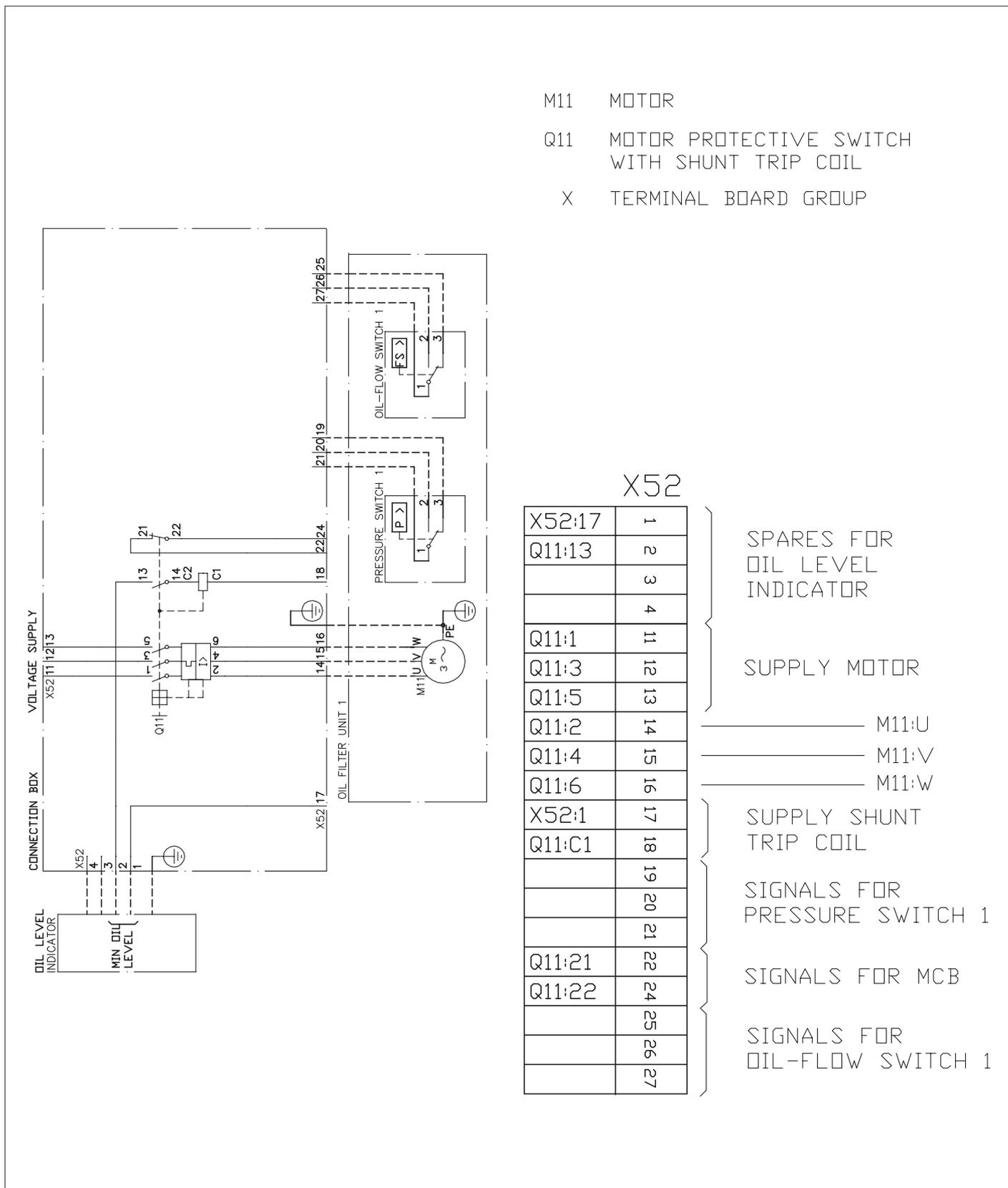
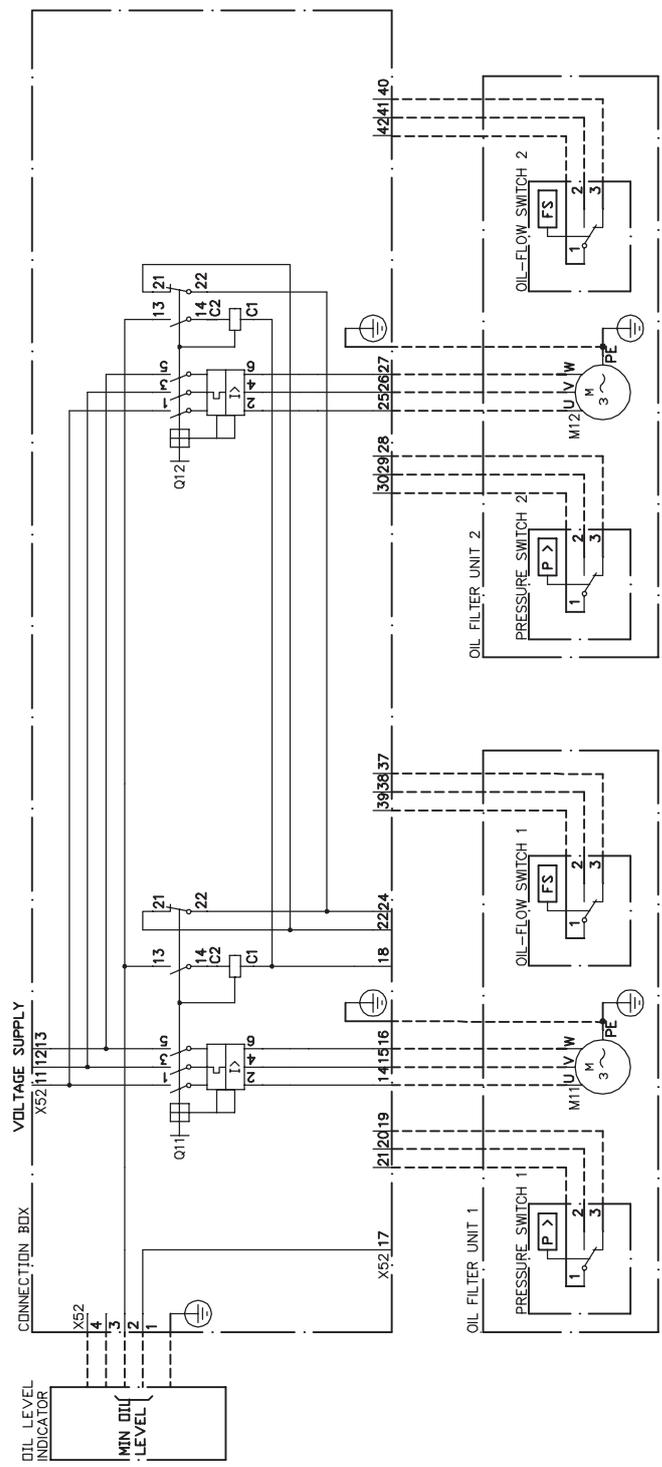


