

Instruction book High speed separator

## IFB 403X-73



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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 centrifuge includes parts that rotate at high speed. This means that:

- Kinetic energy is high
- Great forces are generated
- Stopping time is long

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. Applies not only to the process but also to cleaning and service liquids.
- 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.





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## **Disintegration hazards**

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



## **Entrapment hazards**

 Make sure that rotating parts have come to a complete standstill before accessing parts inside the machine or starting any dismantling work.

If there is no braking function the run down time can exceed two hours.

• To avoid accidental start, switch off and lock power supply before starting **any** dismantling work.

Assemble the machine **completely** before start. **All** covers, connections and guards must be in place.





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## **Electrical hazard**

- Follow local regulations for electrical installation and earthing (grounding).
- Only qualified electricians are allowed to install and maintain the drive.
- Make sure the intermediate circuit capacitors discharge before you start working on the drive, motor or motor cable. After disconnecting the input power, always wait in accordance with the documentation for the frequency converter.



# $\triangle$

## Skin irritation hazards

- When using chemical cleaning agents, make sure you follow the general rules and suppliers recommendation regarding ventilation, personnel protection etc.
- Use of lubricants in various situations.



## Flying objects

 Risk for accidental release of snap rings and springs when dismantling and assembly. Wear safety goggles.





## 1.1 Warning signs in 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.



### DANGER

Type of hazard

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



### WARNING

Type of hazard

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



## CAUTION

Type of hazard

CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

## NOTE

NOTE indicates a potentially hazardous situation which, if not avoided, may result in property damage.



## 1.2 Recycling Information

### Unpacking

Packing material consists of wood, plastics, cardboard boxes and in some cases metal straps.

- Wood and cardboard boxes can be reused, recycled or used for energy recovery.
- Plastics should be recycled or burnt at a licensed waste incineration plant.
- Metal straps should be sent for material recycling.

#### Maintenance

During maintenance oil and wear parts in the machine are replaced.

- Oil must be taken care of in agreement with local regulations.
- Rubber and plastics should be burnt at a licensed waste incineration plant. If not available they should be disposed to a suitable licensed land fill site.
- Bearings and other metal parts should be sent to a licensed handler for material recycling.
- Seal rings and friction linings should be disposed to a licensed land fill site. Check your local regulations.
- Worn out or defected electronic parts should be sent to a licensed handler for material recycling.

#### Scrapping

At the end of use, the equipment must be recycled according to relevant local regulations.

Besides the equipment itself, any hazardous residues from the process liquid must be taken into consideration and dealt with in a proper manner. When in doubt, or in the absence of local regulations, please contact your local Alfa Laval sales company.



## 1.3 Requirements of personnel

Only **skilled** or **instructed** persons are allowed to operate the machine, e.g. operating and maintenance staff.

- Skilled person: A person with technical knowledge or sufficient experience to enable him or her to perceive risks and to avoid hazards which electricity/mechanics can create.
- **Instructed person**: A person adequately advised or supervised by a skilled person to enable him or her to perceive risks and to avoid hazards which electricity/mechanics can create.

In some cases special skilled personnel may need to be hired, like electricians and others. In some of these cases the personnel has to be certified according to local regulations with experience of similar types of work.

## 1.4 Remote start

If the separator is operated from a remote position where the separator cannot be seen or heard the power isolation device shall be equipped with an interlock device to prevent that a remote start command could result in liquid being fed to the separator when it is shut down for service.

The first start after the separator has been taken apart or been standing still for a long time shall always be manually supervised locally.

## 2 Separator basics

## 2.1 Application

The separator is a small, solid-walled bowl, discstack centrifugal separator. It separates two insoluble liquids, where the heavy one (coolant) has the major volume.

Its use is restricted to the removal of solids and tramp oil from coolants.

| Liquid type: | Coolant |
|--------------|---------|
|--------------|---------|

Separating temperature: Min. +15 °C, max. +70 °C

NOTE

Maximum permissible separation temperature is +70 °C.



## WARNING

**Disintegration hazard** 

Do not use the separator for separating any liquids other than those specified above.

# 2.2 Description of main parts

### 2.2.1 Overview

A general view of the separator is shown in the illustration beside.

The dirty liquid is fed to the inlet (A) and down to the rotating bowl (1) where separation takes place. The cleaned liquid leaves the separator at (B). The separated oil runs down the collecting channel (4) to the outlet (C).

