**A4QV Mareesburg Project**

**Fluor Purchase Order or Contract Number**

A4QV-4-7-106P0-P541B - Filter

**Larox**

<table>
<thead>
<tr>
<th>Supplier or Contractor to Complete</th>
<th>Submittal Revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Issue</td>
<td>1</td>
</tr>
<tr>
<td>Resubmission</td>
<td>1</td>
</tr>
<tr>
<td>&quot;As Built&quot; final</td>
<td>FD Number</td>
</tr>
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</table>

**Equipment / Tag Number:**

8720-FL-001

**Document No.:**

DOC25954

**Fluor Document Code (EDR Code):**

IOM

**Category No.:**

Sequence Number:

**Date Received by Fluor:** 25 Sept 2012

**Date Reviewed:** /16/0/2012

**Document Reviewed by:**

- A- Proceed
- F- Final
- B- Proceed, change as Noted
- AB - As Built
- C- Do not Proceed
- Q- Quality below Standard
- I.O- Information Only

**Review Signature (Name):** [signature]

"B" instruction code on second review and "C" and "Q" instruction codes will require a desktop review with all parties.

THIS REVIEW DOES NOT RELEASE THE SUPPLIER / CONTRACTOR FROM ITS CONTRACTUAL OBLIGATIONS AS PER THE PO OR THE CONTRACT.

**NOTE FROM DAVID HATTINGH:**

- Documentation Accepted on Status Submitted.

24 JULY 2012
INSTALLATION
OPERATION
MAINTENANCE

PF1041

Outotec
More out of ore
Outotec Larox PF
PF19/25 M12 1 45
Rhodium Reefs Ltd

Outotec (Filters) Oy
P.O. Box 29
53101 Lappeenranta
Finland
Tel +358 (0) 20 529 4236
Fax +358 (0) 20 529 4439
E-Mail info@outotec.com
firstname.lastname@outotec.com
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1. **Introduction to the machine**

To safely install, operate, maintain and decommission this machine you must read and fully understand the installation, operation, maintenance and safety instructions. Only qualified personnel may install, operate, maintain or decommission the machine.

1.1. **Unit identification**

1.1.1. **Product identification**

<table>
<thead>
<tr>
<th>Product name</th>
<th>Press Filter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type designation</td>
<td>PF12 SERIES</td>
</tr>
<tr>
<td>Serial number</td>
<td>PF1041</td>
</tr>
<tr>
<td>Year of construction</td>
<td>2012</td>
</tr>
</tbody>
</table>

The product information is presented in the product plate on the machine. Picture below is an example of name plate.
1.2. Manuals and documentation

1.2.1. Purpose of the document

The purpose of this manual is to make it easier to become acquainted with the machine and machine functions. Document contains important advice and instructions to operate the machine in a safe, proper and economical manner.

Following these instructions will help to avoid risks, to reduce repair costs and down-times and to improve the reliability and life of the machine.

In addition to these Operating Instructions, the information and instructions in the supplier’s documentation must also be followed (see attachments).

1.2.2. Original documents

All information and advice in this document have been written with our present experience and insights to the best of our knowledge.

The original version of this document may have been written in another language. Details about original document version and translation are written in the front cover.

All illustrations and drawings in these operating instructions only serve as a general illustration, as their details are not always decisive for construction.

This document and its appendices must be kept throughout the lifespan of the product. Attach any further changes to the document and keep it clean and accessible for whenever it is needed. If the document is damaged, immediately order a new one. If the product is sold, the new owner must be provided with the document.

1.2.3. Additional copies and copyright of the document

Additional copies of these documents can be ordered from the manufacturer. Please note that further copies are not free of charge.

All rights expressly reserved. Reproduction or communication to third parties, no matter in which form, is not permitted without our written consent.
1.2.4. **Scope of the manual**

This installation and operation manual includes the information for installing and operating the Outotec pressure filter and related safety issues.

The detailed technical data (e.g. drawings and spare parts list) and descriptions of the working methods, maintenance procedures etc. are contained in this operation and maintenance manual.

An interleaf separates the groups of the main division from each other and the instructions in the main division are in numeric order.

---

**DANGER**

Do not operate or perform maintenance on the automatic pressure filter until you have read and understood this operation and maintenance manual.

---

We hope this manual will help you to make the best use of your filter.

1.3. **Intended use of the filter**

1.3.1. **Construction and operation**

The OUTOTEC PF filter is intended for indoor professional automatic use in the mining and chemical process industries. It is an automatic operating pressure filter for efficient solid/liquid-separation. The machine can be operated remotely from a control room or locally from the control panel.

The main operating stages of the PF filter include filtering, diaphragm pressing, cake washing and compressed air drying.

The filtration elements (i.e. plates) of the PF filter are placed horizontally between two pressure plates. During filtration the plate pack is pressed together, and the pack is opened for cake discharge.

The plate pack is opened and closed with hydraulic cylinders.

The endless filter cloth zigzags between the filter plates and results in the filtered cake being formed on either side of the filter cloth. While the filtrate squeezes through the filter cloth, it absorbs and removes solid matter particles remaining in the filter cloth from preceding filtration cycles.

The filter cloth transports the cakes off the filter and, at the same time, the filter cloth is cleaned from both sides by high pressure water sprays. The filter cloth moving device is actuated by a hydraulic motor which actuates the filter cloth drive roller. When the filter plates are opening and closing, the tension of the filter cloth is maintained at a level by a simple filter cloth tensioning device. The filter cloth tensioning device operates during plate pack opening and closing.
Slurry is fed into the filter chambers through a distributor pipe located on the feed side of the filter (the feed side is on the left looking from the direction of the drive unit). Wash liquid and drying air are fed through the same pipe. The distribution pipe is emptied through a drain valve.

Pressing water is generated by a multistage centrifugal pump and is led above the diaphragm through a water distribution pipe. After the pressing stage the water returns to the pressing water station through the same pipe.

The operation of the filter is controlled automatically by the operation unit containing the programmable logic, operator's interface, switches, push buttons and graphic display panel to enable easy adjustments and cycle observation.

The automatically controlled actuators are hydraulically operated.

---

**DANGER**

It is strictly forbidden to use this machine in any other way or for any other purpose, other than those specified in this instruction manual and its appendices.
1.3.2. **Filter types**

The filtration area can vary depending on the model, as shown in the table below.

<table>
<thead>
<tr>
<th>PF 12</th>
<th>9,5/9,5</th>
<th>12,5/16</th>
<th>16/16</th>
<th>16/19</th>
<th>19/19</th>
<th>22/25</th>
<th>25/25</th>
<th>28/32</th>
<th>32/32</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filtration area (m²)</td>
<td>9,45</td>
<td>12,6</td>
<td>15,75</td>
<td>15,75</td>
<td>18,9</td>
<td>22,05</td>
<td>25,2</td>
<td>28,35</td>
<td>31,5</td>
</tr>
<tr>
<td>Filter plates (pcs)</td>
<td>6</td>
<td>8</td>
<td>10</td>
<td>10</td>
<td>12</td>
<td>14</td>
<td>16</td>
<td>18</td>
<td>20</td>
</tr>
<tr>
<td>Filter plate size (mm)</td>
<td>900 x 1750</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main dimensions, length (mm)</td>
<td>4250</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main dimensions, width (mm)</td>
<td>3600</td>
<td>3600</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main dimensions, height (60 mm chambers) (mm)</td>
<td>2600</td>
<td>3100</td>
<td>3600</td>
<td>4100</td>
<td>4600</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight (metric tons)</td>
<td>10,9</td>
<td>12,0</td>
<td>12,7</td>
<td>13,5</td>
<td>14,2</td>
<td>16,1</td>
<td>16,8</td>
<td>17,4</td>
<td>18,1</td>
</tr>
<tr>
<td>Required floor area (m²)</td>
<td>39,5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. pressure (bar)</td>
<td>16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Filter cloths, width (mm)</td>
<td>1050</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Filter cloths, length (m)</td>
<td>21,5</td>
<td>27,5</td>
<td>33</td>
<td>34</td>
<td>38,5</td>
<td>44,5</td>
<td>49,5</td>
<td>55</td>
<td>60,5</td>
</tr>
<tr>
<td>Electric motors (400V, 50 Hz)</td>
<td>18,5 - 1500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Hydraulic unit (kW-r/min)</td>
<td>0,55 - 1500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cloth centering (kW-r/min)</td>
<td>11 - 3000</td>
<td>15 - 3000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressing water pump (kW-r/min)</td>
<td>1500</td>
<td>2500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressing water tank (l)</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
General marking principle for filters:

Company, Brand, Filter family, Size specification(s)/series, Material, Extra parameters, options

<table>
<thead>
<tr>
<th>Outotec Larox PF 19/25 M12 1 45</th>
<th>19 /25</th>
<th>M12</th>
<th>1</th>
<th>45</th>
</tr>
</thead>
<tbody>
<tr>
<td>filtration area</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>frame size (max area)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>filter series</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>construction material</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>chamber height</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>diaphragm type for 45mm chamber</td>
<td></td>
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</tr>
</tbody>
</table>