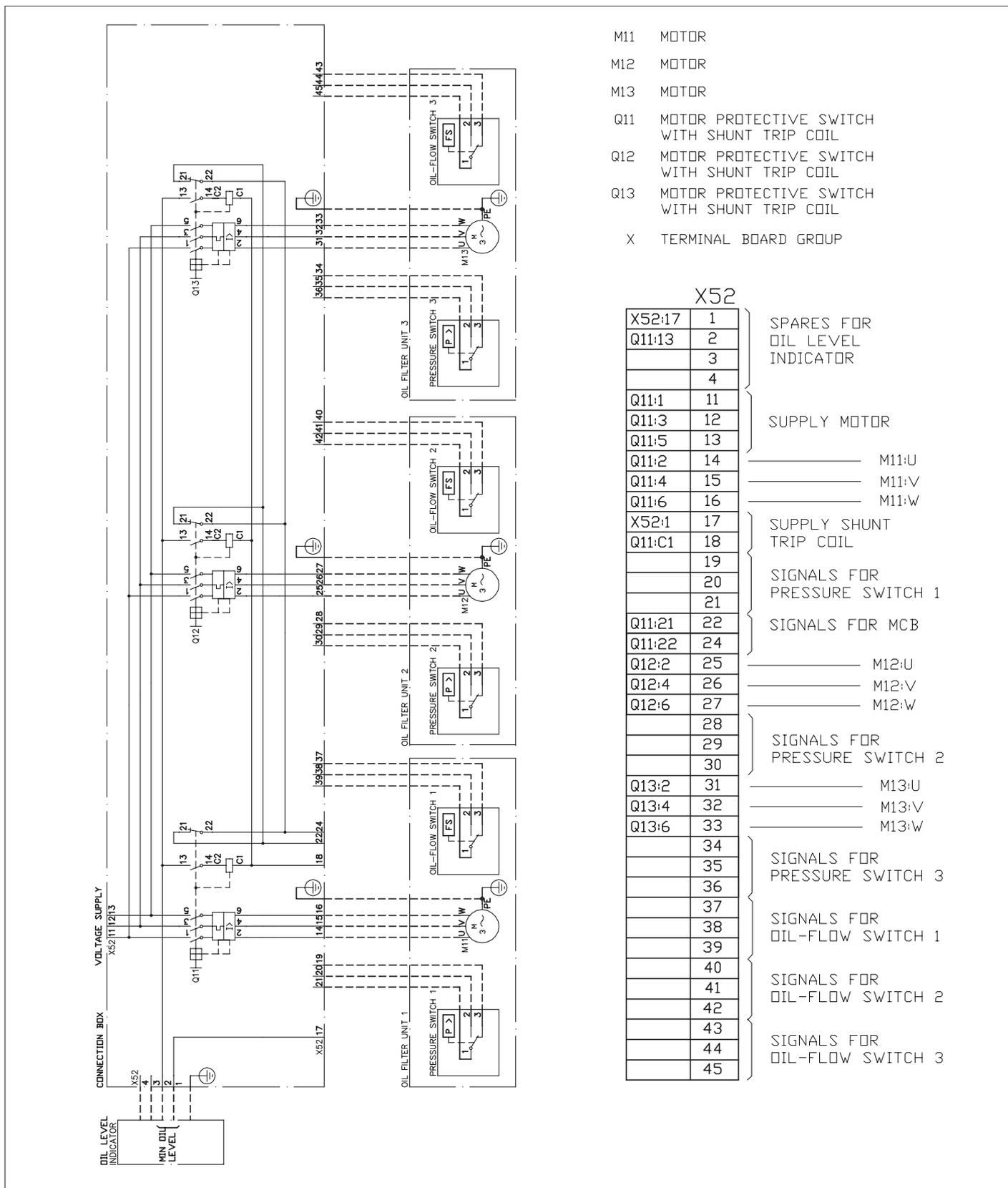
Fig. 2a. Circuit diagram for one oil filter unit.



- M11 MOTOR
- M12 MOTOR
- Q11 MOTOR PROTECTIVE SWITCH WITH SHUNT TRIP COIL
- Q12 MOTOR PROTECTIVE SWITCH WITH SHUNT TRIP COIL
- X TERMINAL BOARD GROUP

X52		
X52:17	1	SPARES FOR OIL LEVEL INDICATOR
Q11:13	2	
	3	
	4	
Q11:1	11	SUPPLY MOTOR
Q11:3	12	
Q11:5	13	
Q11:2	14	M11:U
Q11:4	15	M11:V
Q11:6	16	M11:W
X52:1	17	SUPPLY SHUNT TRIP COIL
Q11:C1	18	
	19	SIGNALS FOR PRESSURE SWITCH 1
	20	
	21	SIGNALS FOR MCB
Q11:21	22	
Q11:22	24	
Q12:2	25	M12:U
Q12:4	26	M12:V
Q12:6	27	M12:W
	28	SIGNALS FOR PRESSURE SWITCH 2
	29	
	30	
	37	SIGNALS FOR OIL-FLOW SWITCH 1
	38	
	39	SIGNALS FOR OIL-FLOW SWITCH 2
	40	
	41	
	42	

Fig. 2b. Circuit diagram for two oil filter units.



