

Oil Filter Unit – Separator S-03



**For
continuous, on load, dehydration and filtration of
Tap Changers of main Transformers.
Operating Manual & Parts List**

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Table of Contents:

1. Technical Specifications	page	3
2. Function	”	4
2.1. Description.	”	4
2.2. System Diagramme and Spare Parts List	”	6
2.3 Electrical Circuit	”	5
3. Installation	”	7
3.1. General instructions,	”	7
4. Commissioning	”	8
4.1. Inserting and changing the filter cartridge	”	8
4.2. Evacuating of S-03	”	9
4.3. Check of the function	”	10
4.4. Refilling of the tap-changer	”	10

1. Technical Specifications

Motor:	3-Phase Squirrel cage motor
	Performance: 0.18 kW
	Voltage: 3x400V, 50Hz (or by request)
	RPM: 1350 1/min.
	Protection: IP65 (hermetically sealed version)
Pump:	Gear pump (Monoblock version)
	Hydraulic performance max : 250l /Hr.
Safety pressure valve	Opening pressure, adjustable : 3b
Filter inserts	Cellulose (dried to 0.2% hm)
	Filtration fineness: 3µm
	Pressure drop at 20°C – new insert < 0.2 bar (0.3 bar)
Control of pressure drop	Gauge
Operating noise level	< 65 dB(A)
Connections	3/8"Hose or 1/2" hard tubing,
Dimensions - Filter unit	L 885 x W 220 x H 275
- Control panel	L 350 x W 200 x H 120
Weights – Filter unit	38 kg – without oil filling
Surface treatment	all-stainless

2. Function

2.1 Description

The filter unit S-03 is designed for the continual operation for the filtration and drying of Insulation oils in Tap Changers and Load Selectors of main transformers under normal operational conditions.

Diluted water as well as mechanical particles are bound into the large volume filter insert during the operation.

- The primary aim of the S-03 is to maintain the required level of dielectric strength of insulation (switching) oil as well as an acceptable moisture content in the oil.
- A further advantage is the reduction of the frequency of otherwise unavoidable oil changes in the equipment.
- The final result is a reduction of the operating and maintenance costs.

The filtration unit, shown in Fig. 1, consist of the housing (1) and the control box (17). The upper cover plate and filter holder (3,11) extends into the housing from the top whereas the lower cover plate and frame (2) for the motor/gear pump (20/21) is attached to the bottom of the housing.