Construction material (material of parts in direct contact with slurry or filtrate):

1 = AISI 304L used in processes where pH is 4 - 14
2 = AISI 316L used in processes where pH is 2 - 4
3 = ASTM N08904L used in strongly acid processes where pH is 1 - 2
4 = PP polypropylene plates; steel parts & pipes AISI304
5 = EN1.4462 (SAF2205) for processes where high CL content
6 = EN 1.4162 (“Lean Duplex”) limited availability (Good chlorides resistance, high tensile strength, corrosion resistance slightly below material 2). Only base plate of filter plate made of 1.4162 other wetted parts acc material 1.
X = Other materials, specified in the technical description

Chamber height:

30 = 30 mm chamber (available only for 1.6 m² and 2.5 m² plate size with certain limitations)
33 = 33 mm chamber (available for 6 m² plate size with certain limitations)
40 = 40 mm chamber (only option with PP plates, plate size 1.6 m², available for PF9.5 – PF32 in 12 series)
45 = 45 mm chamber
60 = 60 mm chamber
Diaphragm type (for 1,6m² plate with 45mm chamber):

No marking for flat diaphragm type

C = cup-type diaphragm

1.4. **Recommended operating conditions**

Maximum limits of the surrounding conditions, for example temperature, humidity etc.

Ambient temperature: 0°C … 50°C
1.5. Warranty information

1.5.1. Warranty terms

Warranty terms of the delivered goods are in accordance with the "contract" or the "contractual purchase order" or if otherwise not specified, then in accordance with general terms NL 85 and NLM 84 with the exception of the below mentioned amendments and additions:

The warranty does not cover:

- Wearing parts such as filter cloths, diaphragms, seals, slide pieces, valve balls and sleeves, V-belts, chains, scrapers, grids, closing device, hydraulic hoses and hydraulic seals.
- Direct or consequential damages which have been caused by structural alterations or use of such parts, which are not of original manufacture.
- Any filter or part of the filter that has been resold by the original contractual purchaser unless agreed in writing with Outotec of the transfer of the remaining warranty period to the new owner.

The claims against the warranty must be made by the purchaser in writing, within a reasonable time after the damage has been discovered.

The following information must be indicated on the claims:

- the serial number of the filter
- date when the damage was discovered
- operational data of the filter when the damage was discovered
- full details of the damage

The damaged part must be sent with the claim to Outotec, freight prepaid. If the mentioned terms are not followed properly, the purchaser may lose his right to the warranty.

Unless otherwise stated, the warranty of the repair work and/or replacement parts shall expire simultaneously with the warranty of the filter.

Outotec (Filters) Oy
### 1.5.2. Warranty claim

<table>
<thead>
<tr>
<th>Warranty claim</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>□ WARRANTY CLAIM</td>
<td>□ CLAIM</td>
</tr>
<tr>
<td>□ RETURNED GOODS</td>
<td>DATE:</td>
</tr>
</tbody>
</table>

**Customer’s name/Contact**
- Affiliate or distributor: Outotec (Filters) Oy
- Address: P.O.Box 29
- FIN-53101 Lappeenranta, Finland

**Country**

**Phone**
- Phone: +358 20 529 4236
- E-mail: info@Outotec.com

**Fax**
- Fax: +358 20 529 4439
- Internet: www.Outotec.com

**Filter type**

**Principal part involved**
- Part No.

**For Outotec’s use only**
- Business unit

**Description of the case, place, circumstances, etc.**

#### Goods to be returned

**Component delivered to customer**
- □ with filter
- □ other delivery date:

<table>
<thead>
<tr>
<th>Qty.</th>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**Signature**

**Warranty status**
- Warranty period
- □ Yes
- □ No

**Actions**
- □ To be repaired
- □ Claim returned for completion
- □ To be scrapped
- □ Claim accepted
- □ Rejected

**To be delivered to supplier for inspection**

<table>
<thead>
<tr>
<th>Date</th>
<th>By</th>
<th>Date of credit</th>
<th>Credit invoice</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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</tbody>
</table>
1.6. **Prohibited uses of the filter**

- **DANGER**
  
  It is strictly forbidden to use this machine in any other way or for any other purpose, other than those specified in this instruction manual and its appendices.

- **WARNING**
  
  Crushing hazard. Falling filter plates can cause death or serious injury. Do not place body parts between the filter plates without first securing the hanging plates.

- Do not use the feed hoses or filter plates for climbing.
- Do not take samples from the solids flow when the machine is discharging.
- Do not change the process operation parameters in the PLC. This can cause product related problems, such as blocking and blinding of the feed lines. This can also lead to mechanical failures of the filter elements.
- The slurry used in the machine may only be in accordance to the original technical specification. Use of other slurry may cause corrosion, mechanical wear, chemical hazards etc.
1.7. **EC declaration by manufacturer**

The machine can be delivered in two alternative executions according to the definition by the EC Machinery Directive 2006/42/EC as follows:

(a). as “complete machinery” (ref. Directive 2006/42/EC, Article 2 (a)) with the following declaration:

EC Declaration of Conformity of the Machinery (Directive 2006/42/EC, Article 5, Annex II, Sub A)

**NOTE!** CE-mark fixed on the machine by manufacturer.

(b). as “partly completed machinery” (ref. Directive 2006/42/EC, Article 2 (b)) with the following declaration:

Declaration of Incorporation of Partly Completed Machinery (Directive 2006/42/EC, Article 5, Annex II, Sub B)

**NOTE!** Machine delivered without a CE-mark.
1.8. **Warning and safety symbols used in this manual**

The warnings in this manual have been divided into the following categories.

- **DANGER**: The term “DANGER” indicates a hazardous situation which, if not avoided, will result in death or serious injury.

- **WARNING**: The term “WARNING” indicates a hazardous situation which, if not avoided, could result in death or serious injury.

- **NOTICE**: The term “NOTICE” indicates a situation which, if not avoided, could result in damage to property.

1.8.1. **Safety symbols**

The safety symbols found in this manual may also be posted on the machine. All personnel involved in the operation, installation, maintenance or repairing of the machine must observe and be familiar with all safety symbols, labels and instructions.

- Keep safety instructions and safety labels clean and visible at all times.

- Replace any illegible or missing safety instructions and safety labels before operating the machine.
Hazard
The black symbol inside a yellow triangle with a black border describes the hazard.

Prohibition
The black symbol inside a red ring with a diagonal red bar describes the action that should not be taken.

Mandatory action
The white symbol inside a blue circle describes the action that must be taken to avoid a hazardous situation.
Hazard symbols

These symbols are used in warnings to indicate a hazardous situation or action. Hazard symbols are divided into five categories according to nature:

- Mechanical hazards
- Electrical hazards
- Radiation hazards
- Material/substance hazards
- Ergonomic hazards
- Second Heading

**Mechanical hazard symbols**

The hazard symbols related to each hazardous situation are presented in the following table.

1. Falling load hazard
2. Squashing hazard
3. Flying material hazard
4. Crushing hazard - feet
5. Crushing hazard - hands
6. Cutting hazard
7. Entanglement hazard
8. Entanglement hazard
9. Entanglement hazard
10. Falling hazard
11. Trip hazard
12. Skin injection hazard
13. High pressure injection hazard
Electrical hazard symbols

- Electrical hazard
- Dangerous electrical voltage
- Electrical shock / Electrocution hazard

Radiation hazard symbols

- Radioactive hazard
- Laser hazard

Material / Substance hazard symbols

- Hot surface hazard
- Explosion hazard
- Flammable hazard
- Hazardous / Poisonous material hazard
- Chemical burn hazard
- Silica / dust hazard

Ergonomic hazard symbols

- Lifting hazard
- Environment pollution hazard
Prohibited action symbols

These symbols are used in warnings and notifications to indicate an action that should not be taken. The prohibited action symbols are presented below.

- No climbing
- No smoking
- No open flames
- Do not touch
- Limited or restricted access
- Do not weld
- Do not remove safety guard
- General symbol for prohibited action

Mandatory action symbols

These symbols are used in warnings and notifications to indicate an action that must be taken. The mandatory action symbols are presented below.

- Wear safety gloves
- Wear eye protection
- Wear safety helmet
- Wear safety harness
- Wear ear protection
- Wear steel toed safety boots
- Wear close fitting overalls
- Wear high visibility vest
- Wear respirator
1.9. **Contact information**

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Outotec (Filters) Oy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adress</td>
<td>P.O. Box 29</td>
</tr>
<tr>
<td></td>
<td>53101 Lappeenranta</td>
</tr>
<tr>
<td>Telephone</td>
<td>+358 20 529 4236</td>
</tr>
<tr>
<td>Fax</td>
<td>+358 20 529 4439</td>
</tr>
<tr>
<td>Internet</td>
<td><a href="http://www.Outotec.com">www.Outotec.com</a></td>
</tr>
</tbody>
</table>

1.10. **Revision history**

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>14.11.2011</td>
<td>First issue / Draft</td>
</tr>
<tr>
<td>B</td>
<td>19.03.2012</td>
<td>Final</td>
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2. Safety instructions

2.1. General safety instruction

Before starting the filter, read through and make sure you understand the operation and maintenance manual.