- M11 MOTOR
- M12 MOTOR
- M13 MOTOR
- Q11 MOTOR PROTECTIVE SWITCH WITH SHUNT TRIP COIL
- Q12 MOTOR PROTECTIVE SWITCH WITH SHUNT TRIP COIL
- Q13 MOTOR PROTECTIVE SWITCH WITH SHUNT TRIP COIL
- X TERMINAL BOARD GROUP

X52			
X52:17	1	SPARES FOR OIL LEVEL INDICATOR	
Q11:13	2		
	3		
	4		
Q11:1	11	SUPPLY MOTOR	
Q11:3	12		
Q11:5	13		
Q11:2	14		M11:U
Q11:4	15		M11:V
Q11:6	16		M11:W
X52:1	17	SUPPLY SHUNT TRIP COIL	
Q11:C1	18	SIGNALS FOR PRESSURE SWITCH 1	
	19		
	20		
	21	SIGNALS FOR MCB	
Q11:21	22		
Q11:22	24		
Q12:2	25	M12:U	
Q12:4	26	M12:V	
Q12:6	27	M12:W	
	28	SIGNALS FOR PRESSURE SWITCH 2	
	29		
	30		
Q13:2	31	M13:U	
Q13:4	32	M13:V	
Q13:6	33	M13:W	
	34	SIGNALS FOR PRESSURE SWITCH 3	
	35		
	36		
	37	SIGNALS FOR OIL-FLOW SWITCH 1	
	38		
	39		
	40	SIGNALS FOR OIL-FLOW SWITCH 2	
	41		
	42		
	43	SIGNALS FOR OIL-FLOW SWITCH 3	
	44		
	45		

Fig. 2c. Circuit diagram for three oil filter units.

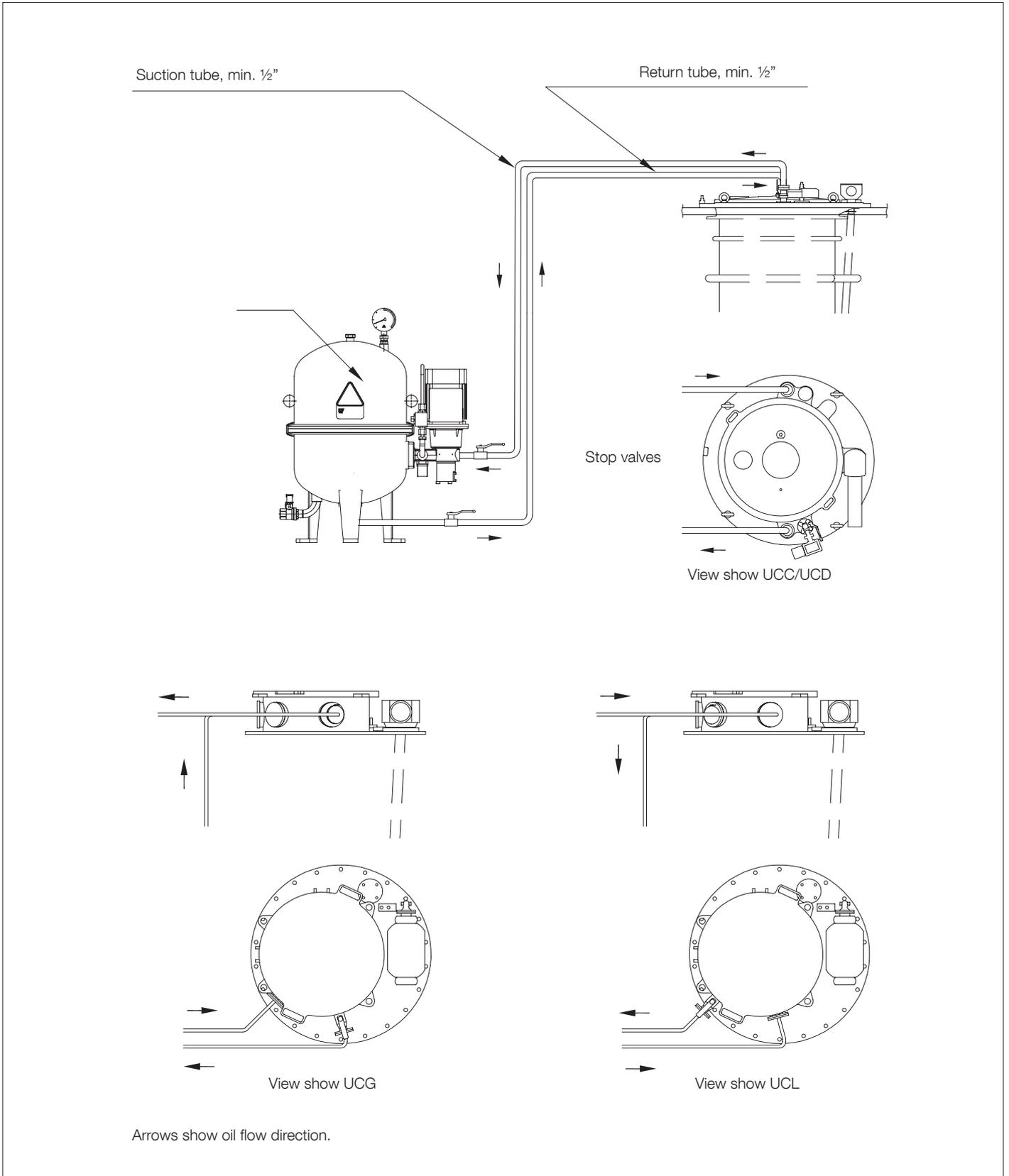


Fig. 3. On-load tap-changer type UC with oil filter unit.