The bowl (1) and motor (3) are suspended on three vibration dampers (2).



#### Separator

- A. Dirty liquid inlet
- B. Clean liquid outlet
- C. Oil outlet. When the separator is stopped the bowl is drained via this outlet.
- 1. Bowl
- 2. Vibration dampers
- 3. Electric motor
- 4. Water collecting channel

More details are shown in the illustration on next page.

## 2.2.2 Detailed description

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 a level ring (4) is fitted.

The motor flange rests on three rubber cushions (16) in the frame (8). An inclined channel in the motor flange directs the oil that has been separated from the liquid to the outlet (10).

The motor (9) is powered via an electronic frequency converter, which converts the incoming mains to an output frequency of 125 Hz. This gives the motor and bowl an operating speed of 7500 r/min. When the current is switched off the converter acts as a brake quickly reducing the speed to below 1000 r/min. within 25 seconds.

The separator is equipped with the following safety devices:

A safety yoke (12) over the hood (13) and the connection housing (11) has a magnet (14) which operates a magnetic safety switch (15), 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.



### Separator main parts

- 1. Paring disc knob
- 2. Paring chamber cover
- 3. Paring disc (see separate description on page 18)
- 4. Level ring
- 5. Lock nut
- 6. Bowl
- 7. Disc stack
- 8. Frame
- 9. Motor
- 10. Oil outlet
- 11. Connection housing
- 12. Safety yoke
- 13. Hood
- 14. Magnet
- 15. Magnetic safety switch
- 16. Rubber cushions

Not shown: Frequency converter, located in Control unit.

## 2.2.3 Paring disc

The paring disc serves as a stationary pump wheel mounted in a chamber in the rotating bowl neck. The paring disc dips radial into the rotating liquid ring and pares out the liquid (coolant). The paring disc is used as a discharge pump.



The liquid and all bowl parts (except the stationary paring disc) rotate in direction illustrated by arrow (A)

## 2.3 Working principle

## 2.3.1 Concentrator mode

Dirty liquid continuously enters at (A) and flows into the bowl (1). The bowl rotates at high speed generating powerful centrifugal forces. As the liquid rotates with the bowl, the liquid (heavy phase) and solid particles moves towards the periphery of the bowl. The particles (2) are deposited on the bowl wall, while the cleaned liquid enters the channels (3) and leaves the bowl at (B) at a constant pressure. The discs (4) in the bowl improves the cleaning efficiency during the separation process.

The oil (light phase) is forced towards the centre of the bowl and then leaves through the underside of the bowl at (C).



Concentrator bowl

## 3 Operating instructions

## 3.1 Operating routine

## 3.1.1 Introduction

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.

## 3.1.2 Before start

- Make sure that the separator is correct assembled according to the instructions given in chapter "5 Maintenance" on page 29.
- Make sure that the three hood screws (3) and the paring disc knob (1) are firmly tightened and that the safety yoke (2) is in its closed (vertical) position.
- Make sure the bowl is free from solids before restarting.



## WARNING

### Disintegration hazard

Unevenly spaced sludge cake will result in heavy vibration and damage can be caused.



- 1. Paring disc knob
- 2. Safety yoke
- 3. Hood screw (3 pcs)

## 3.1.3 Start

- 1. Make sure that the outlet valve (if any) for cleaned coolant is open.
- 2. Start the separator (keep the button pressed 3 4 seconds).



## WARNING

**Disintegration hazard** 

Some vibrations can occur for short periods during the start phase when the separator passes through the critical speed. This is normal and passes over without danger. If the vibrations become very severe or continue at full speed, **stop the separator immediately**. See chapter "4.3 The separator vibrates" on page 26 for possible causes.

3. After 20 seconds (when the separator has gained full speed), turn on the liquid feed to the separator.

Max. recommended flow is 525 litres/hour.

- 4. Regulate the counter pressure in the oil outlet line to 100 200 kPa.
- 5. After 1 minute, check that coolant is not discharging from the separator. Check as illustrated (1) using a torch or check through the oil outlet at the bottom of the separator.

If coolant escapes through the oil outlet, stop the liquid feed and follow the instructions given in "4.7 Some coolant is escaping through oil outlet" on page 28 or "4.8 Coolant flows through oil outlet only" on page 28.



Check if coolant escapes through the oil outlet (1)

## 3.1.4 Operation

## NOTE

Never run the separator longer than 3 days between bowl cleaning.