**WARNING**

This sign means: WARNING! An injury may follow if the instructions are not carefully followed.

**CAUTION**

CAUTION! This text is a warning of a possible damage to property. Damage may occur if the instructions are not carefully followed.

1. Never start any maintenance or repair work during the operation of the filter.
2. Never open the hose shields during operation.

Remember:

3. Before starting the filter, make sure there is nobody in the vicinity of the filter.
4. Before starting the filter, make sure that there are no strange objects between the plates.
5. Take into account that the operation of the filter requires the use of pressing air and water as well as hydraulic oils at high pressures. The slurry hoses operate under pressure as well. Damage in any of these pressure pipelines may be dangerous.
6. Take into account that the filter operates automatically and thus different parts may move without any separate measures.
7. When working in close proximity to the filter, always use a helmet, goggles and overalls with long sleeves. When filtering corrosive or other dangerous materials, take into account special protection requirements.
8. During minor maintenance, repair or adjustment work, stop the filter at the end of the cycle and press the EMERGENCY STOP switch down. Proper Lock out Procedures shall be followed.
9. For a longer stop, or whenever working in between the plates, stop the filter at the end of the cycle, lock the plate pack, close the manual valves and switch off the electricity from the main switch.
10. If the filter is located in a hazardous area where there is a danger of explosion, make sure that the cloth is wetted all around with conductive liquid (e.g. water) before it is moved.

**NOTE!** If the cloth is moved while dry, there must be no hazardous gases, dust or any other explosively sensitive materials in the same space with the filter.

### 2.2. Training the personnel

#### 2.2.1. Advice on precautionary measures to be taken by the operator

Only personnel with the necessary qualifications may carry out work on the machine.

Clearly define responsibilities and accountability of the operating and maintenance personnel.

Complete these operating instructions with the rules from national health and safety regulations (e.g. occupational organization) and environmental protection standards.

Complete the operating instructions by adding the regulations that consider operational features (e.g. supervisory and notification duties, work organization, operating sequences, personnel used, fire alarm and fire fighting possibilities, use of fire extinguishers).

Complete the operating instructions by adding compulsory local regulations on the prevention of accidents and environmental protection (e.g. handling hazardous substances, disposing of operating and/or auxiliary materials, placing at disposal/wearing personal protective gear).

Besides the operating instructions valid local legitimate regulations on prevention of accidents at the country of application must be observed.

In addition locally recognized technical rules on safe and correct working are to be followed.
Always keep the operating instructions available for personnel in a legible condition at the place of installation.

2.2.2. Organizational measures

Instruct the operating instructions to be observed.

Make sure the directions are followed by personnel.

NOTE! When the personnel discover failures or dangers, the operator or the authorized person must be informed of this immediately.

2.2.3. Maintaining perfect technical condition

Keep all safety instructions and danger warnings at/on the machine in a complete and legible condition.

Keep to all recurring deadlines for controls/inspections as well as for the replacement of safety-relevant components that are prescribed (by law) or referred to in the operating instructions.

Spare parts must meet the technical requirements specified by the manufacturer. These are always guaranteed with original spare parts.

Make sure the appropriate tools are available to carry out maintenance measures.

Do not make any modifications, extensions or conversions on the machine that could restrict its safety without consulting the manufacturer/supplier. This also applies to the installation and adjustment of safety devices and valves as well as for welding on load-bearing parts.

Do not change the programs (software) on programmable control systems!
2.2.4. Training the personnel

Selection and qualification of personnel

- Work at/with the machine may only be carried out by reliable personnel. Observe the lawfully permitted minimum age!

- Only use trained or at least instructed personnel. Instruct and occasionally check that only authorized personnel are working at the machine.

- Clearly define the personnel’s responsibilities and accountability for operation, setup, maintenance and service.

- Only permit personnel to be trained, instructed or in an apprenticeship to work at the machine under the supervision of an experienced person.

- Work on electrical equipment of the machine may only be carried out by a qualified electrician or by an instructed person under the directions and supervision of a qualified electrician. The electrical rules are to be observed for safety reasons.

- Only qualified personnel with experience may work at the hydraulic/pneumatic system.

NOTE! The operator can instruct the operating personnel by using the attached “Instruction Form”.
2.2.5. Instruction form

The following instruction confirmation form can be used to ensure personnel have been familiarized with important information concerning the filter.

<table>
<thead>
<tr>
<th>No.</th>
<th>Instruction Item</th>
<th>Date</th>
<th>Signature of instructed person</th>
<th>Signature of instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>To read the operating instructions and to clarify all possible questions.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>The operation method of the filter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Pictographs and information signs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Safety equipment of the filter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Personal protective equipment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Changing the filter cloth</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Work regulations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Additional operating instructions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Cleaning instructions</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.2.6. Target groups

The Operator as a superior legal entity is responsible for the intended use of the machine and for training and using authorized persons. He determines the authorized person’s binding responsibilities and authority to issue instructions.

According to the current machinery directive, Operating Personnel are people responsible for the installation, operation, setup, maintenance, cleaning, repairs or transport of machines.

A Skilled Worker is a person who, owing to his training in the subject, knowledge and experience, is able to assess the tasks is has been entrusted with and recognize any possible hazards. He also has knowledge of the governing regulations. Only qualified personnel or personnel that the operator judges capable can be considered.

A Trained/Instructed Person is someone who has been instructed or, if necessary, received on-the-job training in the tasks he has been entrusted with and to recognize the possible dangers with improper behavior. This person has also been informed about the necessary protective equipment and precautionary measures. Personnel that still have to be trained instructed or who are in general training may only work under the permanent supervision of an experienced person.
2.3. Main safety risks in operation and maintenance of the machine (residual risks)

Make sure there are no unauthorized persons in the danger zones during use.

Always use personal protective equipment, such as a safety helmet, goggles, protective overalls, protective footwear and safety gloves when working with the machine. Other protective equipment, such as ear protection, a respirator etc. must also be used whenever needed.

Observe local laws, rules and regulations whenever applicable.

To avoid potential damage or injury, carefully plan your work beforehand.

Keep all warning labels on the machine clean and visible at all times.

All discovered defects or faults must immediately be brought to the attention of the operator or an authorized person.
<table>
<thead>
<tr>
<th><strong>DANGER</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>It is strictly forbidden to remove or disable any safety feature before starting the machine. When the machine is in use, all safety features must be in place and operational.</strong></td>
</tr>
<tr>
<td><strong>Hazardous moving parts. Moving parts of the machine will cause serious injury or death. Stop the machine completely before maintenance, repairs or disassembly. Do not touch the machine unnecessarily when it is use.</strong></td>
</tr>
</tbody>
</table>
| **Electrocution hazard. Electrocution will cause serious injury or death.**  
Connect the grounding points on the frame of the machine to an earth before connecting the machine to a power supply.  
Cut the power supply to the machine before maintenance, repairs or disassembly and use the appropriate lockout-tagout procedure. |
| **Falling load hazard. Falling loads will cause severe injury or death. Never stand under a lifted load.** |
### WARNING

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-pressure air injection hazard.</td>
<td>High pressure air spray can cause death or serious injury. Ensure the pneumatic system is not pressurized before maintenance, repairs or disassembly.</td>
</tr>
<tr>
<td>High-pressure oil injection hazard.</td>
<td>Compressed hydraulic oil can cause death or serious injury. Ensure the hydraulic system is not pressurized before maintenance, repairs or disassembly.</td>
</tr>
<tr>
<td>Slipping/tripping hazard.</td>
<td>An untidy work area can cause severe injury or death. Keep the machine and the area around the machine accessible and clean. Clean up spilled liquids and oils immediately.</td>
</tr>
<tr>
<td>Cutting hazard.</td>
<td>Sharp edges or corners on the machine can cause severe injury or death. Wear the appropriate protective equipment when working near the machine.</td>
</tr>
<tr>
<td>Burning hazard.</td>
<td>May cause severe injury or death. Some surfaces of the machine or substances used in the process may be hot. Wear protective overalls and gloves and do not unnecessarily touch the machine.</td>
</tr>
<tr>
<td>Fire hazard.</td>
<td>Fire can cause death or serious injury. Keep heat sources, ignition sources and all forms of open fire away from the machine.</td>
</tr>
</tbody>
</table>
2.4. Fire Safety

**WARNING**

In the event of a fire, immediately evacuate the area to reduce the risk of injury from flames, heat, hazardous vapors, explosion, or any other hazard that may arise.

Follow your local rules and regulations in the event of a fire.