### 1.5 Continuous oil filtration

The best filtration result is achieved if the filtration is proceeding continuously without interruptions. This method requires also very little control equipment. The necessary components are placed in a separate connection box.

The maximum power needed is approximately 150 W per unit. The average power needed during a life cycle of the filter insert is considerably lower.

### 1.6 Filtration medium

The oil filter unit should only be used for filtering transformer oil according to IEC 60296. For other media, please consult ABB.

### 1.7 Service temperature

The ambient temperature may vary between -40 °C and +60 °C (-40 °F and +140 °F). Normal operating range for the filtrated oil is from 0 °C to +110 °C (+32 °F to +230 °F). An oil filter unit with a new filter insert can be started with an oil temperature down to -25 °C (-13 °F) without any problem.

If the filter insert has been in service for a while and a pressure drop has been built up, the pressure switch may give alarm when starting at low oil temperatures. This can be avoided by letting the transformer oil be warmed up to at least 0 °C (32 °F) before the oil filter unit is switched on. The pressure switch will trip until the warm oil from the on-load tap-changer has come into the oil filter unit.

If the pressure switch is still tripped after half an hour, wait until the transformer oil has become even warmer and then start again.

If the transformer is subjected to many starts in very low temperatures (e.g. spare transformers), make sure that the filter insert is changed frequently.

If the service conditions are such that the ambient temperature is very low (often and during long periods below -10 °C (14 °F)), the oil temperature of the transformer is low and the inlet tube is long (>3 m), the inlet tube should be insulated.

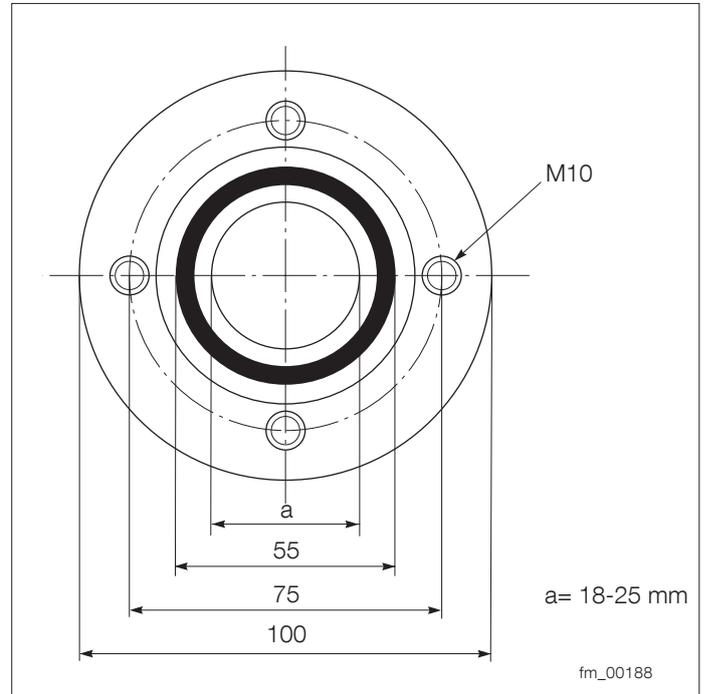


Fig. 4.

### 1.8 Filter insert replacement interval

At service on a HVDC network on-load tap-changer with a switching frequency of up to 100 operations a day as an average, the filter insert is replaced every year, provided that the pressure drop has not exceeded 2.0 bar and the breathing devices of the on-load tap-changer have worked properly.

The filter insert should be replaced when the pressure drop exceeds 2.0 bar or latest when the pressure switch trips.

If the breathing devices of the on-load tap-changer have failed, enough water may have entered the on-load tap-changer to saturate the filter insert. In such case, replace the filter insert.

The pressure drop should be read when the on-load tap-changer is judged to be at normal service temperature.

### 1.9 Leakage in the oil filter unit circuit

There is always a risk of leakage in an outer oil circuit, with a too low oil level in the housing as a result. This risk is reduced by using an oil level indicator with an alarm contact for low level on the conservator. The signal is used to give alarm in the control room, and to trip the motor protective switch of the oil filter unit by activating the trip coil. See the wiring diagrams in figure 2.

### 1.10 Oil level in the on-load tap-changer

**i** When filling oil into an on-load tap-changer with an oil filter unit, fill approximately 20 l oil in excess into the conservator to avoid refilling afterwards!

### 1.11 Ordering data

When ordering an oil filter unit, the motor voltage and the voltage for the trip coil of the motor circuit breaker must be given.

### 1.12 Spare parts

**i** Avoid ordering spare filter inserts until they are needed. They can not be stored for more than one year without reduced water removing capacity. See also chapter 7.

### 1.13 Technical specification

Motor:	Type: 3-phase, squirrel-cage without cooling fan. Voltage: as ordered by the customer Speed: 1370-1660 rpm Protection class: IP55
Oil pump:	Flow rate: 100-200 l/h Over-pressure valve: Opening pressure 2.8 bar
Filter insert:	Type: BNK 27/27 Material: Cellulose Filtering grade: 3 µm absolute Specially dried for water absorption. Typically pressure drop at 20 °C temperature, new filter insert: <0.5 bar Max. storage time: 12 months, with undamaged package.
Pressure switch:	Adjusted value: 2.3 bar Max. voltage: 230 V Max. current: Res. load 5 A Ind. load 3 A Protection class: IP65
Noise:	<70 dB(A)
Connecting tubes:	Min. ½"
Connections:	G ¾" female
Surface protection:	The oil filter housing is of stainless steel, and the pump and the motor are painted to withstand corrosion category C4 according to ISO/DIS 12944-2
Colour:	Pump and motor: RAL 7032 (stone grey) Filter housing: Stainless steel

## 2 Installation

### 2.1 General

The oil filter unit should be mounted at ground level in order to enable maintenance and repair work without de-energizing the transformer.

