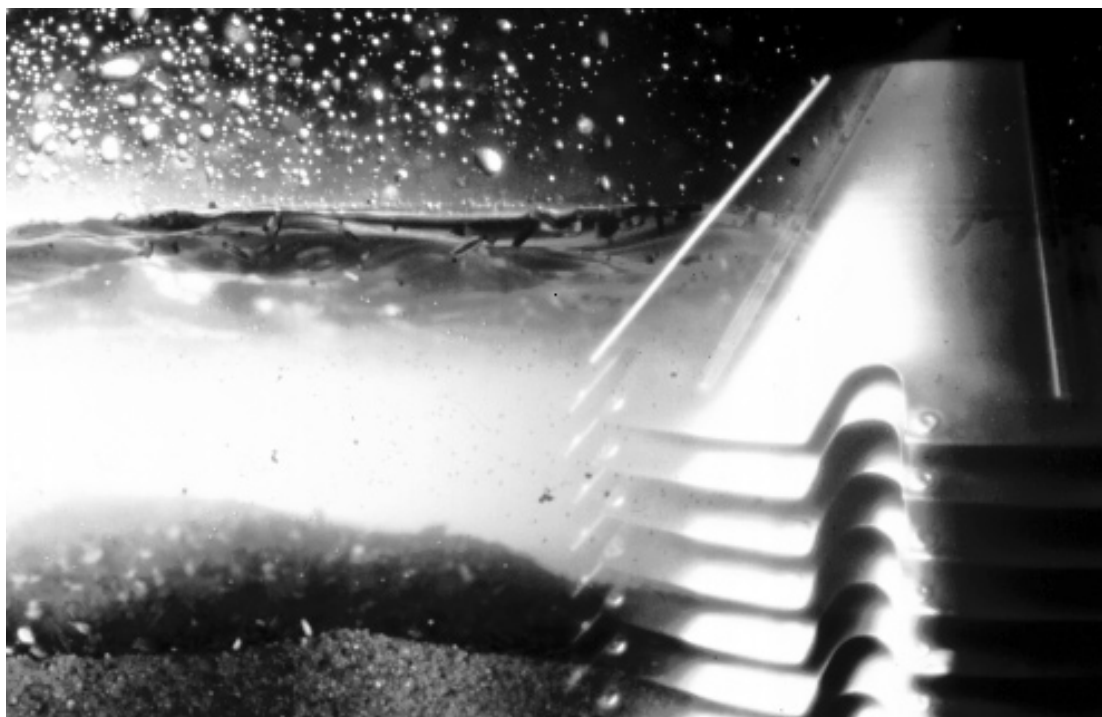


MIB 303S-13/33



Separator Manual

Product No.
Book No.

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1271024-02 V1

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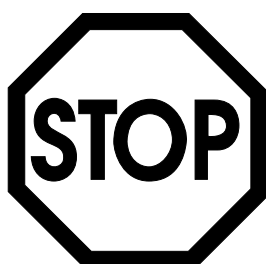
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Study instruction manuals and observe the warnings before installation, operation, service and maintenance.

Not following the instructions can result in serious accidents.

In order to make the information clear only foreseeable conditions have been considered. No warnings are given, therefore, for situations arising from the unintended usage of the machine and its tools.



1 Safety Instructions



The centrifugal separator includes parts that rotate at high speed. This means that:

- Kinetic energy is high
- Great forces are generated

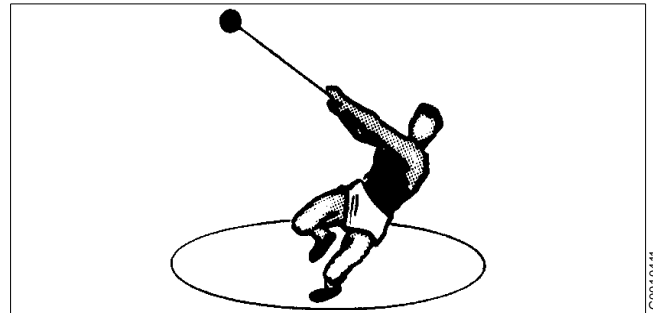
Manufacturing tolerances are extremely fine. Rotating parts are carefully balanced to reduce undesired vibrations that can cause a breakdown. Material properties have been considered carefully during design to withstand stress and fatigue.

The separator is designed and supplied for a specific separation duty (type of liquid, rotational speed, temperature, density etc.) and must not be used for any other purpose.

Incorrect operation and maintenance can result in unbalance due to build-up of sediment, reduction of material strength, etc., that subsequently could lead to serious damage and/or injury.

The following basic safety instructions therefore apply:

- **Use the separator only for the purpose and parameter range specified by Alfa Laval.**
- **Strictly follow the instructions for installation, operation and maintenance.**
- **Ensure that personnel are competent and have sufficient knowledge of maintenance and operation, especially concerning emergency stopping procedures.**
- **Use only Alfa Laval genuine spare parts and the special tools supplied.**





DANGER



Disintegration hazards

- Use the separator only for the purpose and parameter range specified by Alfa Laval.
- If excessive vibrations occur, keep liquid **feed on** and **stop** separator.
- Welding or heating of parts that rotate can seriously affect material strength.
- Inspect regularly for **corrosion** and **erosion** damage. Inspect frequently if process liquid is corrosive or erosive.

Entrapment hazards

- Make sure that rotating parts have come to a **complete standstill** before starting **any** dismantling work.
- To avoid accidental start, switch off and lock power supply before starting **any** dismantling work.
- Assemble the machine **completely** before start. **All** covers and guards must be in place.


Electrical hazards


- Follow local regulations for electrical installation and earthing (grounding).



Warning signs in the text

Pay attention to the safety instructions in this manual. Below are definitions of the three grades of warning signs used in the text where there is a risk for injury to personnel.