Check the separator for correct operation (temperature, counter pressure and vibration). This is especially important the first few times the separator is run after installation or after any dismantling and assembly has been carried out.

Check that coolant is **not** discharging from the separator. Check as illustrated (1) using a torch or check through the oil outlet at the bottom of the separator.

If coolant escapes through the oil outlet, stop the liquid feed and follow the instructions given in "4.7 Some coolant is escaping through oil outlet" on page 28 or "4.8 Coolant flows through oil outlet only" on page 28.



Check if coolant escapes through the oil outlet (1)

## 3.1.5 Manual stop

## NOTE

After each stop the separator bowl must be well cleaned. Otherwise an unevenly spaced sludge cake will at next start result in heavy vibration and damage can be caused.

- 1. Turn off the liquid feed.
- 2. Stop the separator.

When the separator has nearly stopped rotating, the contents of the bowl (approx. 1 litre) will be drained out by gravity at the bottom of the separator. This is the normal draining of the bowl as it stops.

3. Make sure that the valves (if any) are closed on both the feed and outlet sides of the separator. If this is not done and the position of the tank level is higher than the inlet/outlet of the separator, there is a risk that coolant may be siphoned through the separator.

## 3.1.6 Automatic stop

The separator is automatically stopped by the 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 the converter.

## NOTE

If the separator stops, the liquid feed must be stopped immediately or there will be serious liquid 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 25 and "4.2 The separator stops" on page 26.

## 4 Trouble shooting

# 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 indicating the position of the safety yoke.             | Make sure that the switch opens and closes when the safety<br>yoke is moved up and down. Measure across terminal points<br>Nos 5 and 6 on the frequency converter board. Replace the<br>switch if faulty.    |
| Incorrect assembly after cleaning.<br>The bowl and motor shaft can not<br>rotate freely. | 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.                         | 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 motor or frequency converter.  | Replace motor or frequency converter (located in Control unit).  |

## 4.2 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.  |
| Too high counter pressure.                          | Reduce the counter pressure (100 - 200 kPa is recommended).     |
| Defective motor or frequency converter.             | Replace motor or frequency converter (located in Control unit). |

# 4.3 The separator vibrates

WARNING

## **Disintegration hazard**

If excessive vibrations occur, **stop** the separator.

| Possible cause   | Action   |
|--|--|
| Bowl out of balance due to:  |  |
| <ul> <li>Insufficient or incorrect cleaning<br/>(sediment in disc stack).</li> </ul> | Dismantle and clean the separator bowl. Be sure that the separator is assembled correctly. |
| • Unevenly spaced sediment cake (bowl not cleaned prior to start).                   |  |
| Incorrect assembly.  |  |
| Vibration dampers are worn.  | Fit three new dampers.   |
| Motor bearings are damaged.  | Fit new bearings.  |

## 4.4 Noise

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

## 4.5 Low outlet flow

| Possible cause                        | Action   |
|---------------------------------------|--|
| Too low flow rate of feed.            | Check the feed line - increase the flow rate.  |
| Too high counter pressure at outlet.  | Reduce the counter pressure (100 - 200 kPa is recommended).  |
| Leakage caused by incorrect assembly. | <ul> <li>The three screws fastening the frame hood or the paring disc knob (the upper part of the separator) are not completely tightened.</li> <li>Dismantle and check the separator bowl parts. Especially check that no O-rings are missing, are defective or incorrectly fitted. Ensure that the separator is assembled</li> </ul> |
|                                       | correctly.   |
| Separator rotates in wrong direction. | Connect the electrical connections properly.   |

# 4.6 Insufficient separation result

| Possible cause                       | Action  |
|--------------------------------------|---|
| The liquid feed rate is too high.    | Reduction of the feed rate improves the separation result.  |
| The counter pressure is too low.     | Increase the counter pressure until oil is observed to be discharged from the oil outlet.<br>Recommended counter pressure is 100 - 200 kPa. |
| The separator disc stack is clogged. | Clean the separator bowl and disc stack.<br>Shorten the cleaning interval.  |

## 4.7 Some coolant is escaping through oil outlet

| Possible cause  | Action   |
|---|--|
| Too high counter pressure at outlet.  | Reduce the counter pressure (100 - 200 kPa is recommended).                |
| The separator disc stack is clogged.  | Clean the separator bowl and disc stack.<br>Shorten the cleaning interval. |
| The three screws fastening the bowl<br>hood or the paring disc knob (the<br>upper part of the separator) are not<br>completely tightened, causing<br>leakage. | Tighten the screws and /or the knob.                                       |