Fig. 3 show the valves that are recommended to use in the oil circuit.

A special bracket plate has to be placed on the transformer. Dimensions for fixing screw joint, see figure 1.

For the UC types of tap-changers up to three units can be mounted, one for each OLTC.

### 2.2 Tools

- Normal set of handtools
- Small pipewrench

### 2.3 Material

- A small vessel (oil resistant)
- Cleaning paper

### 2.4 Weight

Approximately 30 kg

### 2.5 Receiving

#### 2.5.1 Unpacking

Check that the package is undamaged.

#### 2.5.2 Inspection on receipt

1. Check that the oil filter unit, the pressure gauge and the pressure switch are undamaged.
2. If transport damage is found, and it is judged that correct operation of the oil filter unit is not possible, a damage report should be sent to the insurance company. It is also recommended that photographs are taken of the damaged details. Mark the photos with ABB's reference number and the serial number of the oil filter unit, and send them to ABB for comments.

#### 2.5.3 Temporary storage before assembly

If the oil filter unit is not to be assembled immediately once the delivery has been approved, keep the oil filter unit and the oil filter insert in the delivery package.

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### CAUTION

The package of the filter insert must not be opened!  
The special package ensures maintained water absorption capacity of the filter insert.

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### 2.6 Mounting

Mounting may be carried out after mounting of the on-load tap-changer in the transformer factory or at commissioning on site.

#### 2.6.1 Plumbing

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### CAUTION

Do not open the filter insert package at this stage!

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### CAUTION

If the inlet and outlet pipes from the oil filter are mixed up, i.e. connected to wrong part, the filtration will be poor and, in worst case, a flashover may occur in the on-load tap-changer.

---

Start by mounting the oil filter unit to a bracket plate on the transformer. Manufacture an inlet tube and an outlet tube as recommended in Fig. 3, depending on which type of on-load tap-changer the filter is to be connected to. Dimensions of connecting flanges, see section 1.4 or the dimension drawing delivered with the on-load tap-changer.

The connection points are shown in Fig. 3. UCG and UCL have vertical flanges and UCC has horizontal flanges. Connect the inlet tube to the valve with flange. The outlet tube from the oil filter unit is connected to any of the free flanges.

Try to keep the tubes as short and with as few joints as possible. If the tubes are longer than 5 metres, increase the tube diameter to ¾".

If the transformer should operate on sites where the temperature frequently falls below -10 °C (+14 °F), it is recommended to insulate the inlet tube.

Make sure that all seals are in place before connecting the flanges.



The pump and filter is equipped with a ¾" BSP cylindrical thread. Tapered threads must not be used!

---

### 2.6.2 Electrical connection

Connect the motor supply and the pressure switch as shown in the wiring diagram in Fig. 2.



#### **WARNING**

Make sure that the voltage is properly switched off before starting wiring work!

---

It is also recommended to use an oil level indicator with a contact for low oil level in the conservator, and connect it so a trip from that contact will switch off the motor protective switch for the oil filter unit, and give an alarm in the control room.

Make sure that the motor has the correct rotation direction by comparing the rotation direction of the magnetic coupling half with the arrow on the coupling bell house. The magnetic coupling can be viewed through the sight glass on the bell house.



#### **CAUTION**

If the rotation direction is wrong, there will be no oil circulation and no filtration. The pump will be warm and might be damaged.

---

## 3 Commissioning

When the on-load tap-changer is filled with oil and all the plumbing and the wiring are done, the oil filter unit can be started.



### CAUTION

If the oil filter unit is to be dismantled from the transformer during transportation, do not mount the filter insert. In case of dismantling, the oil has to be drained from the oil filter unit and air to be let in. The moisture in the air will reduce the water absorption capacity of the filter insert.

---

Make sure that all valves are shut. See Fig. 5. Unscrew the clamp ring (8) and lift off the housing (1). Unscrew the top nut (12) and remove the spring (11) and the spring guide (3).

Unpack the filter inset. Check that all the O-rings look good and are correctly placed in their slots (4 and 5). Check that the usit ring (6) under the vent screw (7) is looking good and is correctly placed.

Put the filter inset (9) in place on the filter base (2). Before pressing the spring guide (3) in place, check that the O-ring (4) is correctly placed.



### CAUTION

Take care not to damage the O-ring (4) on the thread of the stay bolt during assembly.

---

When the spring guide (3) and the spring (11) have been placed, tighten the top nut (12) until it touches the spring guide disc (3), and then an additional 4 turns with a spanner, making the inset settle.

Refit the housing, tighten the clamp ring (8) with 20 Nm and the filter is ready to be started.



### CAUTION

Do not carry out the filter insert mounting during rain without covering the oil filter unit. Also avoid mounting during foggy weather.

---

Shut the filter draining valve (10) and open the other valves in the inlet and outlet tubes. Open the vent screw (7) on top of the filter housing. Start the pump.

Close the vent screw (7) as soon as oil appears under it (it will take about 15 minutes). If necessary, fill up the conservator to normal level.

Vent the filter housing again after approximately one hour in service.



### CAUTION

Do not carry out the filter insert mounting during rain without covering the oil filter unit. Also avoid mounting during foggy weather.

---

Look for leakages when there is an oil pressure in the filter housing. No leakages are allowed.

Make a final check of the rotation direction of the motor by closing the valve on the outlet tube slowly. The pressure gauge should show increasing pressure. If it is possible to shut the valve without pressure increase, the motor rotates in the wrong direction. Change direction by changing place of two supply wires.



### WARNING

Make sure that the voltage is properly switched off before starting wiring work!

---

Open the oil valve fully afterwards.

Then switch on the voltage and make a new check of the rotation direction of the motor. When the motor has been checked to rotate in the right direction and the filter housing has been vented a second time as previously described and no leakages are observed, the oil filter unit will now operate without inspection.