	WARNING
	Type of hazard
<p>This type of safety instruction indicates a situation which, if not avoided, could result in disabling injury or disabling damage to health.</p>	

	CAUTION
	Type of hazard
<p>This type of safety instruction indicates a situation which, if not avoided, could result in light injury or light damage to health.</p>	

NOTE	
<p>This type of instruction indicates a situation which, if not avoided, could result in damage to the equipment.</p>	



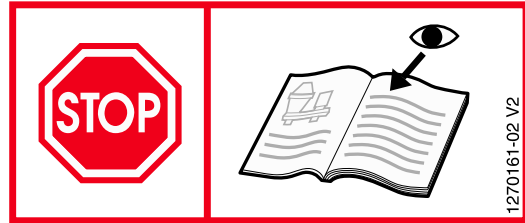
Warning label

Warning label placed on the separator hood.

Interpretation:

Stop! Read the instruction manuals before installation, operation and maintenance.

Failure to strictly follow instructions can lead to fatal injury.



Warning label

S00687B1

Machine plate

Plate placed on the separator base.

Text on label:

Separator type MIB 303S-13/33

Product number 881176-06-01

Speed max. 7 500 r/min

Rotation ----->

Supply voltage	230V ~50/60 Hz	110V ~50/60 Hz	24V DC
----------------	----------------	----------------	--------

Current max.	4 A	8A	30A
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S0061411

2 Separator Basics

Contents

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2.2 Application	13
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2.4 Working principle (purifier)	16
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2.6 Working principle (clarifier)	20



2.1 Basic principles of separation

2.2 Application

The use of the separator is restricted to removal of water and solids from gasoil, mineral oil or marine diesel oil.

Marine diesel oils should be preheated to +70 °C which is the maximum permissible separation temperature

Following are examples of oils to be treated:

Oil type	Density at +15 °C	Viscosity at +40 °C
Gas oil	810 - 860 kg/m ³	1,5 - 6 cSt
Marine diesel oil	850 - 920 kg/m ³	up to 14 cSt
Lube oil	Max. 920 kg/m ³	up to 150 cSt
Mineral oil		Max. 50 cS



WARNING

Do not use the MIB 303S-13/33 separator for separating any oils or liquids other than those specified above.

2.3 Description of main parts

A general view of the MIB 303S-13/33 separator is shown in fig 1.

The oil is fed to the oil inlet (A) and down to the rotating bowl (E) where separation takes place. Separated water runs down the water collecting channel (B) to the water outlet (C), while the cleaned oil leaves the separator at (D).

The bowl and motor (G) are suspended on rubber cushions(F).

The frequency converter (H) for the motor is mounted at the bottom of the separator.

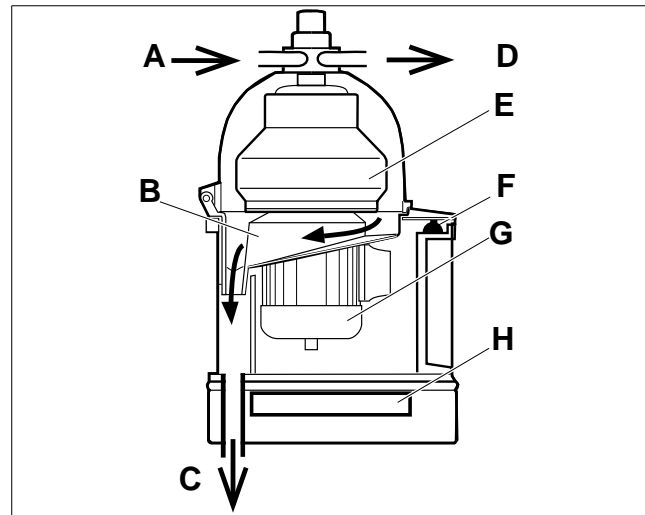


Fig. 1 Separator

- A. Oil inlet
- B. Water collecting channel
- C. Water outlet
- D. Oil outlet
- E. Bowl
- F. Rubber cushions
- G. Motor
- H. Frequency converter

More details shown in " Fig. 2 Separator main parts" on page 15

Separation takes place in the bowl (6) which is mounted directly on the motor shaft. The bowl contains a set of conical discs (7) between which the separation process takes place.

The bowl wall (6) and the paring chamber cover (2) are held in place by the lock nut (5).

Note: The lock nut has a conventional right-hand thread contrary to most Alfa Laval separators that have left-hand threaded lock rings.

The paring disc (3) is stationary, held by the paring disc knob (1). Below the paring disc is a level ring (4) the size of which has to be selected according to the type of fuel oil being used.

The motor flange rests on three rubber cushions (17) in the frame (8). An inclined channel in the motor flange directs water that has been separated from the oil down to the water outlet (10).

The motor (9) is powered via an electronic frequency converter (11), which converts the 50/60 Hz mains to 125 Hz. This gives the motor and bowl an operating speed of 7500 rpm. When the current is switched off the converter acts as a brake quickly reducing the speed.

The separator is equipped with the following safety devices:

A safety yoke (13) over the hood (14) and the oil connection housing (12) has a magnet (15) which operates a magnetic safety switch (16), so that power can only be supplied to the motor when the yoke is in its upright position. The yoke can be raised to this position only when both the mounting screws of the hood and the paring disc knob (1) have been tightened.

The separator also has built-in overload protection.