2.5. Danger zones

The dangerous zones of the machine may only be accessed by authorized persons.

When several persons are working at the machine, good cooperation and an exact coordination of jobs is necessary.

Do not unnecessarily touch the machine when it is in use.

A danger zone is any space within and/or around the machine in which a person can be exposed to hazards.

The danger zones have been recognized during the design phase of the machine (risk assessment process) and the risks have been minimized by design and by the use of safety guards and/or safety devices.

When the safety instructions in the manuals are observed and all safety features are in place and operational, moving inside the “Danger zones” is safe and allowable. The danger zones are presented in the following illustration.
1. DANGER ZONE A (both sides)
2. DANGER ZONE B (both ends)
3. DANGER ZONE C
2.6. Emergency stops and stopping devices

2.6.1. Emergency stops

Make sure the emergency stops are accessible at all times.

Check operation of the emergency stops regularly.

The filter is equipped with several emergency stop buttons. When an emergency stop push-button is pressed, the filter stops and all of its functions cease. An emergency stop message is displayed on the screens in the control room.

The location of the emergency stop push buttons are displayed in the following illustration.

Filter is equipped with several emergency stop buttons. If there is any danger, the filter can be stopped immediately by pressing emergency stop button. Never release emergency stop button until it is safe to do so. After all emergency stop buttons are released, emergency stop circuit can be acknowledged by pressing alarm acknowledge push button S733 (see chapter 5.6.1 Alarm acknowledgement).

When filter is equipped with protective door system, all filter protective doors must be closed in order to operate filter automatically. If any door is opened during automatic operation filter will stop immediately. Only test mode functions are possible with doors opened.

Emergency stop buttons and protective door limit switches and related safety functions must be tested regularly.

NOTE!
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Terminal box, in filter</td>
</tr>
<tr>
<td>2</td>
<td>Emergency stop S707, in terminal box</td>
</tr>
<tr>
<td>3</td>
<td>Emergency stop S702, on hand held unit</td>
</tr>
<tr>
<td>4</td>
<td>Control panel</td>
</tr>
<tr>
<td>5</td>
<td>Emergency stop S701, on control panel</td>
</tr>
<tr>
<td>6</td>
<td>Emergency stop acknowledgement push button</td>
</tr>
<tr>
<td>7</td>
<td>Emergency stop S703, at pressing water station</td>
</tr>
<tr>
<td>8</td>
<td>Pressing water station</td>
</tr>
</tbody>
</table>
2.6.2. Protective door system

**NOTE!**

All protective doors must be closed in order to operate the filter automatically.

The filter is equipped with protective doors which are monitored with safety switches. All the safety switches are connected to the safety controller. The machine will be brought to a safe state (stop category 0) following actuation of any of the safety switches (i.e. opening a protective door). As a result, all electrical power is disconnected from actuators.

If any of the doors are opened during automatic operation, the filter will stop immediately. If any of the protective doors are open, only test mode functions are possible.

If a protective door is opened during filtering, it must be acknowledged before filtering can be restarted. The acknowledgement buttons on the filter (2 pcs) are situated on the left and right sides of the filter. The acknowledgement must be done in two parts. Firstly, by pressing the acknowledgement button on that side of the filter at which the protective door was opened. And secondly, after acknowledging the protective door alarm at the filter, the alarm must also be acknowledged from the main filter control cabin within 60 s.
2.7. Location of main switch

The main switch (1) is located on the cover of the control panel (2).
2.8. **Personal protective equipment**

The personal protective equipment described in the following is to be made available by the operator and to be worn by the operating personnel responsible for handling the machine.

- Wear protective gloves!
- Wear protective shoes/boots!
- Wear a helmet!
- Wear protective clothing!
- When handling hazardous substances and applied media, wear eye protection!
- Wear ear protection in the area of the hydraulic unit!
2.9. Pneumatics installation and maintenance

Only qualified personnel are allowed to carry out installation, maintenance and repair work on the pneumatic system.

Wear safety goggles when maintaining, repairing or disassembling the pneumatic system.

The customer must provide a device with which the machine can be disconnected from the pneumatic supply. The device must be clearly marked and lockable to prevent accidental switch on.

![WARNING]

High-pressure air injection hazard. High pressure air spray can cause death or serious injury. Make sure the pneumatic system is not pressurized before maintenance, repairs or disassembly.

- Perform a visual check of all pipes, hoses and screw fittings for leaks and visible damage daily and regularly check the condition more thoroughly. Repair any damage immediately.
- To locate leaks in the pneumatic system, use a piece of cardboard.
- Lay and install all lines and connections correctly. Fittings, lengths and hose pipe qualities must correspond to requirements.
2.10. Hydraulic system installation and maintenance

Only qualified personnel are allowed to carry out installation, maintenance and repair work on the hydraulic system.

Wear safety goggles when maintaining, repairing or disassembling the hydraulic system.

The customer must provide a device with which the machine can be disconnected from the hydraulic supply. The device must be clearly marked and lockable to prevent accidental switch on.

**DANGER**

Hydraulic fluid injection hazard. High-pressure hydraulic fluid spray can penetrate the skin and will cause death or serious injury. Make sure the hydraulic system is not pressurized before maintenance, repairs or disassembly.

- Perform a visual check of all pipes, hoses and screw fittings for leaks and visible damage daily and regularly check the condition more thoroughly. Repair any damage immediately.
- Lay and install all lines and connections correctly. Fittings, lengths and hose pipe qualities must correspond to requirements.
- Avoid skin contact with the hydraulic fluid.
2.11. **Electricity installation and maintenance**

Only qualified personnel are allowed to carry out the installation, maintenance and repair work of the electrical system.

The customer must provide a device with which the machine can be disconnected from the electrical supply. The device must be clearly marked and lockable to prevent accidental switch on.

<table>
<thead>
<tr>
<th><strong>DANGER</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Triangle Warning" /> Electrocnution hazard. Electrocution will cause severe injury or death. Cut the supply voltage before performing work on the electrical system.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>NOTICE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Exclamation Mark" /> Stop the machine immediately if electrical failure occurs.</td>
</tr>
<tr>
<td><img src="image" alt="Exclamation Mark" /> Only use original Outotec (Filters) Oy fuses with the correct intensity of current.</td>
</tr>
</tbody>
</table>
If it is absolutely necessary to work on live parts, ensure there is a second person present to actuate the main switch or emergency stop. Appropriately close off and clearly mark the working area. Only use appropriate, insulated tools and devices.

Perform a visual check of the condition of the electrical equipment daily and regularly check the electrical equipment of the machine more thoroughly. Repair all defects immediately. Examples of typical defects: loose connections or damaged cables.

2.12. Safety during welding, firing and grinding

Before starting welding, determine the material to be welded, the appropriate method of welding and the consumables.

Carry out welding, firing or grinding on the machine only if it is permitted.

<table>
<thead>
<tr>
<th>DANGER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explosion hazard. Explosions will cause severe injury or death. Clean all dust and flammable substances from the machine and its surroundings and ensure sufficient ventilation.</td>
</tr>
<tr>
<td>Poisonous gas hazard. Poisonous gases will cause severe injury or death. Maintain and check the working order of the ventilation installations regularly.</td>
</tr>
</tbody>
</table>
2.13. Safety devices

2.13.1. Safety and monitoring devices

All safety and protective devices must be kept in perfect condition.

Safety and monitoring devices may only be deactivated by persons entitled to do so.

Do not remove safety or monitoring devices unless necessary to perform repair or maintenance work.

Safety devices must be installed and activated and checked before running the machine.

If the safety and monitoring devices are not included in the scope of delivery, the press operator bears full responsibility for the due installation of all necessary safety devices in accordance with the national rules and regulations for the prevention of accidents in force in the operator's country at the time of putting the machine into operation.

2.13.2. Devices for disconnecting from the power supply

The customer is to provide the machine with a device with which it can be disconnected from the pneumatic and electric energy supply.

This device has to be:

- clearly marked
- lockable to prevent accidental on-switching

The description of the device for disconnecting from the electrical and hydraulic power supply can be found in the “Description of the electrical equipment” attached to these instructions.
2.13.3. Devices for the relief of pressurized systems

**NOTE!**

It must be possible to eliminate any residual energy or stored energy in the pneumatic system without danger of personal injuries.

The customer must provide appropriate devices.

The residual energy in the hydraulic system is eliminated through the following measures:

Closing pressure control - see hydraulic diagram attached to these instructions

2.13.4. Warning devices

A description of the optical and/or acoustic warning devices can be found in “Description of the electrical equipment” attached to these instructions.

2.14. Safety equipment

- Emergency stop push buttons
- Protective door system (if applicable)
- Safety rails
- Safety covers and plates
- Warning labels
- Working platforms

2.15. Noise levels and noise emission

Sound insulation devices on the machine must be in operation when the machine is running.

Wear ear protection.