## 4.8 Coolant flows through oil outlet only

| Possible cause                            | Action               |
|---|----------------------|
| Obstruction in cleaned coolant feed line. | Check the feed line. |

# 4.9 No outlet flow either through clean coolant outlet or oil drain

| Possible cause             | Action  |
|----------------------------|---|
| No feed.                   | Check the feed line (valves, feed pump, filter etc.). |
| The separator has stopped. | See "4.2 The separator stops" on page 26.             |

# 4.10 Coolant leakage through oil outlet when separator is not running

| Possible cause  | Action   |
|---|--|
| Coolant is siphoned from coolant tank due to siphon effect. | Close valves (if any) on both feed and outlet sides of the separator or disconnect the liquid hoses/pipes. |
|   | • Place the separator at a level higher than the tank.   |

## 5 Maintenance

## WARNING

### Entrapment hazard

To avoid accidental start, switch off and lock the power supply before starting **any** dismantling work. Make sure that rotating parts have come to a **complete standstill** before starting any dismantling work.

## 5.1 Cleaning

The separated sediment collected inside the separator bowl must be removed manually. The length of the cleaning interval depends on the liquid flow rate and on the amount of solids.

During the initial period, open and inspect the bowl once a day to determine the necessary cleaning interval. The bowl must be cleaned before the solids layer has become thicker than 10 mm. Otherwise there will be risk of that the clean liquid outlet in the bowl will be covered by solids.

"5.4.2 Cleaning of bowl" on page 32 explains how to proceed.

## NOTE

Never use cleaning agents with a pH below 6 or above 9 as they can damage the metal surfaces.

## 5.2 Once per year

Replace the O-rings with new ones included in the O-ring service kit. Their positions are shown in the *Spare Parts Catalogue*. Before fitting, lubricate the O-rings.

See "5.4.3 Replacement of O-rings" on page 36 how to proceed.

Check the condition of discs in the bowl, replace if necessary. See comments in "5.3.1 Disc stack replacement" on page 30.

## 5.3 Every second year

## 5.3.1 Disc stack replacement

Check/replace the disc stack to maintain the separation efficiency. At separation temperature 60  $^{\circ}$ 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.

See "5.4.3 Replacement of O-rings" on page 36 how to proceed.

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 position of the vibration dampers is shown in illustration No. 11 at page 38.

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

# 5.4 Dismantling - assembly instructions

## 5.4.1 Introduction

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 symbols only to indicate the actions required. The key to the symbols is given below.



## 5.4.2 Cleaning of bowl

## Comments to illustrations on opposite page.

#### **Illustration 4:**

Before dismantling the separator, wait until the rotating parts have come to a complete standstill, which will take up to two minutes.

To be sure, open the front cover and check that the rotation of the electric motor shaft has stopped.



## NOTE

If the separator is opened too soon, the following could happen:

- The pin on the inside of the connecting housing breaks.
- The pin inside the top of the paring disc breaks.
- Excessive wear of top of level ring.

#### **Illustration 8:**

A few drops of coolant will normally leak from the connecting housing when the bowl hood is opened.

If coolant continues to leak, the cause could be a non-sealing check valve (if any) while the separator is connected to a tank with a level higher than the separator (siphon effect).

#### **Illustration 15:**

## NOTE

Never use sharp or metallic tools when cleaning the bowl wall. This can damage the coating. Always use soft rags.

Cleaning of the disc stack in not normally necessary unless sediment has accumulated and entered the stack (cleaning interval too long).

## Dismantling



\*

See comments on opposite page

## Comments to illustrations on opposite page.

#### **Illustration 16:**

When fitting the bowl wall, press firmly downwards with both hands to overcome the resistance from the O-ring fitted on the bowl bottom. A "clicking" sound will be heard.

#### **Illustration 17:**

If the level ring (1) and O-ring (2) have been removed, first fit the level ring and then the O-ring outside the level ring. Finally press down the O-ring by pressing the cover (3) firmly with both hands.



#### **Illustration 18:**

Check that the distance illustrated is max. 0,5 mm. If not, the reason could be:

- 1. The O-ring outside the level ring is not in the downwards position or the O-ring is located under the level ring.
- 2. Two washers are fitted under the centre screw fixing the bowl to spindle.