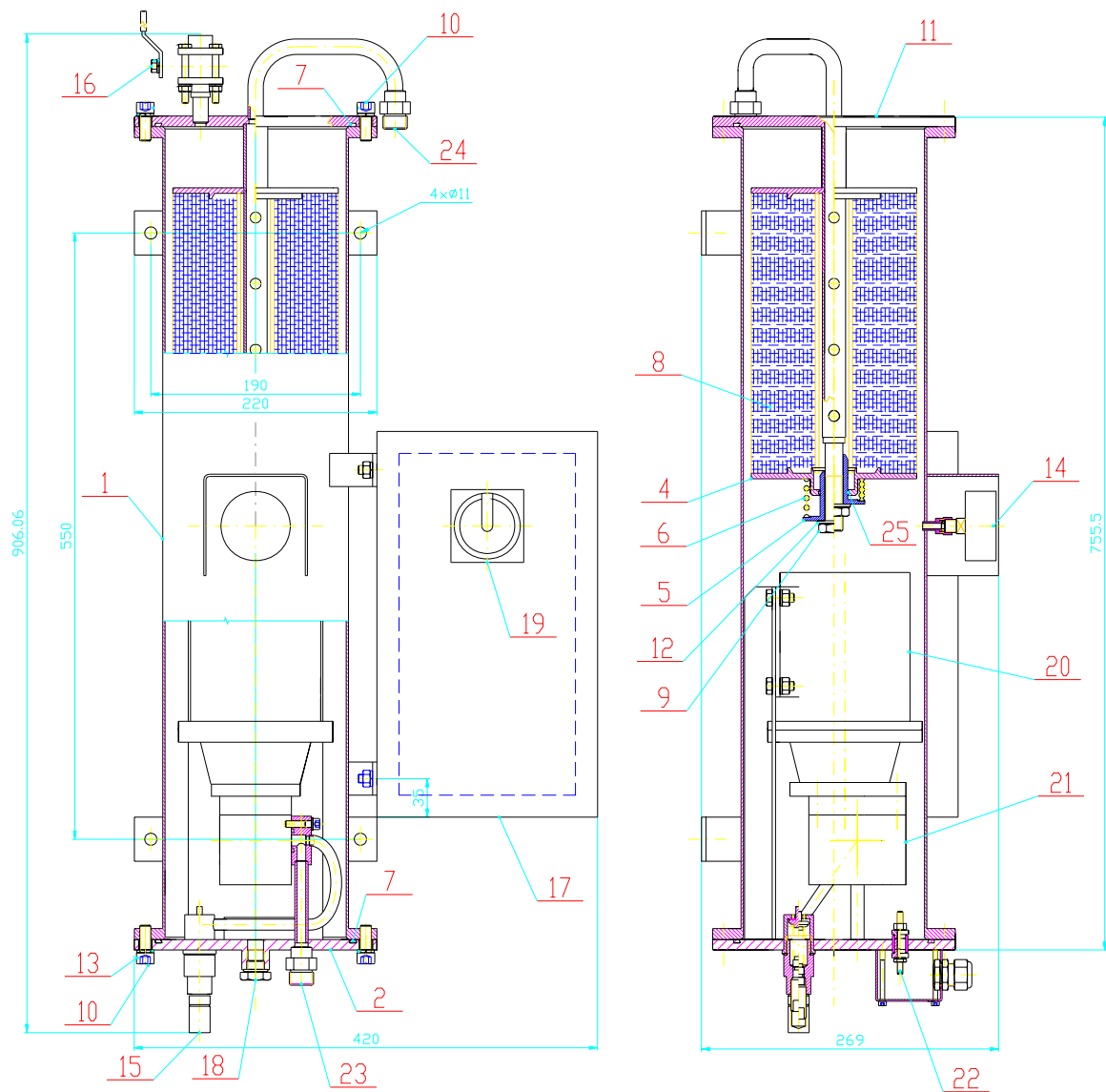
The filter holder (3,11), which is inserted from the top onto the flange of the housing (1), is sealed with an O-ring (7) and fixed with washers (13) and bolts (10). The 3/8" outlet connection for the filtered oil (24) and the deaerating cock (16) are fitted to the upper cover (3). The filter cartridge (8) is inserted over the central tube of the holder (11) and pressed against the upper plate of the filter holder by the lower pressure plate (4), pressure spring (6), sliding sleeve (5), washer (12) and compression nut (9). This ensures that there is no by-pass of unfiltered oil where the surfaces of the cartridge (8) meet the upper fixed holding plate and lower pressure plate. Also, an O-ring (25) seals the sliding sleeve (5).

The lower cover plate (2) has an intergrated mounting frame for the electrically driven gear pump (20/21). The lower cover plate, complete with the motor/gear pump (20/21) is inserted from the bottom of the housing (1), sealed with O-ring (7) and fixed to the lower housing flange in the same manner as the upper cover plate with washers (13) and compression bolts (10).

The lower cover plate (2) contains the 3/8" oil inlet connection (23), the safety valve (15), the sludge drain screw (18) and the cable connection block with bushings (22) for the motor/gear pump (20/21).

In the case that a partial or total blockage of the filter cartridge should occur, the pressure increase will open the safety valve(15) whereby the oil flows back into the inlet of the gear pump (21). The pressure increase in the housing (1) can be read from the gauge (14) and evaluated. If the recommended time-limit (2 years) is exceeded or the pressure indicated by the gauge (14) is permanently higher than 2 bars, the filter cartridge (8) the filter cartridge has to be changed.