2.16. Vibration value

The highest root mean square value of weighted acceleration does not exceed 0.5 m/s².
2.17. Lubricants and other chemical substances

Materials and supplies are to be used and disposed in accordance with the manufacturer's instructions.

Use appropriate personal protective equipment when handling chemical substances.

**WARNING**

Hot materials hazard. Hot materials and supplies can cause severe injury or death. Observe extreme caution and wear appropriate personal protective equipment when handling hot materials or supplies.

2.18. In case of accident

Stop the filter immediately to prevent further damage. Refer to chapters 2.6 Emergency stops and stopping devices and 5.5 Stopping the filter on how to do this.

Follow the factory safety rules and regulations.

2.19. Prohibition to use other than original spare parts

Only original spare parts or parts approved by Outotec (Filters) Oy can be used for replacement.

Any damage that occurs by using other than the original spare parts or accessories rules out all liability and warranty on supplier's behalf.
2.20. Making modifications to the product

**DANGER**

It is strictly forbidden to modify this machine or use it in any other way or for any other purpose, other than those specified in this instruction manual and its appendices. Unauthorized changes and modifications may affect operation and/or safety and may result in damage to property, personal injuries and even death.

Alterations to the Outotec Larox pressure filter can be carried out only with permission in writing by Outotec (Filters) Oy.

Outotec (Filters) Oy remains the right to make alterations to the Outotec Larox pressure filter at all times, in order to:

- Improve the filter;
- Have the filter comply with applicable standards changed in the meantime;

If need for these alterations is recognized by Outotec (Filters) Oy.

It is possible the instruction manual differs in some points from the filter as supplied to you.

If an unauthorized modification has been implemented, its effect on warranty liability will be considered and may result in the rejection of warranty applications.
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  3.5. Functional description of the filter .............................................................................3-19
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## Machine description

### Technical description

<table>
<thead>
<tr>
<th>Type OUTOTEC LAROX PF 12 SERIES Serial No. PF1041</th>
<th>19/25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filtration area</td>
<td>m²</td>
</tr>
<tr>
<td>Filter plates</td>
<td>pcs</td>
</tr>
<tr>
<td>Filter plate size</td>
<td>mm</td>
</tr>
<tr>
<td>Main dimensions length</td>
<td>mm</td>
</tr>
<tr>
<td>width</td>
<td>mm</td>
</tr>
<tr>
<td>height</td>
<td>mm</td>
</tr>
<tr>
<td>Weight without auxiliary equipment</td>
<td>t</td>
</tr>
<tr>
<td>Required floor area</td>
<td>m²</td>
</tr>
<tr>
<td>Filter cloth width</td>
<td>mm</td>
</tr>
<tr>
<td>length</td>
<td>m</td>
</tr>
<tr>
<td>Electric motors 550 VAC 50 Hz 3-phase hydraulic unit</td>
<td>kW-r/min</td>
</tr>
<tr>
<td>cloth tracking</td>
<td>kW-r/min</td>
</tr>
<tr>
<td>pressure water pump</td>
<td>kW-r/min</td>
</tr>
<tr>
<td>oil heater</td>
<td>kW</td>
</tr>
<tr>
<td>Water station/Pump type</td>
<td>60 Hz</td>
</tr>
<tr>
<td>Pressure water tank</td>
<td>l</td>
</tr>
<tr>
<td>Pressures slurry feed</td>
<td>bar</td>
</tr>
<tr>
<td>pressure water</td>
<td>bar</td>
</tr>
<tr>
<td>pressure air</td>
<td>bar</td>
</tr>
<tr>
<td>cloth wash water</td>
<td>bar</td>
</tr>
<tr>
<td>cake wash water</td>
<td>bar</td>
</tr>
<tr>
<td>hydraulic pump</td>
<td>bar</td>
</tr>
</tbody>
</table>

*Pump type is CRN when construction material is 2 or 3*
3.2. Process operations

<table>
<thead>
<tr>
<th><strong>DANGER</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazardous moving parts. The plate pack consists of several moving parts, which can cause serious injury or death. Never touch the plate pack during operation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>WARNING</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>High-pressure liquid injection hazard. Compressed liquid can cause death or serious injury. As a result of seal damage or foreign objects between the plate pack, liquid squirts are possible. When the pack is closed, always be careful.</td>
</tr>
</tbody>
</table>
3.2.1. **Plate pack**

The filter plate pack consists of horizontally laying filter plates which are connected to each other with suspension plates. When the filter plates are pressed together they form the chambers.

The filter plate consists of two parts: the bottom plate (6) (filtrate chamber) and the frame (5) (filter chamber). The purpose of the bottom plate is to collect and take away the filtrate.

Ensure all feed inlets are open all the time, so that both sides of the plate are under equal pressure during all the operation stages. Otherwise the plate bends and causes leakage and holes in the cloth.

3.2.1.1. **Frame**

The frame serves as the fixing element for the diaphragm. The frame and diaphragm together allow the space required by the cake.

3.2.1.2. **Grid**

The grid supports the cloth and forms an outlet for the filtrate.
3.2.1.3. Diaphragm

The rubber diaphragm acts as a pressing element with which, by means of water pressure, the cake is pressed to remove the liquid from it.

Pressure may rise above 16 bar, but as far as the durability of the diaphragm is concerned, it is much more recommendable to start with a pressure of 8 bar and then observe the effect of a pressure rise on the pressing time and the residual moisture. In this way the most suitable pressure of slurry for each process can be determined.

In temperatures above +60 °C, a strong aging phenomenon affects rubber. If the slurry to be filtered is hotter than +60 °C, pay special attention to the temperature and follow the manufacturer's instructions.

Check the condition of the diaphragms regularly. If the cakes from any of the chambers get wetter than the others or if the pressing water level in the tank starts rising or falling, replace the damaged diaphragm with a new one; check the condition of the pressing water. Clean the pressing water tank and change the pressing water if necessary.

Clean water is recommended as the pressing medium. Using other pressing media may cause risk situations.

3.2.1.4. Seal

The seal is located in the frame, above the filter cloth; its purpose is to prevent slurry leakage.

There is no seal below the filter cloth – the filter cloth and the steel surface are face to face. If any counter-pressure forms space on the grid on its feed side, this will cause filtrate to leak from underneath the cloth.
3.2.2. Process piping

The OUTOTEC PF filter includes two pipelines, which are directly in contact with the filtration process, namely the feed pipe and the filtrate pipe.

3.2.2.1. Filtrate pipe

The purpose of the filtrate pipe is to remove the filtrate or the wash liquid (filters with cake washing) which has penetrated through the cake.

3.2.2.2. Feed pipe

The slurry as well as drying air a direct route to the filtration is led through the feed pipe into the filter chambers. Also in filters with a cake washing option the same route is used for the washing liquid. Slurry is pumped through the lower end, drying air and the possible washing liquid through the upper end of the feed pipe.
3.3. **Auxiliary operations**

3.3.1. **Closing device**

The closing device is hydraulic. Any damage to the hydraulic pipeline is dangerous and may cause an injury.

The closing device comprises of hydraulic cylinders (14) and (16) and locking pins as shown in the drawing “Hydraulic PF filter closing and opening” on next page.

The closing of the plate pack is carried out in three stages: closing (=quick action), locking and sealing.

The force of the quick action cylinder and the sealing cylinder can be adjusted by regulating the oil pressure.

3.3.1.1. **Quick action**

The filtration cycle starts with the closing of the plate pack (17), which is left open after the preceding cycle. The pack is lowered to a closed position by quick-action cylinders (14) which move down the upper pressing plate (3).

3.3.1.2. **Locking**

After the plate pack is closed, the locking pins (15) lock the top pressing plate (3) to the columns (6), which are fixed to the foundation plate (5).

The filtration chambers have thus been formed. Now the plate pack is surrounded by the upper pressing plate, bottom plate and columns.

3.3.1.3. **Sealing**

The lower pressing plate (4) presses the plate pack against the upper pressing plate (3) closing the filtration chambers tightly. This is accomplished by short hydraulic cylinders (16) fixed to the foundation plate.

After the cylinders (16) reach the force required to close the plate pack, automatic locking valves shut off the oil lines located in the cylinders. The purpose of these valves is to prevent the cylinder from yielding.

When the filtration stage is finished, the plate pack opens to facilitate cake discharge.

The sealing cylinders (16) return to their starting positions. Then the locking pins (15) are released. This frees the upper pressing plate (3) for quick opening.

When the filter is stopped for maintenance, the plate pack is in the upper position, and the locking pins are used to lock the upper pressing plate to the columns.
3.3.2. **Filter cloth**

The filter cloth operates both as a filtering element and a conveyor belt which transports cake out of the filter. Besides having a good filtering ability, the cloth must be able to withstand heavy pulling.

Only special type of fabrics can be used. The most commonly used filter cloth is made of multifilament fabric that is stronger lengthwise (warp) than crosswise (weft).

Should any holes appear in the cloth, these must be mended immediately. Solid material entering between the filter cloth makes the rollers dirty and thus destroys the filter cloth.