#### **Illustration 20:**

Only tighten by hand. Never over tighten when assembling parts.



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### Illustration 22:

### NOTE

Always screw home the knob fitted on the connecting housing **before** tightening the screws shown in illustration 23. Otherwise there is a risk that the pin inside the connecting housing could break.

## Assembly



## 5.4.3 Replacement of O-rings

## Comments to illustrations on opposite page.

#### Illustration 5:

Take care of the washer.

#### **Illustration 13:**

Check that the washer is fitted. Otherwise there is a risk that the bowl will not make firm contact with the spindle.

If two or more washers are fitted accidentally this will prevent the top parts of the bowl from being positioned correctly.

#### **Illustration 15:**

### NOTE

Fit the upper O-ring outside the level ring, see comments to illustration 17 on page 34.



First dismantle the separator bowl as described in "5.4.2 Cleaning of bowl" on page 32.

★ See comments on opposite page.

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## 5.4.4 Replacement of motor bearings

First dismantle the separator bowl as described in "5.4.2 Cleaning of bowl" on page 32.



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See "**Assembly**" on page 35 for how to assemble the rest of the separator.

## 5.4.5 Replacement of connection housing



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## 6 Technical references

## 6.1 Product description

Alfa Laval ref. 576350, rev. 4

| Product number:                                     | 881176-09-01/1   |
|---|--|
| Separator type:                                     | IFB 403X-73  |
| Application:  | Removal of solids and tramp oil from coolants  |
|   |  |
| Technical design:                                   | Solid-wall separator bowl made of aluminium and plastics with concentrator function. |
|   | Motor intended for frequency converter, mounted on bowl spindle.                     |
|   | Rigidly mounted top bearing. Exterior rubber buffers.                                |
| Design in accordance with directives and standards: | See "6.1.1 Declaration" on page 44   |
| Restrictions:                                       | Max. hydraulic capacity 0.75 m <sup>3</sup> /h                                       |
|   | Feed temperature: +15 °C to +70 °C   |
|   | Ambient temperature: 0 °C to +55 °C  |
|   | Use is restricted to above mentioned coolants.                                       |
|   | Recommended for liquid with pH-values between 6-9                                    |
|   | Risk for corrosion and erosion has to be investigated in each case.                  |

## 6.1.1 Declaration

Alfa Laval ref. 591985, rev. 10

This declaration is issued under the sole responsibility of the manufacturer.

| Manufacturer:          |
|------------------------|
|                        |
|                        |
| Туре:                  |
| Product specification: |
| Configuration number:  |
| Serial number:         |
|                        |

#### **Declaration of Incorporation of Partly Completed Machinery**

The machinery complies with the relevant, essential health and safety requirements of:

| Description  |
|--|
| Machinery Directive  |
| e following standards have been applied:   |
| Description  |
| Electrical equipment of machines, part 1: General requirements                           |
| Safety of machinery - General principles for design - Risk assessment and risk reduction |
| Acoustics - Determination of sound power levels of noise sources using sound pressure    |
|  |

#### **EU Declaration of Conformity**

The machinery complies with the following Directives:

| Designation | Description                   |
|-------------|-------------------------------|
| 2014/30/EU  | Electromagnetic Compatibility |

The technical construction file for the machinery is compiled and retained by the authorized person Fredrik Nytomt within the Business Unit High Speed Separators, Alfa Laval Tumba AB, SE-14780 Tumba, Sweden. By reasoned request all relevant technical documentation will be sent by post to national authorities.

This machinery is to be incorporated into other equipment and must not be put into service until it has been completed with starting/stopping equipment, control equipment, auxiliary equipment. e.g. valves, according to the instructions in the technical documentation, and after the completed machinery has been declared in conformity with the directives mentioned above, in order to fulfil the EU-requirements.

| Signed for and on behalf of: . |  |
|--------------------------------|--|
| Place:                         |  |
| Date of issue:                 |  |
|                                |  |
| Signature:                     |  |
| Name: .                        |  |
| Function: .                    |  |
|                                |  |