Table 1. Filter details HPS 27/27, 54.

No.	Object
1	Filter housing 27/27
2	Filter housing 27/54
3	Spring guide
4	O-ring
5	O-ring
6	Usit ring
7	Air screw
8	Clamp ring
9	Filter insert
10	Drain valve
11	Spring
12	Top nut
13	Label
14	Pressure gauge
15	Sight glass
16	Motor and pump

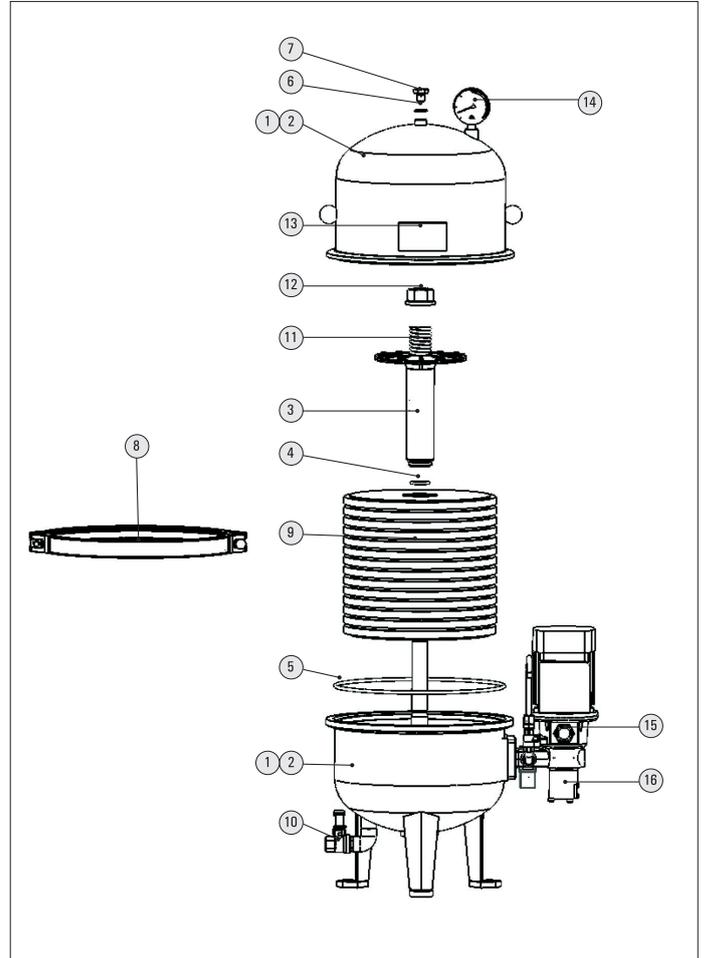


Fig. 5. Filter details HPS 27/27, 54.

## 4 Transportation

The oil filter unit may be transported mounted on the transformer, provided that it is properly fixed.

If the unit should be dismantled before transportation, proceed as follows:

Prepare the on-load tap-changer as stated in the applicable guide. The oil level should be lowered in the UC on-load tap-changers.

If the unit has been oil filled, drain as follows:

Shut all valves. Put a bucket under the drain valve (10) and open it and the vent screw (7). Drain all oil from the filter housing (1 and 2). The bucket may be emptied before the draining is completed.

Close the drain tap (10) and the vent screw (7).

Dismount the tubes. Keep the O-rings, the nuts, and the washers. Prefer to use the plastic plugs delivered with the oil filter unit in the connection threads.



### CAUTION

Oil will pour out from the tubes when they are loosened. Prepare for taking care of that oil!

---



The sealing in the flange of the on-load tap-changer work with "rubber excess" which makes the O-rings looking somewhat damaged, but they can be reused provided that they are left in their positions or refitted in the same position as they had earlier.

---

Mount the cover on the return flange of the on-load tap-changer. Mount a cover on the flange for the inlet tube on the on-load tap-changer.

Remove all wirings.



### WARNING

Make sure that the voltage is properly switched off before starting wiring work!

---

The oil filter is transported in its delivery package which can be reused.

Remounting at site is done by using appropriate parts according to section 2.6.

# 5 Maintenance

The oil filter unit is maintained during inspection of the on-load tap-changer and during the normal maintenance of the on-load tap-changer.

The maintenance needed is replacement of the filter insert when necessary and replacement of the pump motor unit every 5th year.

## 5.1 Tools

- Adjustable spanner

## 5.2 Material

- Spare filter insert

For ordering, see chapter 7 Spare parts list.

## 5.3 Inspection

During the inspection of the on-load tap-changer, the pressure gauge is read. Note the reading so the change from time to time can be seen.

If the pressure is 2.0 bar or more, or close to 2.0 bar, the filter insert should be replaced.

If moisture is suspected to have come into the on-load tap-changer compartment, the filter insert should be replaced.

Also check for leakages. All leakages should be repaired!

## 5.4 Maintenance

On-load tap-changers in service in HVDC networks are normally maintained every seventh year. The filter insert should be replaced every year even if the pressure drop is lower than 2.0 bar, if it has not been replaced sometime during the preceding year.

The filter insert must be replaced if moisture is suspected to have come into the on-load tap-changer compartment. If the pressure switch gives an alarm, the filter insert must be replaced at once.

### 5.4.1 Maintenance schedule

Component	12 months	5 years	10 years
Filter insert	Change		
Filter insert sealing set	Change		
Electric motor	Visual inspection	Replace pump/motor assembly	
Pump	Visual inspection		Replace pump/motor assembly
Magnetic coupling	Visual inspection		

## 5.5 Filter insert replacement

See Fig. 5.

Stop the pump by switching off the motor protective switch in the electric connection box. Close the valves in the inlet and outlet tubes. Untighten the vent screw (7) and drain the filter housing (1 and 2) by opening the bottom drain valve (10).