![Diagram of filter cloth system]

1. **CENTERING ROLLER**
2. **TENSIONING DEVICE ROLLER**
3. **TENSIONING ROLLER**
4. **IMPULSE ROLLER**
5. **GUIDE ROLLER**
6. **SCRAPER**
7. **VAT ROLLER**
8. **CLOTH WASH NOZZLES**
9. **DRIVE ROLLER**
10. **PRESSING ROLLER**
11. **CAKE**
12. **SEAM DETECTOR**
13. **ENCODER**
3.3.2.1. **Cloth drive mechanism**

To discharge the cakes and to wash the cloth, the cloth is moved with a drive roller between filtering cycles. The drive roller is actuated by a hydraulic motor.

A spring loaded pressing roller presses the filter cloth against the drive roller to improve the maintaining of friction.

3.3.2.2. **Auxiliary drive motors (optional)**

Auxiliary drive rollers reduce the tension of the filter cloth during the filter cloth drive by dividing the tension into three points instead of one.

Auxiliary drive motors are series-connected to the return port of the main drive motor. A pressure reducing valve PR91 is installed in the line after the main drive motor HM91. It determines the input pressure to the HM92 to approx. 50 bar.

3.3.2.3. **Adjustments**

The most important factor with the auxiliary drive rollers is to check they do not slip in the beginning of the cloth drive. Should this happen, reduce the pressure rate in PR 91 by turning the adjusting screw counterclockwise.
3.3.3. Electro-mechanical cloth tracking

Normally the filter cloth moves in the plate pack without crossing the guide roller edges. However, in case the cloth tends to be directed more towards either of the edges than what is allowable, the automatic cloth tracking brings the cloth back into the allowance limits.

The cloth tracking takes place by moving the right end of the centering roller in the cloth conveyor unit up or down or by moving it according to the signals of the cloth side sensors S838 (left) and S839 (right) and by the automatic control operation. In case the centering roller moves too much up or down, the limit switch S873 gives a signal (centering roller outside allowance limits) and the automatic control operation stops. After this, the centering roller may be brought back into the correct limits by using a manual control device.

The sensors S838 and S839 are located in the cloth conveyor unit and have been adjusted at factory to give a signal before the cloth edge goes over the roller edge.

There are five different parameters for the automatic cloth control the time values of which may be changed through the user interface; these are as follows:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Normative times</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRACK DELAY</td>
<td>3s</td>
</tr>
<tr>
<td>TRACKING TIME</td>
<td>7s</td>
</tr>
<tr>
<td>RETURN DELAY/TIME</td>
<td>5s</td>
</tr>
<tr>
<td>RETURN TIME TO LEFT</td>
<td>6s</td>
</tr>
<tr>
<td>RETURN TIME TO RIGHT</td>
<td>5s</td>
</tr>
</tbody>
</table>
Automatic Operation Control when Cloth Drifts to the Left

If the cloth left side sensor S838 gives a signal the length of which is longer than the TRACK DELAY, the cloth tracking motor M07 starts “to the right” by driving the right end of the centering roller down for the TRACKING TIME. When the TRACKING TIME has run out, M07 stops for the RETURN DELAY/TIME. After this, M07 starts and drives the centering roller up for the RETURN TIME TO LEFT. The tracking has thus been finalized.

The cloth tracking to the left takes place the same way, but to the opposite direction.

When comparing the times TRACKING TIME and RETURN TIME TO LEFT/RETURN TIME TO RIGHT, it can be noticed that after tracking, the position of the centering roller has only slightly changed.

Cloth alarm limit switch S838A or S839A causes the alarm if cloth tracking device cannot control cloth to the center position. Cloth drifts too much aside and cloth alarm switch is activated too long time (5 sec delay).
3.3.4. **Pressing water station**

The volume of the pressing water station tank is twice the volume needed for one pressing cycle. The tank is equipped with a level switch, which prevents the pump from running dry.

The pump used in the pressing water station is a multistage centrifugal pump capable of producing 16 bar pressure.

The pressure of the pipeline between the filter and the pressing water station is controlled by a spring-loaded safety valve.
3.3.5. Pressing water pipe

Check the hose covers are always closed during filtering operations.

The pressing water pipe distributes the pressing water in the membranes. The operation is carried out using the pressing water pump and is controlled by the safety valve and the pressing water return valve V04.

3.4. Control operations

The operator interface terminal consists of a digital touch screen unit, which is connected to the programmable logic with a serial connection port. Information exchange between the PLC and the touch screen unit is automatically controlled by the touch screen unit.

3.4.1. Control panel

The control panel communicates with a programmable logic (PLC) which enables the automatic control of the filter.

<table>
<thead>
<tr>
<th>DANGER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explosion hazard. Explosions will cause severe injury or death. Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.</td>
</tr>
<tr>
<td>Explosion hazard. Explosions will cause severe injury or death. When in hazardous locations, turn off the power before replacing or wiring the modules.</td>
</tr>
</tbody>
</table>

A window with a lock protects the operator interface. When you are not using the screen, you should keep this window closed. The door to the control panel should also be kept closed, unless you need to carry out maintenance work.

The changes in the PLC program are allowed only when accepted by the manufacturer.

It is not permitted to add or remove any components of the control panel without the permission of the manufacturer. All components replaced in the course of maintenance work must, at the very least, fulfill the same technical requirements as the original parts.

The control panel power supply must not be used for any other external equipment.
Hydraulic unit system

Hydraulic pump

The pump used in the hydraulic system is an axial piston pump with a load sensing adjustment and a maximum pressure limitation. The pump regulators, i.e. compensators, keep to the system requirements and keep the delivery and pressure of the pump correct despite the load in the system. For a more detailed description see the information provided by the manufacturer.

Proportional valves and their plug amplifiers

The volume of flow and the pressure in the system are controlled by proportional valves. PF11 is for the volume flow and PP11 for the pressure.

- PF11 is a flow proportional valve. The output flow is proportional to the electrical current of the direction valve coil.

The operation of the flow proportional valve is controlled using the amplifying card located in the plug of the coil of the directional valve.

- Y54 is an amplifying plug for the volume flow proportional valve. It receives analog signals from the programmable logic and outputs current to the solenoid of the proportional valve.

To direct the analog signal, the plug also contains a ramp which can be adjusted separately up or down, which slows down the change in the volume flow rate when shifting from one level to another.

- PP11 is a pressure proportional valve. The output flow is proportional to the electrical current of the direction valve coil.

The operation of the pressure proportional valve is controlled using the amplifying card located in the plug of the coil of the directional valve.

- Y64 is an amplifying plug for the pressure proportional valve. It receives analog signals from the programmable logic and outputs current to the solenoid of the proportional valve.

Accumulator system

The bladder type accumulator is an energy reserve for the pinch valve line. Accumulator medium is nitrogen gas. The pre-charging pressure must be approx. 0.9 times the pressure of the pinch valve line (90 bars). The pre-charging pressure can be checked by discharging the accumulator through the valve SV01 (the hydraulic motor must be stopped). When the pressure gauge PG01 has fallen to the pre-charging pressure, the cursor quickly drops to zero. Too low pre-charging pressure leads to a fast discharge of the accumulator and to frequent recharging. Normal recharging interval is over 10 minutes when the actuator of the pinch valve is not used. The accumulator recharges when the pressure in the system falls below the pre-set value in the pressure switch PS01 or the pressure in the system is over the preset pressure.
- PS01 determines the starting pressure of the accumulator charge. It is marked S405 in electrical drawings. Recommendable switching pressure is 100-120 bars. The switching pressure can be checked from pressure gauge PG01. Adjust the pressure switch PS01 by turning the adjusting plate clockwise until the required pressure is reached. Pressure switch PS01 can quickly be checked and adjusted by discharging the accumulator through valve SV01.

  **NOTE!** Timer adjusts the charging of the accumulator. Charging time is approx. 2 sec.

  **NOTE!** Normal unloading time is at least 10 minutes if no components of the accumulator line are actuated.

- PR01 is a safety valve for the accumulator, which also controls the maximum charging pressure of the accumulator. However, it cannot adjust the pressure higher than that of the pumping system. Recommendable pressure is 220-250 bars. To reduce the maximum operating pressure of the accumulator open the locking nut, turn the adjusting screw anticlockwise and lock the nut.

- PR02 is a pressure reducing valve for the pinch valve line. It defines the closing pressure of the pinch valve actuating cylinders. Recommendable pressure is 95-105 bars, which can be checked in gauge PG02. To increase line pressure open the locking nut, turn the adjusting screw clockwise and lock the nut.

The pre-filling pressure of the accumulator is approx. 90 bars. The line pressure must not be allowed to fall under the rate of the pre-filling pressure. An unnecessary high line pressure results in a more frequent need of charging the accumulator and thus shortens the life of the rubber bladder.