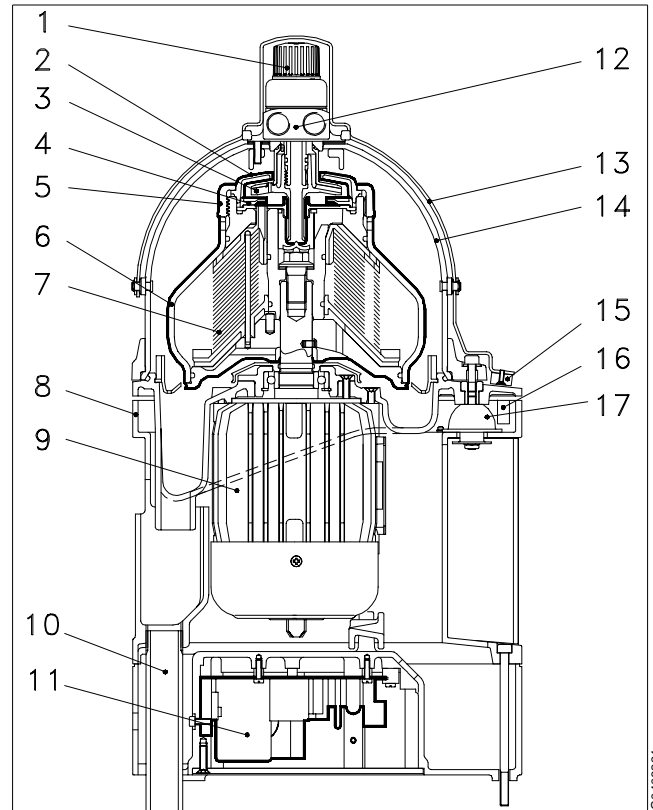


Fig. 2 Separator main parts

1. Paring disc knob
2. Paring chamber cover
3. Paring disc
4. Level ring
5. Lock nut
6. Bowl
7. Disc stack
8. Frame
9. Motor
10. Water outlet
11. Frequency converter
12. Oil connection housing
13. Safety yoke
14. Hood
15. Magnet
16. Magnetic safety switch
17. Rubber cushions

2.4 Working principle (purifier)

Uncleaned oil continuously enters at (1), in fig 3, and flows into the bowl (2). The bowl rotates at high speed generating powerful centrifugal forces. As the oil rotates with the bowl, the heavier contents of the oil, such as solid particles and water, move towards the periphery of the bowl. The particles are deposited on the bowl wall, while water collects in the water seal space (3) and drains at (4) into the water channel below the bowl.

The discs (5) in the bowl make the separation process very efficient and the cleaned oil leaves the bowl through the paring chamber at a constant pressure. The paring chamber which contains the stationary paring disc is not shown in this illustration.

The water seal is very important as it prevents oil from leaving the bowl through the water outlet. To establish the necessary water seal, a small amount of water has to be fed into the bowl before the uncleaned oil is fed to the bowl. The heavier water prevents the oil from escaping the wrong way.

More information about the theory of centrifugal separation can be obtained from your local Alfa Laval representative.

Fig. 3 Process principle (opposite page)

1. Oil inlet
2. Bowl
3. Water seal
4. Water outlet radius
5. Bowl discs
6. Oil outlet radius

Detta blad utbytes mot färgbild:

G-04490-1-1

2.5 Conversion kit

If the liquid to clean only contains smaller amounts of water and solids, the purifier bowl can be converted to a clarifier, using the optional conversion kit to replace the purifier parts in bowl see “6.2 Operation chart selection” on page 44 instruction C₁.

A brief explanation of the clarifying mode is given on page 20.

2.6 Working principle (clarifier)

Uncleaned oil continuously enters at (1), in fig 4, and flows into the bowl (2). The bowl rotates at high speed generating powerful centrifugal forces. As the oil rotates with the bowl, the heavier contents of the oil, such as solid particles and water, move towards the periphery of the bowl. The particles are deposited on the bowl wall, while water collects in the sludge and water space (3) and drains into the channel below the bowl, when the rotation is stopped.

The discs (4) in the bowl make the separation process very efficient and the cleaned oil (5) leaves the bowl through the paring chamber at a constant pressure. The paring chamber which contains the stationary paring disc is not shown in this illustration.

More information about the theory of centrifugal separation can be obtained from your local Alfa Laval representative.

Fig. 4 Process principle (opposite page)

1. *Oil inlet*
2. *Bowl*
3. *Collected solid particles*
4. *Bowl discs*
5. *Oil outlet*

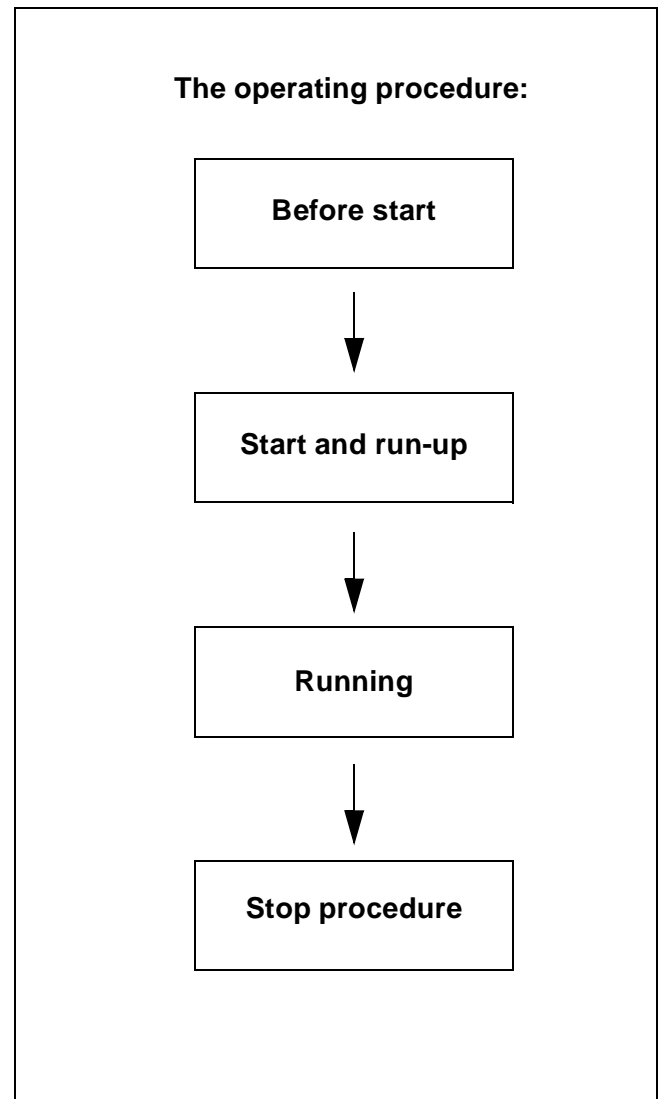
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3 *Operating Instructions*

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3.6	Automatic stop	27





3.1 Operating routine



WARNING

The separator is supplied with a safety yoke and a magnetic safety switch. Modifications to the machine which put the safety devices out of operation can lead to serious injury or damage.