2.2 System Diagram and Spare Parts List

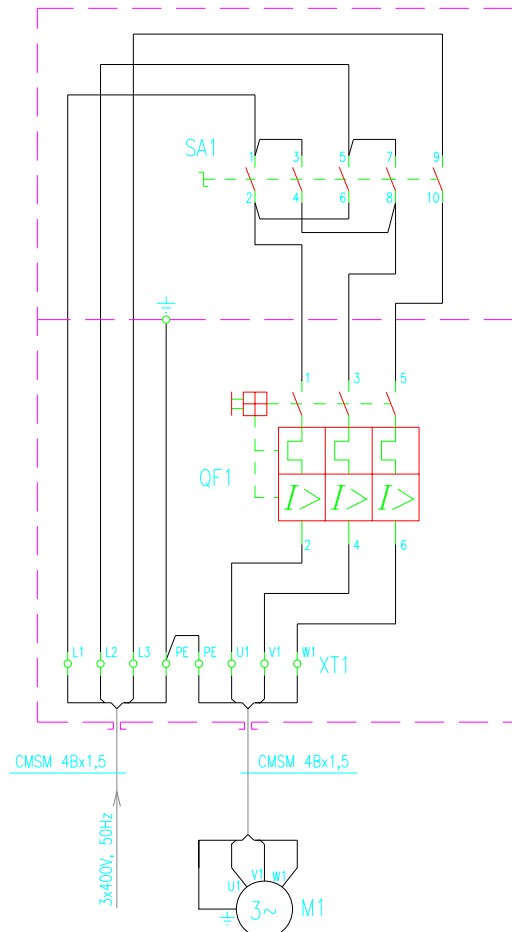


1	Housing	1	13	lock washer	12
2	Lower cover plate c/w mounting frame	1	14	Gauge (-100, 300 kPa)	1
3	Upper cover plate c/w filter holder	1	15	Pressure safety valve	1
4	Pressure plate	1	16	deaerating cock	1
5	Sliding sleeve	1	17	Control box	1
6	Spring	1	18	Sludge screw	1
7	O-ring	2	19	Main switch (reverse, off, run)	1
8	Filter Cartridge	1	20	E. Motor, 400VAC, 0.18 kW	1
9	Compression nut	1	21	Gear pump, 250l/hr	1
10	Fixing screw	12	22	bushing	3
11	Holder of Filter Cartridge	1	23	Inlet hydraulic connector	
12	Flat washer,	1	24	Outlet hydraulic connector	
			25	O-ring – sliding sleeve	1

Fig. 1. Separator S-03 Individual parts.

2.3 Electrical Circuits

The running of the motor of the gear pump is controlled from the Control Box (17) in which the motor protection switch and the reversable switch is installed. The circuit diagramme is shown on Fig.2.



SA1	Main (Reverse) Switch	1
QF1	Circuit breaker	1
M	Motor	1
XT1	Terminal	8

Fig. 2 Electrical circuits of the S-03 separator (continuous operation).

The electrical switching allows the realisation of three individual operations of the system:

The switching positions of the Main Switch are as follows:

Position : **OFF** – the pump (and the whole S-03 unit) is switched off

Position: **REVERSE** - the pump is running is reverse motion (filter insert change See, commisioning,...)

Position **RUN** – the standard filtration procedure

3. Installation

3.1 General instructions and Hydraulic connection.

The filter system S-03 should be fixed to the lower side of the Tap Changer or Transformer so that the operation and filter changes are easily carried out.