**NOTE!** Closing of the pinch valve sleeve with the cylinder takes place against a mechanical limiter. In case the valve has been incorrectly adjusted, it cannot be closed by increasing the closing pressure.

- SV01 is a discharge valve for the accumulator. It is normally closed. In case the pressure in the accumulator must be discharged, open the SV01 by pulling the button.

- FC01 is a flow control valve in the pinch valve line. It is normally fully open but it enables the shutting of the line during service operations.

- CVT1 is a check valve, which opens when discharging the accumulator.

Hydraulic components for functional actuators:

- HV51 is a directional valve for quick action cylinders.
- HV71 is a directional valve for sealing cylinders.
- HV81 is a directional valve for the cloth tensioning motor.
- HV91 is a directional valve for the cloth drive motors.
- PR81 PR81 is a pressure reducing valve for the cloth tensioning motor. The tensioning force of the filter cloth is set using this valve. The recommended pressure is 50 bar.
3.4.4. Sealing plate position transmitter B275

Location

The B275 transmitter is located underneath the bottom sealing plate, in the center of the plate, mounted to an arm sticking up from the filter foundation plate. The transmitter is in a position where sensing surface is facing up towards the sealing plate. The transmitter directly measures the sealing plate’s vertical position. The transmitter is a long range inductive proximity sensor, with 8 to 60 mm nominal sensing distance proportional to 4…20 mA analog output.

Adjustment

When the sealing plate is in its lowest position, the distance between the transmitter and the sealing plate should be approximately 7-8 mm. Adjust the transmitter position by moving the mounting bracket up or down.

Function

The transmitter signal is used for multiple purposes and the following set points are used to trigger respective functions:

- Sealing plate in the low (unsealed or fully down) position. If the low position is not reached within 30 seconds during unsealing, the B275L LOWER PRESSING PLATE DOWN SENSOR alarm is triggered. To set the sealing plate low position drive the sealing cylinders down with the hand held test unit, on position HC7 and using the green pushbutton S723, until the B275 UNSEALED indicator turns on in the OI.

**NOTE!** The hand held test unit must be used to set the sealing plate low position!

- Minimum sealing stroke distance. If the minimum sealing distance is not reached while sealing the filter the B275S SEALING STROKE INCOMPLETE alarm is triggered. To set the minimum sealing stroke distance first set the "Sealing Pressure in Test Mode" parameter set point to 30 bar. Then using the hand held test unit, on position HC7, seal the filter (by pressing the yellow pushbutton S725) until the B275 SEALED indicator turns on in the OI.

**NOTE!** The hand held unit must be used to set the minimum sealing stroke distance!

- Yielding distance. Each time the pack is sealed, the measured value of sealing plate position is captured and the allowed yielding distance is deducted. The allowed yield is 0.5 mm per plate. If the yield is greater an alarm B275Y SEALING PLATE YIELDING is triggered.
3.4.5. Oil container equipment

**Hydraulic system pressure transmitter B401**

*Location*

Hydraulic unit block, connection PG12

*Functions*

The value of the pressure transmitter is shown on screen. The closing pressure can be modified within the range of 30 - 60 bars. The control pressure is 5 bars below the closing pressure. If the pressure during the closing stage is higher than the calculated control pressure for 3.5 seconds, the plate pack has been closed. If the closing pressure has been changed, the control pressure is set automatically.

**Hydraulic oil temperature transmitter B601**

*Location*

On the side of the hydraulic unit/oil container

*Functions*

The value of the temperature sensor is shown on screen. The general functions related to the oil temperature are, for example:

- If the oil temperature is below 0°C, it stops the operation of the motor M01. The control panel issues an alarm and the heating resistor starts up. The alarm can be reset as soon as the temperature of the oil rises above 10°C.
- When the temperature of the oil is below 20°C, the closing time for the plate pack increases by 5 seconds, thus the pressure in the hydraulic unit is higher than the pressure of the closing control mechanism for 8.5 seconds.
- When the oil temperature lies between 30 - 35°C, the heat resistors start up.
- When the oil temperature lies between 50 - 55°C, the oil cooler starts up. (OPTIONAL)
- When the temperature of the oil exceeds 60°C, the control panel screen informs the user the oil temperature is too high and starts the ENDMODE program. Once the filtration cycle has completed, the filter stops and the control panel issues an alarm.
- If the oil temperature exceeds 65°C, the filter immediately stops and the control panel issues an alarm.
3.5. **Functional description of the filter**

This chapter describes the principle of pressure filtration and all the process steps included in the filtration process.

3.5.1. **Filtration**

When the filter plate pack has been closed, slurry is simultaneously pumped into each filtration chamber through the slurry hoses. Filtrate flows through the cloth and into the filtrate chamber. The filtrate chamber is emptied through filtrate hoses and on into the filtrate pipe.

3.5.2. **Pressing I**

Pressing water is pumped on the diaphragm through the pressing water hoses. The diaphragm presses the cake against the filter cloth surface, thus pressing the filtrate from the cake through the cloth.

3.5.3. **Washing (optional)**

Wash liquid is pumped into the filter chambers in the same way as the slurry. As the wash liquid fills the filtration chamber, the diaphragm is lifted up and water is forced out from the upper side of the diaphragm. The wash liquid flows into the filtrate pipes after passing through the filter cake and the cloth.

3.5.4. **Pressing II (optional)**

The wash liquid remaining in the chamber after the washing stage is pressed out of the cake as in stage 2 above.

3.5.5. **Air drying**

The final drying of the cake is accomplished with compressed air. The air enters through the slurry pipe, fills the filter chamber, raises the diaphragm and forces the pressing water above the diaphragm out of the filter. The air flow through the cake reduces its moisture content to the optimum and, at the same time, empties the filtrate chamber.

3.5.6. **Cake discharge**

When the air drying is completed, the plate pack is opened and the filter cloth moving mechanism started. The filter cake on the cloth is discharged from both sides of the filter.

The four-stage (short) program does not include washing and second pressing stages.
Main assembly drawing

1. FRAME
2. FOUNDATION
3. LOWER PRESSING PLATE
4. FILTER PLATES
5. COLUMNS
6. UPPER PRESSING PLATE
7. TOP FRAME
8. CAKE CHUTE
9. CLOTH TENSIONING DEVICE
10. CLOTH DRIVE UNIT
11. HYDRAULIC UNIT
12. PIPELINES
13. COVERS
14. FILTER CLOTH
15. PRESSING WATER STATION
16. CONTROL PANEL
17. LOAD CELLS
18. OPEN END CAKE CHUTE

Common layout drawing for PF12

Please see appendix “Mechanical drawings” and there “Common Layout” drawing (drawing number F651732).
3.6. **Description of controls and functions**

The control panel is used to facilitate the operation of the Outotec pressure filter.

The control panel incorporates switches, push buttons and an operator interface terminal, which are required for the operation.

Each push button, switch and indicator lamp is provided with a label briefly describing the function of the device.

The flow diagram is located in the display of the operator interface terminal. The indicator lamps show the present state of the actuator or motor in question.

![Operator interface terminal with a flow diagram](image)

The control panel is illustrated on the following page.
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       4.1.1. Lifting instructions ...................................................................................... 4-2
   4.2. Installation instructions ....................................................................................... 4-4
       4.2.1. Pressing water station ................................................................................ 4-4
       4.2.2. Control panel .............................................................................................. 4-4
       4.2.3. Installation readiness check list .................................................................... 4-6
4. Installation and decommissioning instruction

Before starting installation, use the packing list to check all the items for the filter and all the accessories have been supplied completely and are undamaged. Immediately contact Outotec (Filters) Oy if there are any missing or damaged parts.

4.1. Main package dimensions and weights

<table>
<thead>
<tr>
<th>POS</th>
<th>EQUIPMENT</th>
<th>PACKAGE No.</th>
<th>DIMENSIONS, m</th>
<th>VOLUME, m³</th>
<th>NET WEIGHT KG</th>
<th>GROSS WEIGHT KG</th>
<th>PACKAGE</th>
<th>TYPE</th>
<th>STACKING LIMITATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pressure filter</td>
<td>1</td>
<td>4,30</td>
<td>2,50</td>
<td>3,68</td>
<td>38,7</td>
<td>14300,0</td>
<td>14800,0</td>
<td>7819121515141</td>
</tr>
<tr>
<td>2</td>
<td>Control panel</td>
<td>2</td>
<td>2,00</td>
<td>1,14</td>
<td>0,60</td>
<td>0,8</td>
<td>300,0</td>
<td>400,0</td>
<td>LA2 500kg</td>
</tr>
<tr>
<td>3</td>
<td>Hydraulics unit</td>
<td>3</td>
<td>2,00</td>
<td>1,52</td>
<td>2,00</td>
<td>6,1</td>
<td>450,0</td>
<td>700,0</td>
<td>LA2 250kg</td>
</tr>
<tr>
<td>4</td>
<td>Fine end valve chute and side doors</td>
<td>4</td>
<td>3,60</td>
<td>2,65</td>
<td>1,40</td>
<td>13,4</td>
<td>800,0</td>
<td>1000,0</td>
<td>LA2 3000kg</td>
</tr>
<tr>
<td>5</td>
<td>Water station</td>
<td>5</td>
<td>2,60</td>
<td>2,00</td>
<td>2,20</td>
<td>12,3</td>
<td>770,0</td>
<td>920,0</td>
<td>LA2 2200kg</td>
</tr>
<tr>
<td>6</td>
<td>Spare parts (steel)</td>
<td>6</td>
<td>2,00</td>
<td>1,02</td>
<td>1,20</td>
<td>9,6</td>
<td>750,0</td>
<td>1000,0</td>
<td>LA2 2000kg</td>
</tr>
<tr>
<td>7</td>
<td>Oil tanks, Euroliners, Cloth, hoses, etc</td>
<td>7</td>
<td>3,20</td>
<td>1,80</td>
<td>2,00</td>
<td>15,8</td>
<td>3000,0</td>
<td>3200,0</td>
<td>LA2 3000kg</td>
</tr>
</tbody>
</table>