After drainage, unscrew the clamping ring (8) and lift off the filter housing. Unscrew the top nut (12) and remove the spring (11) and the spring guide (3). Lift up the filter insert.

When all inside parts have been cleaned and the O-rings (4 and 5) and the usit ring (6) have been replaced (they are delivered together with the spare filter), the new insert can be placed in the housing.



### CAUTION

Do not break the sealed package of the new filter insert until immediately before installation.



### CAUTION

All the sealing rings (4, 5 and 6) must be replaced with every filter change to guarantee the integrity of the filter.

Before pressing the spring guide (3) in place, check that the O-ring (4) is placed correctly in the slot.



### CAUTION

Take care not to damage the O-ring on the thread of the stay bolt during assembly.

When the spring guide (3) and the spring (11) have been placed, tighten the top nut (12) until it touches the spring guide disc (3) and then an additional 4 turns with a spanner, making the insert settle.

Refit the filter housing, tighten the clamping ring (8) with 20 Nm and the filter is ready to be restarted. Remember to close the bottom drain valve (10).

For restarting, follow the applicable parts of chapter 3 Commissioning.

# 6 Repair

The lifetime of the oil filter unit is long. However, after long time in service (approximately 10 years), the pump may be worn and needs to be replaced. The motor bearings may also be worn after long time in service (approximately 5 years) or the motor may be damaged due to over-voltages.

The pump/motor assembly is delivered as one unit. The pump/motor is corrosion protected as a unit and it is recommended that it is replaced as such. No warranty will be given if the motor or pump is replaced separately.

## 6.1 Replacement of pump/motor unit

See Fig. 6. For ordering, see chapter 7 Spare parts list.

### 6.1.1 Tools

- Normal set of handtools

### 6.1.2 Material

- Pump/motor assembly
- O-ring (18)
- Sealing tape or sealing fluid
- Bucket (oil resistant)

### 6.1.3 Dismounting

1. Switch off the oil filter unit. Close the valves in the tubes on both sides of the oil filter unit. Disconnect the electrical power supply cable in the terminal box of the motor.
2. Disconnect the electrical connection plug from the pressure switch by unscrewing the center screw and lift off the connection plug.

### WARNING

Make sure that the voltage is properly switched off before starting wiring work!

 Note the phase sequence to get the right rotation direction after reconnection.

3. Open the vent screw (7) and put a bucket under the drain valve (10) and open it. Drain the filter housing completely.
4. Close the drain valve (10).
5. Disconnect the coupling of the inlet tube.
6. Unscrew the four nuts in the filter housing/pump flange assembly. Take care of the nuts and the washers.
7. Lift off the pump/motor unit (16).
8. Unscrew the sampling valve (17) from the pump housing.
9. Unscrew the pressure switch (19) from the pump housing.

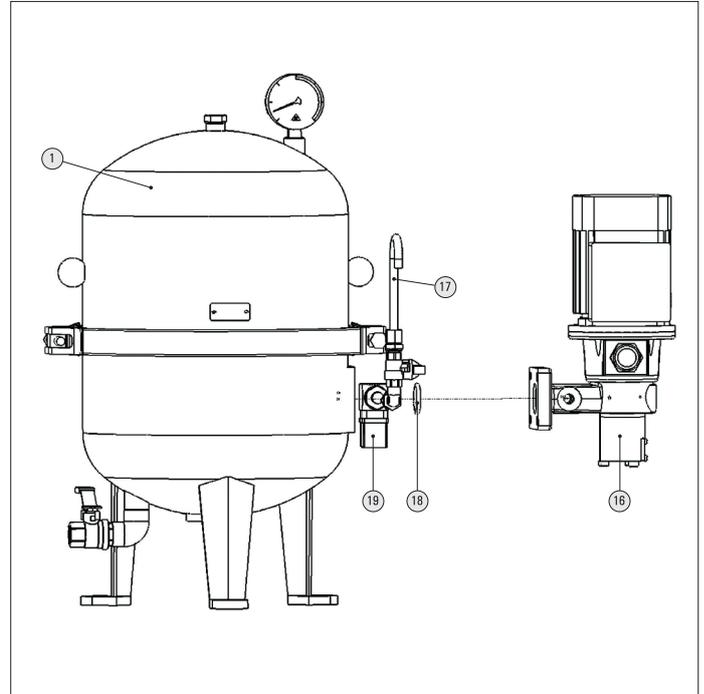


Fig. 6. Filter details HPS 27/27, 54.

Table 2. Filter details HPS 27/27, 54.

No.	Object
1	Filter housing
16	Pump
17	Sampling valve
18	O-ring
19	Pressure switch, set-point 2.3 bar

### 6.1.4 Remounting

See Fig. 6.

1. Clean the threads of the sampling valve (17) and pressure switch (19). Apply new sealing fluid. Mount the sampling valve and the pressure switch on the new pump housing. Adjust them in the direction shown in Fig. 6.
2. Mount a new O-ring (18) between the pump flange and the filter base flange. Fit the pump/motor unit. Mount and tighten the nuts and washers. Reconnect the power supply cables to the terminal box of the motor as noted earlier. Tighten the cable bushing properly.
3. Remount the electrical connection plug to the pressure switch. Reconnect the inlet tube to the pump housing. Use sealing fluid as sealant.



#### WARNING

Make sure that the voltage is properly switched off before starting wiring work!

4. Make a quick start and stop of the motor and check the direction of rotation. The direction is shown with an arrow near the sight glass at the coupling bell house.



#### CAUTION

If the rotation direction is wrong, the cleaning of the oil will be poor, and in worst case, a flashover may occur in the on-load tap-changer.

5. If necessary, change the rotation direction by changing place of two phases.



#### WARNING

Make sure that the voltage is properly switched off before starting wiring work!