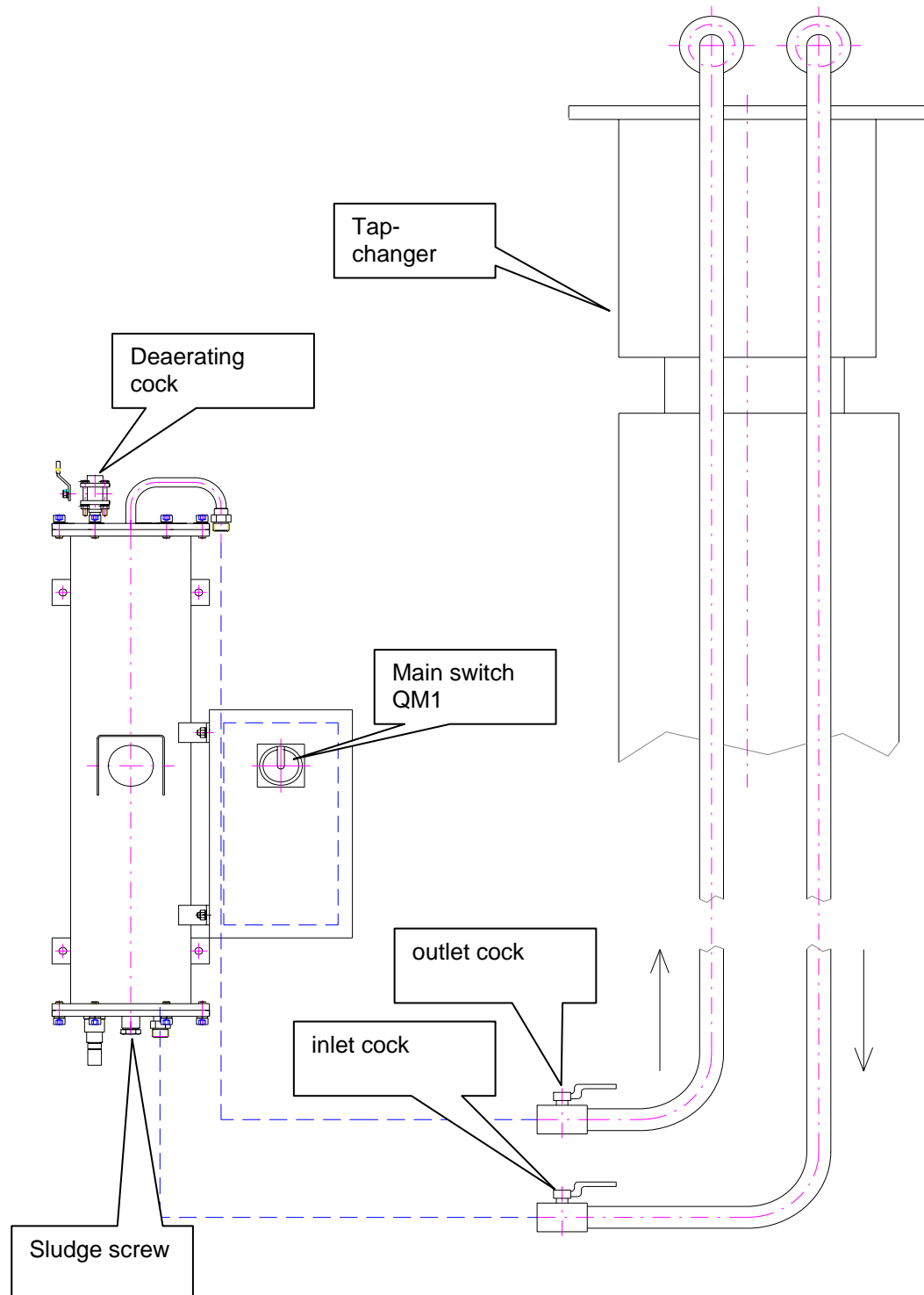


Fig.3 Schematical lay-out of the hydraulic connection.

The rear side of the filter system S-03 is fitted with 2 holders to enable an easy fixing to any suitable surface or mounting points with 4 x M10 bolts.

The hydraulic connection to the Tap Changer or Transformer can be made with suitable hoses, hard tubing or a combination of both.