These operating instructions describe routine procedures to follow before and during the start, running and stopping sequences of the separator.

NOTE

If there is a System Manual, always follow the operating instructions given therein. If there is no System Manual the instructions below are to be followed.

3.2 Before start

- Make sure that the separator is installed according to the instructions given in chapter “8.2 Installation” on page 78.
- Make sure that the correct level ring is installed:
 - For cleaning **gas oil** only, install the **white level ring** which has a 43 mm diameter hole.
 - For cleaning marine diesel oil and lube oil, install the **black level ring** which has a 50 mm diameter hole.
 - For alternating between marine diesel oil and gas oil, install the black level ring which has a 50 mm diameter hole.

- Make sure that the hood screws and the paring disc knob are firmly tightened and that the safety yoke is in its closed (vertical) position.

3.3 Start

1. Make sure that the outlet valve is open.
2. Start the separator. Note! hold the button depressed till the machine is running.
3. After 20 seconds, when the separator has gained full speed, feed at least one litre of water into the oil inlet line. This will create the water seal.
4. Turn on the oil feed to the separator.
5. Regulate the counter-pressure in the oil outlet line to 40-60 kPa.
6. After 1 minute, check that oil is not discharging from the separator through the water outlet (at the bottom). If oil escapes through the water outlet, stop the oil feed and follow the instructions given in "4.3 No outlet flow (no outlet pressure)" on page 32.

3.4 Operation

Check the separator for correct operation. This is especially important the first few times the separator is run after installation or after any dismantling and assembly has been carried out.

3.5 Stop

1. Turn off the oil feed.
2. Stop the separator.

The bowl will almost have stopped rotating after about 1 minute. Approximately 1 litre of oil and water will flow out of the water outlet at the bottom of the separator. This is the normal draining of the bowl as it stops.

3. Make sure that the valves are closed on both the feed and outlet sides of the separator. If this is not done oil may siphon off through the separator and the water collecting vessel will overflow.

3.6 Automatic stop

The separator is automatically stopped by the built-in electronic safety devices if one of the following situations should occur:

- too high current due to overload of the separator motor
- too high temperature in the frequency converter
- wrong frequency from converter.

Auxiliary safety devices, that also stop the separator: See “7.3 Connection diagram” on page 71,72 and 73



CAUTION

If the separator stops, the oil feed must be stopped immediately or there will be serious oil overflow.

If the separator does not start or if it stops during operation, follow the instructions given in “4.1 The separator does not start” on page 31.

4 *Trouble shooting*

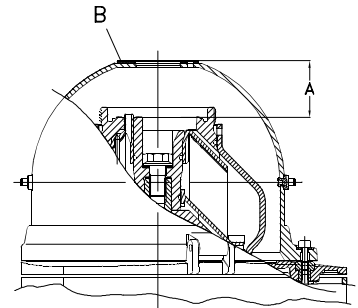
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4.1 The separator does not start

Possible cause	Action
Safety yoke is not in the correct position.	Position the yoke correctly.
No power supplied to the separator.	Check the mains switch, fuses and supply line.
Defective magnetic safety switch.	Make sure that the switch opens and closes when the safety yoke is moved up and down. Measure across terminal points No. 5 and 6 on the frequency converter board. Replace the switch if faulty.
Incorrect assembly after cleaning.	Make sure that the bowl and motor shaft can rotate freely by turning the bottom end of the motor shaft with a suitable tool.
Incorrect height adjustment of paring disc after major overhaul.	CHECK: The height adjustment of the paring disc is measured as shown in figure. The height A should be $48,5 \pm 0,5$ mm and can be adjusted by the number of washers B (1-3 pcs) under the oil connection housing.
Defective frequency converter.	Have an Alfa Laval representative test the converter.



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4.2 Low outlet flow (low outlet pressure)

Possible cause	Action
Low feed flow.	Check feed line.
Paring disc knob is not completely tightened, causing leakage.	Tighten the knob.
Leakage caused by incorrect assembly.	Dismantle. Check especially that no O-rings are missing, defective or incorrectly installed. Assemble correctly.

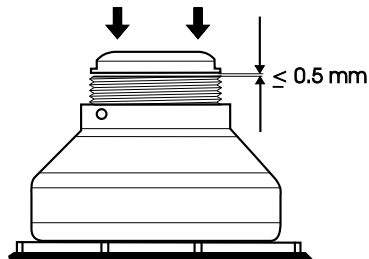
4.3 No outlet flow (no outlet pressure)

Possible cause	Action
No feed.	Check feed line.
The feed functions properly but oil discharges through the water outlet (purifier only).	This happens if there is no water seal. Either no water was added at start-up or the water seal has broken during operation. Add 1 litre of water to create a new water seal. If this fault repeats itself so that oil again discharges through the water outlet the density of the oil is too high. Stop the separator and fit the black level ring instead of the white one. If the black level ring is already installed, this oil cannot be cleaned in the separator because the density of the oil is too high.
Leakage caused by incorrect assembly.	Dismantle. Check especially that no O-rings are missing, defective or incorrectly installed. Assemble correctly.

4.4 The separator stops

Possible cause	Action
The safety yoke has been moved out of its position.	Reposition the yoke. Running position = vertical.
Overload due to incorrect assembly.	Check the bowl assembly.
Defective frequency converter.	Have an Alfa Laval representative test the converter.