## 6.2 Technical data

Alfa Laval ref. 576339, rev. 3

| General technical data                        |             |                      |
|---|-------------|----------------------|
| Motor power:                                  | 0,45        | kW                   |
| Power consumption, idling / at max. capacity: | 0,2 / 0,5   | kW                   |
| Gear ratio:                                   |             | direct drive         |
| Bowl inner diameter max:                      | 176         | mm                   |
| Jp reduced to motor shaft:                    | 0,03        | kg/m <sup>2</sup>    |
| Start time max.:                              | 0,5         | minutes              |
| Density of sediment / feed, max.              | 1600 / 1000 | kg/m <sup>3</sup>    |
| Feed temperature min./max:                    | 15 / 70     | Oo                   |
| Bowl material AL 111 4212-06                  |             | 6                    |
| Operating data                                |             |                      |
| Allowed speed max.:                           | 7500        | r/minute             |
| Speed motor shaft max .:                      | 7500        | r/minute             |
| Stop time, normal stop max .:                 | 3           | minutes              |
| Sound power:                                  | 7,9         | Bel (A)              |
| Sound pressure:                               | 62          | dB (A)               |
| Vibrations, separator in use                  | 30          | mm/second (r.m.s)    |
| Volume and capacity data                      |             |                      |
| Hydraulic capacity, bowl, max.:               | 0,75        | m <sup>3</sup> /hour |
| Bowl liquid volume:                           | 1,1         | litres               |
| Weight information                            |             |                      |
| Weight of separator                           | 18          | kg                   |
| Weight of bowl                                | 4           | kg                   |

## 6.3 Basic size drawing

Alfa Laval ref. 576171, rev. 0



All connections to be installed non-loaded and flexible

## 6.4 Connection list

Alfa Laval ref. 576334, rev. 0

| No. | Description   | Requirements/limits                        |
|-----|---|--|
| 201 | Inlet for process liquid                            |  |
|     | <ul> <li>Allowed temperature</li> </ul>             | Min. 15 °C, max. +70 °C                    |
|     | <ul> <li>Viscosity</li> </ul>                       | Max. 40 cSt                                |
|     | <ul> <li>Flowrate</li> </ul>                        | Max. 525 litres/hour                       |
|     | – Pressure  | 0-60 kPa                                   |
| 220 | Outlet for light phase                              | No counter pressure                        |
| 221 | Outlet for heavy phase                              |  |
|     | <ul> <li>Counter pressure</li> </ul>                | 170 kPa                                    |
| 225 | Bowl drain outlet                                   | No counter pressure                        |
| 701 | Motor for separator                                 | See "6.5 Interface description" on page 49 |
|     | – Voltage   | 3 x 230 VAC / 125 Hz                       |
|     | <ul> <li>Current, max.</li> </ul>                   | 3 A  |
| 760 | Cover interlocking switch                           | See "6.5 Interface description" on page 49 |
|     | – Туре  | Magnetic proximity switch                  |
|     | <ul> <li>Switch rating, voltage<br/>load</li> </ul> | 230 V AC<br>20 VA                          |

## 6.5 Interface description

Alfa Laval ref. 576337 rev. 1

## 6.5.1 Scope

This document gives information, requirements and recommendations about operational procedures and signal processing for safe and reliable operation of the separator. It is intended to be used for designing auxiliary equipment and control system for the separator.

## 6.5.2 References

This Interface Description is one complementary document to the separator. Other such documents that contain necessary information and are referred to here are:

#### "Connection list" on page 48

"Technical data" on page 46

#### Standards referred to are:

- EN ISO 13850 Safety of machinery -Emergency stop equipment, functional aspects - Principles of design
- EN ISO 14118 Safety of machinery -Prevention of unexpected start-up
- EN ISO 13849-1 Safety of machinery Safety related parts of control systems - Part 1 General principles for design

## 6.5.3 Definitions

For the purpose of this document, the following definitions apply:

- Maximum allowed speed: The speed the separator bowl and other, to the bowl spindle attached parts, never shall exceed.
- Change of separator mode: It is assumed that the control system has done a reasonable amount of trials to correct the fault condition before further steps are initiated.

## 6.5.4 Goal

To eliminate situations that can cause harm, i.e. injury, damage to health or property and unsatisfactory process result are e.g.:

| Situation   | Effect   |
|---|--|
| Failure in control system.                                    | Too high stress on bowl which might cause harm.                    |
| Unbalance caused by uneven sediment accumulation in the bowl. | Too high stress on bowl and bearing system which might cause harm. |
| Bowl speed exceeding maximum allowable rotor speed.           | Too high stress on bowl which might cause harm.                    |
| Insufficient cleaning of centrifuge.                          | Unsatisfactory product quality.                                    |
| Bowl leakage.   | Product losses.  |

Information and instructions given in this document aim at preventing these situations.