In the case of connections with hard tubing care should be taken to place the filter system with adequate room to remove the filter holder (3,11) for changing the filter insert(8).

An example of connections with 3/8" hoses is shown on Fig. 3.

4. Commissioning

4.1 Changing the Filter Cartridge.

The S-03 filter system must always be fitted with a **DRY** filter cartridge as supplied by Fa. Altmann in a hermetically sealed plastic bag or the special container. The cartridge is pre-dried to a moisture content in the cellulose of $C_p < 0.2$ weight%.

Replacement of the "old or clogged" filter cartridge – See Fig. 1.

- Switch off the filter system S-03 at the main switch QM1 – position **OFF**, shut the outlet cocks at the Tap Changer.
- Remove the protective caps of deaerating cock (16) on the upper cover plate (3).
- Switch the main switch in the position 1 (reverse run of the pump) and read the gauge (14). If the underpressure is higher than -60 kPa, switch it OFF (position 0).
- Open the deaerating cock (16) and wait for the pressure stabilization
- Disconnect the outlet hose (or pipe) from the hydraulic connector (24) of the holder (11), remove the fixing screws (10) and lift out the upper cover plate (3) complete with the filter holder and filter cartridge (8) from the housing (1).
- Remove the compression nut (9), washer (12), sliding sleeve (5), pressure spring (6) and finally the pressure plate (4) from the central shaft of the filter holder.
- Remove the saturated (clogged) filter cartridge (8) and place in a oil tight plastic bag or container and seal it against spillage.
- To avoid a spillage by the installation of new cartridge, check the oil level in the housing (1). If higher than $\frac{1}{2}$ of length the housing (1), switch the main switch (QM1) in the position 1 (reverse run) and follow the sinking oil level until the upper part of the motor (20) will be visible. Switch the QM1 in the position 0.
- Cut open the hermetically sealed bag (or container) with the new cartridge (8). Place the new cartridge (8) **IMMEDIATELY** onto the shaft of the filter holder (11) **to avoid the contamination of the filter cartridge by the air moisture**. Refit the pressure plate (4), pressure spring (6). Check the condition of the O-ring (19), if necessary replace, refit sliding sleeve (5), washer (12) and compression nut (9).
- Tighten the compression nut (9) until the coils of the pressure spring (6) are pressed together.
- Refit the upper cover plate (3) with the new cartridge into the housing (1). Check the condition of the upper O-ring (7). If necessary replace. Refit the fixing screws (10) and spring washers (13), tighten evenly. Reconnect the outlet hose or piping.
- Continue as for the evacuating of air as described under section 4.2, point 4.
- Check that both upper and lower cover plates as well as the outlet hose pipe do not leak. If necessary retighten and if leaks still occur replace the O-ring (7).

4.2 Evacuating of the S-03 and the Inlet and Outlet sections.

Before the normal start up can be made it is necessary to ensure that all air is removed from the filter system as well as from both the inlet and outlet pipes (hoses) connecting the S-03 and the Tap-Changer See Fig.3.

After this step the complete system, including filter and pipes (hoses), must be completely filled with oil. The start up can only take place after this second step.

Evacuating and filling the S-03 with oil.