4.5 The separator vibrates

Possible cause	Action
Bowl out of balance due to: <ul style="list-style-type: none"> – Insufficient or incorrect cleaning. – Centre screw is missing. – Paring chamber cover and lock-nut are not correctly installed. 	Clean the bowl carefully. Install the centre screw. Dismantle. Assemble correctly. Press the paring chamber cover down firmly, (see fig.) otherwise the lock nut cannot be installed correctly. <div style="text-align: right;">  </div>
Vibration dampers are worn.	Fit three new dampers.
Motor bearings are damaged.	Fit new bearings.

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4.6 Insufficient separation

Possible cause	Action
Insufficient cleaning.	Clean the bowl. Shorten the cleaning interval.
The black level ring is too large for present oil (purifier only).	Replace the black level ring with the smaller (white) level ring.
Oil feed rate is too high.	Reduction of the feed rate improves the separation result.

4.7 Noise

Possible cause	Action
Incorrect assembly.	Dismantle and assemble correctly.
Bearings damaged.	Fit new bearings.
Vibration dampers are worn	Fit new dampers


5 *Maintenance*

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5.1 Periodic cleaning

	<p>WARNING</p> <p>Switch off the main power supply before dismantling for repair. Lock the mains switch in its OFF position.</p>
---	---


5.1.1 Bowl cleaning

The separator must be stopped at regular intervals and the bowl opened for removal of collected sludge. This is important for correct operation of the separator and achieving the desired result.

The length of the periods between cleaning depends on the feed rate of the oil and on the quantity of solid particles in the oil. During the initial period, open and inspect the bowl once every 24 hours to determine the necessary cleaning interval.

The bowl must be cleaned before the solids layer of the bowl has become thicker than 10 mm.

The cleaning procedure is shown in "6.2 Operation chart selection" on page 44.

	<p>WARNING</p> <p>Never use cleaning agents with a pH below 6 or above 8 as they will damage the metal surfaces.</p>
---	---

5.2 Preventive maintenance every year

Replace the O-rings with the new ones supplied in the O-ring Service Kit. Their positions are shown in the Spare Parts List and the dismantling and assembly procedures are shown in the Dismantling and Assembly chapter.

Before fitting, lubricate the O-rings with the silicone grease supplied in the service kit.

5.3 Preventive maintenance every two years

5.3.1 Disc stack replacement

At separation temperature 60 °C and below, it is recommended to fit a new stack every two years to ensure that the separation efficiency is maintained.

At separation temperature above 60 °C, it is recommended that the disc stack is replaced every year or at any sign of brittleness.

The replacement procedure is shown in the “6.2 Operation chart selection” on page 44.

The disc stack is available as a set.

5.3.2 Vibration damper replacement

Fit new vibration dampers every two years. Inspect the stop flanges of the dampers for possible damage and replace the stop flanges with new ones if necessary.

The replacement procedure is shown in the Dismantling and Assembly chapter “6.2 Operation chart selection” on page 44.

The vibration dampers are available as a set (see *Spare Parts Catalogue*).



WARNING

The separator must not be operated unless the stop flanges for the vibration dampers are correctly installed.

6 *Dismantling and assembly*







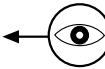

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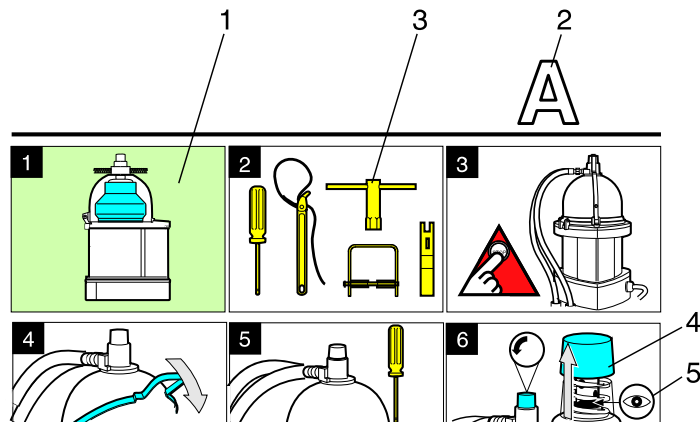
6.1 Instructions

The illustrations on the following pages describe step by step how to dismantle, clean, replace and assemble the various parts of the separator.

The illustrations have only symbols to indicate the action required. The key to the symbols is given below.

 S-00439-1-1	<i>Remove</i>	 S-00442-1-1	<i>Screw or turn clockwise</i>	 S-00438-1-1	<i>Press or move in the direction of arrow</i>	 S-00443-1-1	<i>Clean</i>
 S-00444-1-1	<i>Fit, insert</i>	 S-00441-1-1	<i>Screw or turn counter-clockwise</i>	 S-00440-1-1	<i>Check, make sure</i>	 S-00003-1-1	<i>Safety</i>

- A. Select the correct chart.
The green introductory illustration (1) indicates the part which will be dealt with in the chart (see the chart designation letter (2)) and "6.2 Operation chart selection" on page 44.
- B. Collect the tools needed.
Tools required are marked in Yellow (3).
- C. Follow the instructions in numerical order
The part concerned is marked in blue (4).
The symbol indicates the action required (5).



6.2 Operation chart selection

Operation	Charts and illustrations	
Bowl cleaning	A + B	G0480031
O-rings and disc stack replacement		
Purifier	A + C + B	G0480141
Clarifier	A + C ₁ + B	G0480131
Bearing replacement	A + D + B	G0480231
Connection housing dismantling and assembly	E	G0480331
Frequency converter replacement	F	G0480431
Level ring replacement (purifier only)	A + C ² / C ¹⁵ + B	G0480531
Vibration damper replacement	A + D ¹⁻¹¹ / D ³³⁻⁴¹ + B	G0480631

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Detta blad utbytes mot färgbild:

G-04492-2-1

Detta blad utbytes mot färgbild:

G-04493-2-1

Detta blad utbytes mot färgbild:

G-05191-9-1



Detta blad utbytes mot färgbild:

G-04494-2-1

Detta blad utbytes mot färgbild:

G-04495-2-1

Detta blad utbytes mot färgbild:

G-04496-2-1

Detta blad utbytes mot färgbild:

G-04497-2-1

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G-04498-2-1

7 *Technical data*

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7.1 Technical data

Alfa Laval ref. 557925 , rev. 2

7.1.1 Type designation

MIB 303S-13/33

7.1.2 Capacities

Hydraulic capacity	1 m ³ /h
Maximum density	
– of sediment	1600 kg/m ³
– of feed	1000 kg/m ³
Feed temperature	
– Minimum	+15 °C
– Maximum	+70 °C

7.1.3 Electric motor drive

The drive comprises a frequency converter and a motor. The motor is wired to suit the voltage and frequency delivered by the frequency converter.