6. Open the oil valve in the the inlet tube and start the motor. As soon as oil comes out of the vent screw (7) (it takes about 10-15 minutes), close the vent screw and open the valve in the outlet tube. Vent the filter housing again after approximately one hour.
7. Make a final check of the rotation direction of the motor by closing the valve on the outlet tube slowly. The pressure gauge (14) should show increasing pressure. If not, change the rotation direction as earlier described, and check again.
8. Open the valve fully afterwards.
9. If necessary, fill the conservator with oil to the right level. For procedure, see the next section.

### 6.1.5 Filling up oil in the conservator

Switch off the oil filter unit by switching off the motor protective switch, located in the electric connection box.

Shut the oil valves in the inlet and outlet tubes and on the on-load tap-changer. Loosen the flange connection on the oil valve of the on-load tap-changer. Connect an oil pump to the flange, open the oil valve and pump in oil until the level of the conservator is right.

Shut the oil valve and remove the oil filling connection. Reconnect the inlet tube of the oil filter unit. Make sure that the O-ring is in place. Open the oil valves on the inlet and outlet tubes and on the on-load tap-changer and start the oil filter unit.

# 7 Spare parts

## 7.1 Introduction

This spare parts list has been compiled to help you with procurement of spares. To obtain trouble-free deliveries you should note a few things which are explained in the following text.

The breakdown level and general contents of this list have been worked out to cover normal customer requests. Our spares sales people will be happy to assist if you require any specific item that is not included in the list.

## 7.2 Oil filter unit serial number

The rating plate on the oil filter unit shows the serial number of the device you are ordering spares for. It is important to have this information, because the manufacture of parts gradually changes as materials and manufacturing technology improves.

ABB makes every effort to supply spares that should fit your requirements. Some parts of later manufacture than those you are replacing may need some adaptation to fit into your device. Our spare parts sales people need to know the serial number to supply exactly what you require.

## 7.3 Item number

Item numbers are shown in the drawings and in the lists.

## 7.4 Name of item

The name should be specified when ordering to make sure the right type of item is ordered.

## 7.5 Quantity

The figures given represent the number of items that are fitted to one oil filter unit.

## 7.6 Remarks

Information of the content and reference to Fig. 7.

## 7.7 General arrangement

The general arrangement of an oil filter unit is shown in Fig. 7.

## 7.8 Standard spare parts

Standard spare parts for the oil filter unit are filter insert, pump/motor assembly.

## 7.9 Special spare parts

If you need parts other than those in the list, our staff will be happy to assist you. Please use Fig. 7 as a reference when discussing your requirements. As usual, the serial number are essential for ordering.

## 7.10 Spare parts list

Item No.	Name of item	Quantity	Remarks
1	Filter housing 27/27	1	1ZSC002743-ABL
2	Filter housing 27/54	1	1ZSC002743-ABM
3	Spring guide	1	1ZSC002743-ABD
4	O-ring	1	1ZSC002743-ABJ
5	O-ring	1	1ZSC002743-ABK
6	Usit ring	1	1ZSC002743-ABH
7	Air screw	1	1ZSC002743-ABF
8	Clamp ring	1	1ZSC002743-ABE
9	Filter insert, including gaskets	1	1ZSC002743-ABG
10	Drain valve	1	1ZSC002743-ABN
11	Spring	1	1ZSC002743-ABC
12	Nut for spring guide	1	1ZSC002743-ABB
14	Pressure gauge	1	1ZSC002743-ABA
15	Sight glass	1	1ZSC002743-ABP
16	Motor and pump, including gaskets	1	1ZSC002743-AAL
17	Sampling valve	1	1ZSC002743-ABT
19	Pressure switch	1	1ZSC002743-AAZ
20	Flow switch	1	1ZSC002743-ABR

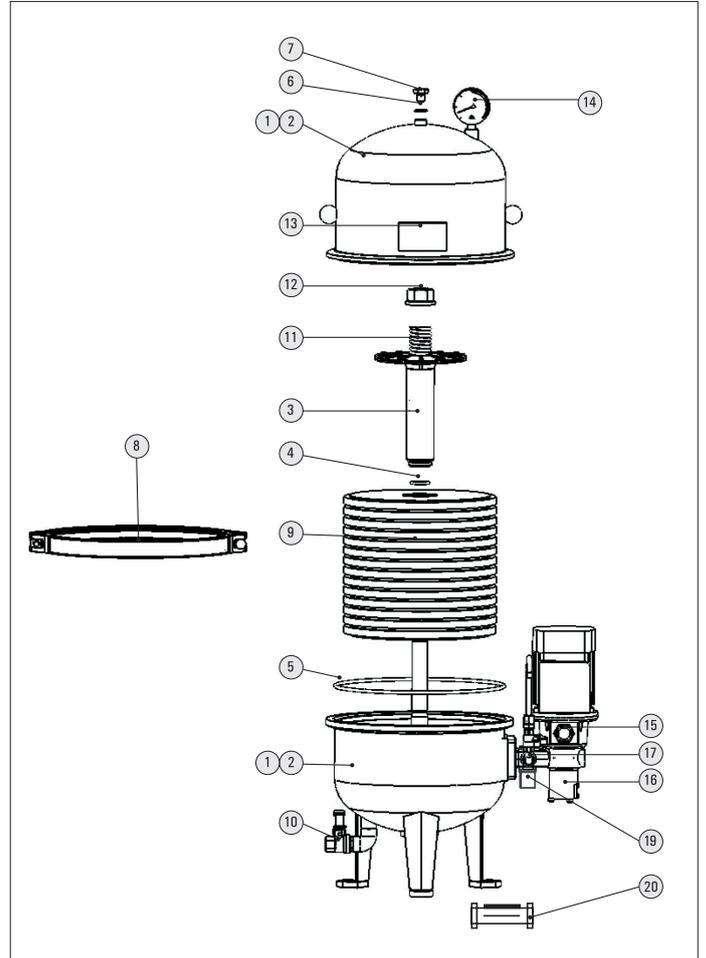


Fig. 7. Spare parts for oil filter unit HPS 27/27, 54.

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