For this reasons functions that are indispensable or needed for safety reasons to protect the machine and/or personnel are denoted with shall while other functions are denoted with should.

## 6.5.5 Description of separator modes

For control purposes the operation of the separator should be divided into different modes.

The normally used modes are described below but other modes might exist.

It is assumed that:

- The separator is correctly assembled.
- All connections are made according to Connection List, Interconnection Diagram, and Interface Description.
- The separator control system is activated.

If above conditions are not fulfilled the separator will be in *SERVICE* mode.

#### STAND STILL means:

- The power to the separator motor is off.
- The bowl is not rotating.

#### STARTING means:

- The power to the separator motor is on.
- The bowl is rotating and accelerating

#### RUNNING means:

- The power to the separator motor is on.
- The bowl is rotating at operating speed.

*RUNNING* is a collective denomination for a number of sub modes which e.g. can be:

- STAND BY: Separator is in a waiting mode and not producing.
- *PRODUCTION*: Separator is fed with product and producing.

STOPPING means:

- The power to the separator motor is off.
- The bowl is rotating and decelerating.

*STOPPING* is a collective denomination for a number of sub modes which e.g. can be:

- NORMAL STOP: A manually or automatically initiated stop.
- SAFETY STOP: An automatically initiated stop.
- EMERGENCY STOP: A manually initiated stop at emergency situations. This stop will be in effect until it is manually reset.

## 6.5.6 Handling of connection interfaces

**Electrical connections** 

#### 701 Separator motor.

The separator is equipped with a 3-phase special motor. The motor is intended to be fed from a electric power drive. The design of the electric power drive shall include an overspeed protection which prevents the separator to reach a speed that exceeds the "Maximum allowed speed" stated in the "Technical Data".

The electric power drive shall be protected against intentionally and unintentionally overspeed settings.

The acceleration period is to be chosen with regard to the separator's moment of inertia, the braking torque during start, the motor's rated torque.

The design, installation and handling of the electric power device shall follow local laws, standards and directives in force as well as international.

There shall be an emergency stop circuit designed according to EN ISO 13850 and a power isolation device according to EN ISO 14118.

There shall be a start button close to the separator that shall be used for first start after assembly of the separator.

Signal processing in STARTING:

 The separator should be stopped automatically according to NORMAL STOP procedure and an alarm should be given when the accumulated time for acceleration is longer than the maximum time specified in "Technical Data". An abnormal start time indicates some malfunction of the separator equipment and should be investigated.

Signal processing in *RUNNING*:

 If low speed is indicated, the separator should be stopped automatically according to NORMAL STOP procedure and an alarm should be given. Low speed indicates some malfunction of the separator equipment and shall be investigated.

#### 760 Cover interlocking switch

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 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 the interlocking circuit is not closed.

### 6.5.7 Fluid connections

Complementary information is given in "Connection List".

201 Inlet

Processing in *STAND STILL*:

• Shall be closed.

Processing in STARTING:

 Shall be closed. Bowl will be empty or filled depending on if start is done from STAND STILL or STOPPING.

Processing in RUNNING:

"Could be closed or open.

Processing in *NORMAL STOP* or *EMERGENCY STOP*:

• Could be closed or open but the bowl should be filled unless the stop is initiated in *STARTING*.

Processing in SAFETY STOP:

• Could be closed or open but the bowl should be filled unless the stop is initiated in *STARTING*.

#### 220, 221 and 222 Outlets

Processing in STAND STILL:

• Could be closed or open.

Processing in other modes:

• Shall be open.

## 6.6 Foundation drawing

Alfa Laval ref. 576170, rev. 0



- A. Recommended thickness 3 min
- B. Horizontal deviation, max. 3°
- C. Service side
- D.  $3 \times 07 \pm 0.2$  mm, spaced  $120^{\circ}$  for foundation bolts

G0935121

#### **Plate location drawing** 6.7

Alfa Laval ref. 576172, rev. 0



1. Safety 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.

Machine plate 2.

Plate placed on the separator base.

Text on label:

Separator type

Product number

Speed max.

Rotation

Supply voltage

Current max.



## **A CAUTION**

Read and understand operator's manual before using this



S0061411

S014781