Motor power	0,45 kW
Power consumption	
– Idling	0,2 kW
– At maximum capacity	0,4 kW
Rated current	
– At 24 V DC	30 A
– At 110 V AC	8 A
– At 230 V AC	4 A
Speed	7500 r/min
Direction of rotation	Counter-clockwise
Running up time	30 seconds
Stopping time	100 to 180 seconds

The frequency converter brakes the bowl speed to below 1000 r/min within 25 seconds after switching off the current.

7.1.4 Lubrication

Permanently lubricated bearings
(no extra lubrication is required).

7.1.5 Operation conditions

Ambient temperature, maximum	55 °C
Feed temperature, maximum	+70 °C
Enclosure class, motor and frequency converter	IP 54

7.1.6 Weight

Total weight	18 kg
--------------	-------

7.1.7 Dimensions

see "7.2 Basic size drawing" on page 67.

7.1.8 Connections

Oil inlet, oil outlet	ISO G 3/8. See "7.2 Basic size drawing" on page 67
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7.1.9 Sound

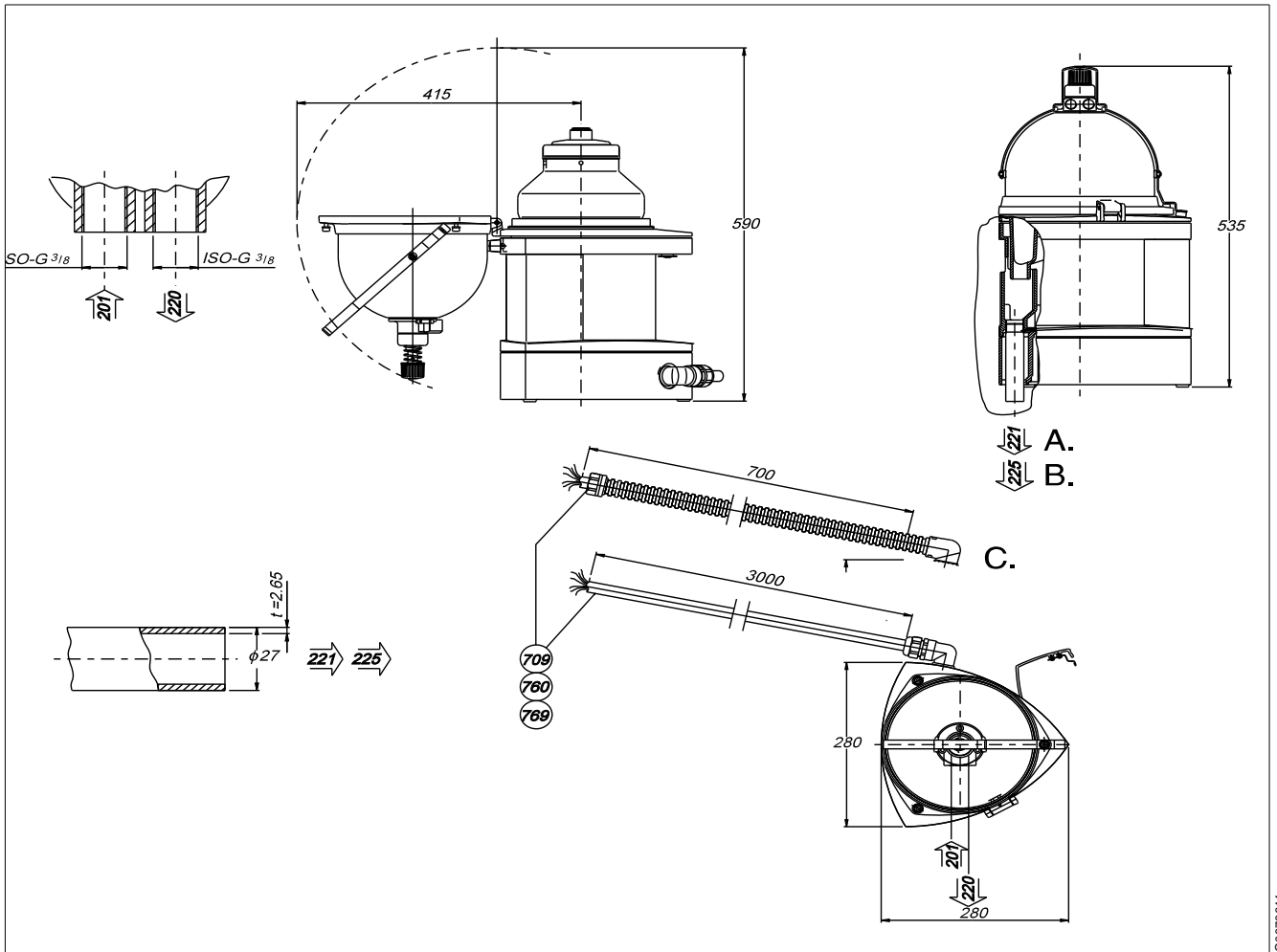
Sound power	7,9 Bel(A)
Sound press. level	65 dB(A)