1. Check that all cocks are closed.
2. Remove the protective cap from the deaerating cock (16) on the upper cover plate. Connect the adapter with a suitable drain hose to this cock and place the open end in an auxiliary oil resistant **container** with a volume of at least 5 ltr. Check that the cock (16) is closed.
3. Check the sequence of the electrical phases in the Control panel and switch on the protection switch in the Control Box.
4. Switch on the switch QM 1 to position **RUN** (Position 2). The pump now removes the air from the inlet pipe (hose) and pumps it into the housing (1) of the S-03.
5. Wait for 30 seconds and then open the inlet cock on the tap-changer . The suction pipe and/or the hose will now be flushed with oil and oil is then pumped into the housing of the S-03.
6. Watch the movement of the Gauge (14) – when the reading shows more than 200kPa, turn off the pump by switching QM1 to the middle position (**OFF**) and by carefully opening the deaerating cock (16) to allow the air to escape.
7. Switch the pump again to the **RUN** position and repeat (2) above until continual, bubble free, oil flows from the drain pipe attached to the deaerating cock(16). Then turn the pump off by switching to **OFF**. Close the deaerating cock (16) , inlet cock on the tap-changer remains open.
8. Wait approx. 30 secs. and turn on the pump to reverse run with the switch at position **REVERSE**. The pump now draws oil from the housing (1) and pumps it back into the tap-changer. Pressure in the housing (1) drops – visible on the Gauge (14) – and at the same time the filter cartridge and the complete outlet pipe (hose) are evacuated.
9. Wait a further 60 secs. and turn off the pump by switching to position **OFF**, then open the outlet cock at the tap-changer. The oil from the Tap-Changer slowly flows in to the S-03, the vacuum in the housing now slowly sinks and upon reaching atmospheric pressure (visible on the Gauge (14)), close the outlet cock on the tap-changer.
10. Go to step 7 and repeat steps 7 to 9 until no further air bubbles exit the drain pipe attached to the Deaerating cock (16).
11. The evacuating and filling the filter system and pipes is now completed. Turn the switch to the position **RUN** for forward running.
12. Check the oil level in the conservation/expansion tank of the Tap Changer and the Buchholz relay. If necessary refill it up before proceeding accordingly the procedure 4.4.

Note: In the event of a large amount of oil remaining in the auxiliary oil resistant **container**, it can be returned to the Tap Changer by the suction method as at section 4.4. below.

4.3 Check of the function

The function of the S-03 Filter System can be checked during the normal operation (**RUN**) through a standard oil sample from the oil circuit of the Tap Changer or the S-03 and a following oil analysis in a laboratory.

It is recommended to use the deaerating cock (16) of the S-03 for drawing the oil sample.

Attention: At least 2 ltrs of oil must be flushed into a container before taking the sample. The oil sample corresponds actual conditions in the bottom part of the Tap-Changer .

Generally, two targets will be followed:

- The moisture/water content in the oil, **Cw (Qw)** , - should be kept below 30 ppm.
- The dielectric strength **Up** (kV/2.5mm) – should be maintained over 30 kV/2.5mm.

If these criteria cannot be maintained then the filter cartridge (8) must be changed as described in 4.1. above.

Note: The oil remaining after flushing out, in the auxiliary **container** and taking the sample can be returned to the Tap Changer by the suction method as at 4.4. below.

4.4 Refilling of the Tap Changer

- Check whether the Filter System is completely filled with oil. Under normal operating conditions – main switch in position **RUN** – no air bubbles should exit from the Deaerating cock (16).
- Turn the main switch **OFF**.
- Close the outlet cock at the Tap Changer (the inlet cock at the tap-changer remains open)
- Switch the main switch in the **REVERSE** position for at least 30 secs and observe the Gauge (14).
- If the vacuum on the Gauge (14) is higher than - 60 kPa, or it takes longer than 30 secs. switch to the position **OFF**. Connect a hose to the Deaerating cock (16) and the opposite open of the hose put in the bottom of the auxiliary **container** and draw in oil from the **container** by slowly opening the Deaerating cock (16).
- During the drawing off of the oil from the auxiliary **container** the vacuum slowly sinks – in the event that the oil is not fully withdrawn from the **container** switch the main switch again in the reverse run mode – position **REVERSE** and repeat the process.

If, during the drawing off of the oil from the auxilliary **container**, the air is also drawn in the S-03, it must be evacuated from the system immediately :

- turn off the main switch to position **OFF**
- Slowly open the outlet cock at the Tap-Changer and allow the air to exit from the filter system via open Deaerating cock (16), until until continual, bubble free, oil flows from the drain pipe attached to the Deaerating cock (16) back in the auxilliary **container**.