7.1.10 Material

Bowl body	AL 111 4212-06
-----------	----------------

7.2 Basic size drawing

Alfa Laval ref. 554367, rev. 2 / 557875, rev. 0 / 557596, rev. 1



All connections to be installed non-loaded and flexible

A + B. Valid for purifier see "7.3 Connection diagram" on page 71

B. Clarifier only

C. Cable with protection for 24 V DC

7.2.1 Connection list

Alfa Laval ref. 554542 rev. 2

No.	Description	Requirements/limits				
		MIB 303S-				
		-13 230 VAC	-13 110 VAC	-13 24 VDC	-33 230 VAC	-33 110 VAC
201	Inlet for product					
	– Allowed temperature	Min. 15 °C, Max. +70 °C				
	– Viscosity	Max. 14 cSt		Max. 50 cSt		
	– Flowrate max.	0 - 1000 litres/h				
	– Pressure	0 - 60 kPa				
220	Outlet for light phase					
	– Pressure	70-200 kPa				
221	Outlet for heavy phase					
	– Pressure	0 kPa (Open)				
225	Bowl drain outlet	0 kPa (Open)				
709	Electrical connection	See “7.2.2 Interface description”. The connection must be protected against voltage peaks (transients) of high amplitude.				
	– Power supply	230 V 1phase 50/60 Hz	110 V 1phase 50/60 Hz	24 V DC	230 V 1phase 50/60 Hz	110 V 1phase 50/60 Hz
	– Fuse max.	10 A	16 A	35 A	10 A	16 A
760	Cover interlocking switch	See “7.2.2 Interface description”				
	– Type	Magnetic proximity switch				
	– Switch rating, resistive load max.	230V AC, 20VA				
769	Frequency converter protection	See “7.2.2 Interface description”				
	– Motor overcurrent trip max.	2,5 A in 15 s		28 A in 20 s	2,5 A in 15 s	
	– Out frequency trip max.	140 Hz				
	– Overtemperature trip (heat sink)	70-75 °C		75-80 °C	70-75 °C	

7.2.2 Interface description

Alfa Laval ref. 557647 rev. nr 0

General

In addition to the Connection list this document describes limitations and conditions for safe control, monitoring and reliable operation.

Definitions

Ready for start means:

- The machine is assembled correctly.
- All connections are installed according to connection list, Connection Diagram and Interface Description.

Start means:

- The power to separator is on.
- The acceleration is supervised to insure that a certain speed has been reached within a certain time, See “7.1 Technical data” on page 65.

The start procedure continues until the full speed has been reached and a stabilizing period has passed (about 1 minute).

Normal stop means:

- Stopping of the machine at any time with brake applied.

Safety stop means:

The machine must be stopped in the quickest way due to the interlocking switch function (769).

- The machine must not be restarted before the reason for the safety stop has been investigated and action has been taken.

In case of emergency condition in the plant, the machine must be stopped in a way that is described in EN 418.

Component description and signal processing

Electrical connections 709

- The three phase separator motor is fed from a built in frequency converter which in turn is fed from a single phase power supply.

Cover interlocking switch 760

- The separator is equipped with a safety yoke and an interlocking switch. When the cover is closed and the yoke is in the upright position the interlocking circuit in the starter control is closed and the separator could be started.

Signal processing:

- The cover interlocking switch should be connected so that starting and running of the motor is prevented when interlocking circuit is not closed.

Interlocking switch function 769

- The built in frequency converter interlocking switch function contains three sensors, connected in series for overtemperature, over frequency trip and overcurrent.

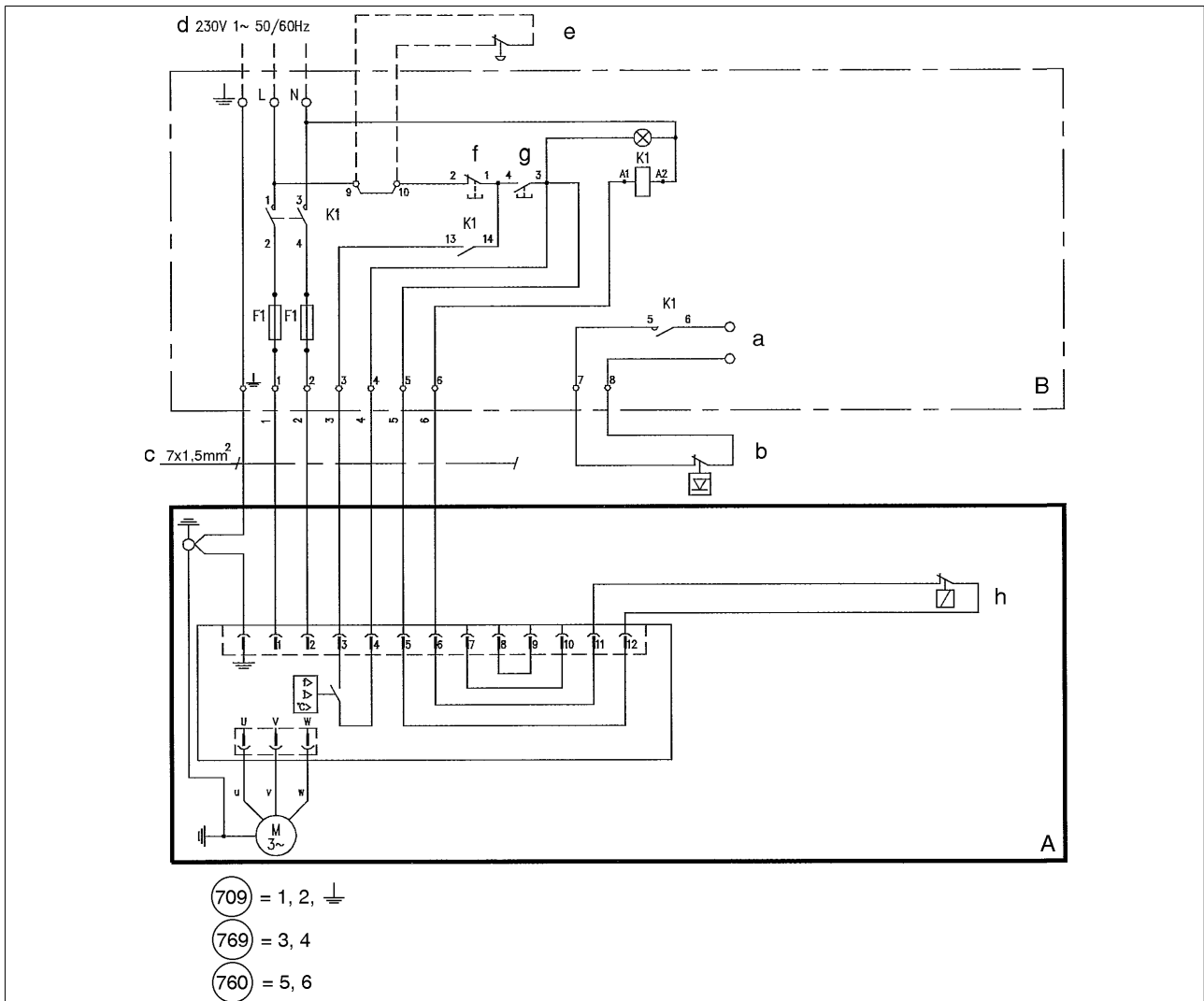
Signal processing:

If the interlocking switch function opens the machine must be stopped with automatic safety stop.

7.3 Connection diagram

7.3.1 230 V AC

Alfa Laval ref. 554581 rev. nr 2



A. Separator incl. frequency converter

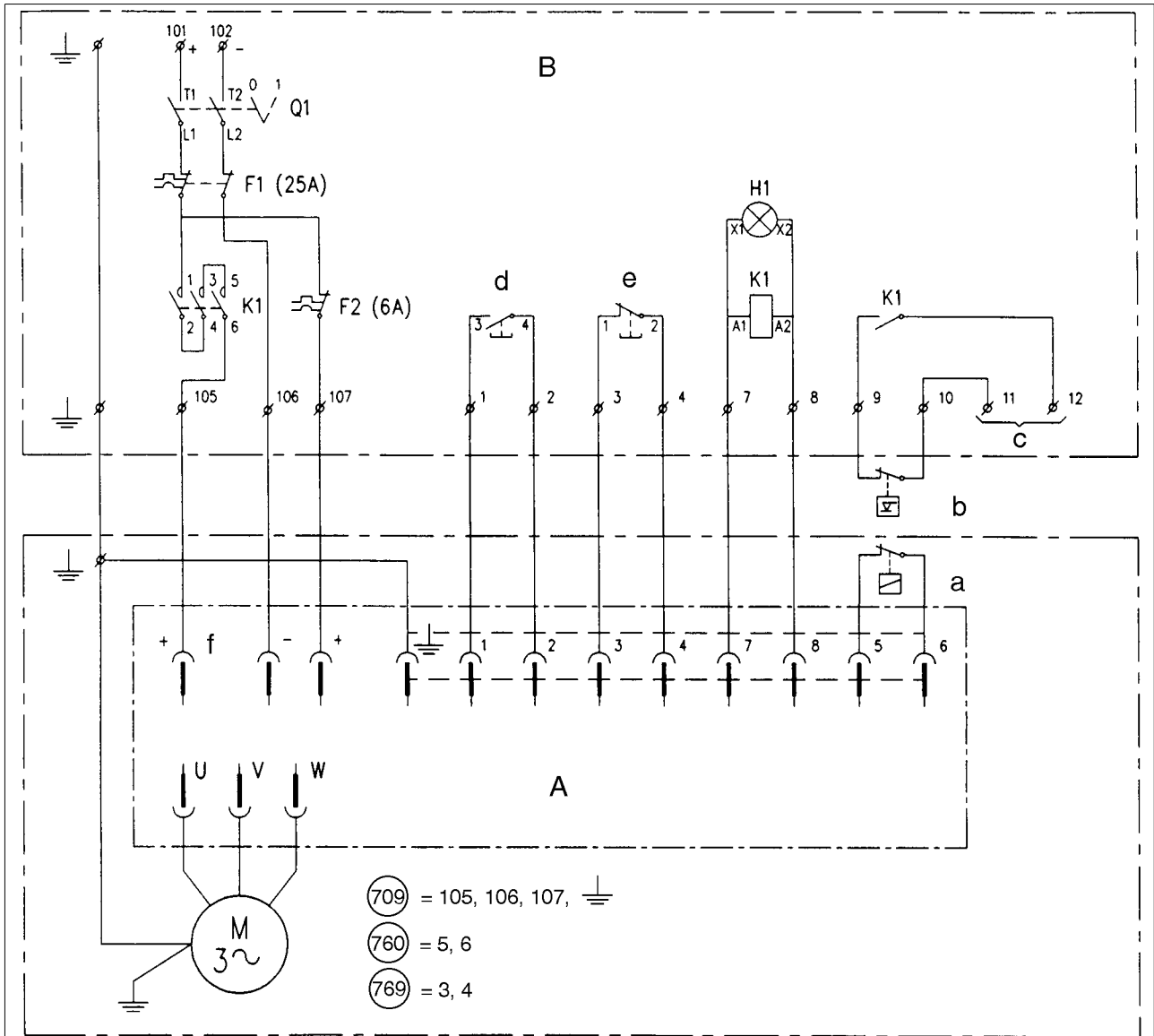
B. Starting equipment (not included in all separators)

- a. Pump control
- b. External level guard
- c. Cable
- d. Power supply 230V AC 50/60 Hz max. fuse 10 A
- e. External emergency stop (replaces jumper when used)
- f. Stop
- g. Start
- h. Interlocking switch

F1= Fuse 6,3A delayed action

7.3.3 24 V DC

Alfa Laval ref. 558253, rev. 0



A. Separator incl. frequency converter
 B. Starting equipment (not incl. in all separators)

- a. Interlocking switch
- b. External level guard
- c. Pump control
- d. Start
- e. Stop
- f. Relay