TOTAL | 91,8 | 28,030 | 22,339 |

4.1.1. Lifting instructions

The pressure filter must be lifted slowly because it will not rise quite horizontally. When it is lifted off the platform it tends to move towards its longitudinal axis. During the lifting and the lowering there must be enough room around the filter.

The shafts (4 pieces) of quick action cylinders are covered by plastic pipes in the factory. Check the plastic pipes are in their places; they prevent damage to the shafts.

Moving on top of the pressure filter (when fixing and loosing lift chains) require special attention and carefulness because water or ice on painted surfaces makes them extremely slippery. Leads, cables and other components must not be damaged.

Use appropriate and certified lifting equipment, such as cranes, hoisting slings and hoisting chains for lifting the filter. Ensure the condition and lifting class of the lifting equipment is sufficient.

Carefully plan your work beforehand.

The transport accessories (plywood frame, steel supports and tarpaulin) must be kept on the machine while lifting.

Lift very slowly and leave enough room around the filter. The filter will not rise quite horizontally. When it is lifted off the platform it tends to move towards its longitudinal axis.
Before lifting the filter check the installation site is as level as possible and that the positions of the fixing holes, pipe inlets and cake chutes of the filter frame are according to drawing “General arrangement” (please see appendices).

Follow the specific lifting instructions for this machine.

<table>
<thead>
<tr>
<th>DANGER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Falling load hazard. Will cause severe injury or death. Do not stand under a lifted load.</td>
</tr>
<tr>
<td>Squashing hazard. A moving hoisted load will cause severe injury or death. Make sure no unauthorized personnel are in the vicinity of a lifted load.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Falling hazard. Falling can cause severe injury or death. Moving on top of the pressure filter (when fixing and loosening lift chains) requires special attention and caution. Water or ice can make painted surfaces extremely slippery.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorrect hoisting may also cause damage to the machinery. Do not damage leads, cables and other components when fixing and loosening the lifting equipment</td>
</tr>
<tr>
<td>The shafts of the quick action cylinders (4 pieces) are covered with plastic pipes in the factory. Check they are in place. Prevent the shafts from being damaged.</td>
</tr>
</tbody>
</table>
4.2. Installation instructions

1. Check the horizontal position of the filter after it has been lowered to its proper place. Do the check with an accurate water level from the shafts of the quick action cylinders. The plastic pipes covering the shafts will be installed after the leveling.

2. Carry out the inspection both in longitudinal and crosswise directions. Allowed tolerance is 1mm/m. If the inspection fails, adjust the position of the filter by placing assembly plates made of stainless steel between the pressure filter and the filter frame as near the fixing bolts as possible.

3. The recommended model for an assembly plate is a so called horseshoe sheet (See appendices, drawing “Instructions for installation” parts 2 and 3), which will be placed around the fixing bolt.

4. Tighten the fixing bolts and check the horizontal position again after adjusting the position of the filter.

5. If the piping work is not started immediately after the installation of the pressure filter on the platform, cover the pressure filter with the tarpaulin used during the transport.

4.2.1. Pressing water station

The fixing and lifting points of the pressure water station can be seen on the drawing "Water station" (please see appendices).

The horizontal tolerance for the pressure water station is 2 mm/m. Measure from the frame bar of the pressure water station.

4.2.2. Control panel

The control panel is delivered in a plywood box. The control unit weighs about 200 kg. The lifting loops are located on top of the control panel. The fixing holes of the control panel are inside the control panel. The bag containing moisture aspirating material should be left inside the control panel until the start-up. The gadget window must be kept closed. If the piping etc. installation work is carried out near the control panel, it must be covered against dust and dirt.
Ref installation/assembly of Outotec Larox PF 12

TORQUE FOR SCREWS AND NUTS

Pre-stress approx. 80% of minimum yield limit.

<table>
<thead>
<tr>
<th>Thread</th>
<th>M6</th>
<th>M8</th>
<th>M10</th>
<th>M12</th>
<th>M14</th>
<th>M16</th>
<th>M20</th>
<th>M22</th>
<th>M24</th>
<th>M27</th>
<th>M30</th>
<th>M36</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strength class</td>
<td>Tensioning torque Nm (Nm ≈ 0.1 kp m ≈ 0.1 kgm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AISI 316</td>
<td>4</td>
<td>10</td>
<td>18</td>
<td>30</td>
<td>48</td>
<td>70</td>
<td>100</td>
<td>130</td>
<td>180</td>
<td>220</td>
<td>360</td>
<td>480</td>
</tr>
<tr>
<td>8.8</td>
<td>11</td>
<td>25</td>
<td>48</td>
<td>80</td>
<td>125</td>
<td>190</td>
<td>265</td>
<td>350</td>
<td>480</td>
<td>590</td>
<td>960</td>
<td>1290</td>
</tr>
</tbody>
</table>

The values in the table require a friction coefficient of $\mu_1 = 0.12, \mu_2 = 0.12$, which correspond to a lightly oily surface – seizing deterrent must be used in all screw joints unless otherwise instructed.

$\mu_1$ = friction coefficient of the thread

$\mu_2$ = friction coefficient between the base and the screw (nut) head

NOTE! The screws for the filter plate/frame have their own torque value.
### 4.2.3. Installation readiness check list

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Filter shipment arrived at site</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Shipment inspected and possible damages reported to Outotec</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Site transportation of the filter components and auxiliaries available</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Foundation ready and matches with Outotec foundation drawings</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Lifting equipment (e.g. overhead crane) available</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Tools (according to Outotec tools list) available</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Scaffolds and ladders available</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Electric power for lifting equipment and tools available</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Compressed air for pneumatic tools available</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Office including, heating/cooling, lighting, telephone, furniture and toilet</td>
<td></td>
</tr>
</tbody>
</table>
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5. OPERATION INSTRUCTIONS

5.1. Starting the Filter

5.1.1. Start up inspection

Make sure all safety features have been fitted to the filter and to the ancillary equipment before startup.

In order to carry out the start up without unnecessary delays certain things have to be ready and completed:

- Filter installed
- All dismantled (for packing and transportation) components assembled to the filter; also pipelines including limit switches
- All hydraulic hoses loosened for packing connected
- Pipelines built according to Outotec design instructions
- Cake can be discharged from the filter, and the conveyor(s) meets Outotec recommendations
- Voltage connected to control panel
- Voltage connected to filter’s motors
- Cables connected (Please see the cabling diagram)
- Cloth wash water available
- Cake wash water (liquid) available
- Compressed air available for cake drying, and capacity meets Outotec recommendations
- Slurry pump installed
- Slurry available
- Hydraulic filter aggregate equipped with a 3-5µm filter available for hydraulic oil filling (Please see the manual, Section 6 – Maintenance)
- Hydraulic oil available (for quality and quantity, please see the manual)
- Test cloth installed in to the filter and production cloth available
- Start up spare parts kit available
5.1.2. Checks before start up

- Check the condition of the filter cloth seam
- Make sure that the times of different operational stages correspond to the optimum times achieved in test filtration or test runs
- Check the surroundings of the filter and make sure that no ladders or other objects are leaning on it

5.1.3. Start up measures

Open the manual valves of the pipelines leading to the filter

Make sure that the cake discharge conveyor works properly

Make sure that the slurry feed pump works properly

Make sure that the separate pump for cloth wash works properly (if in use)

If the stage timings and the "ready for operation" lights are blinking, filtering can be started

NOTE! if any of the alarm lights is on or the "emergency-stop" button is pushed down, the "ready for operation" light does not illuminate

Start the filter by discharging

NOTICE

Pieces of cake left in between the sealing surfaces might damage the filter cloth. Make sure that the spaces between the plates are clean before the plate pack is closed

Turn the selector switch to "AUTO" position. From now on the operation of the filter proceeds automatically onwards to "plate pack closing", "filtering" etc.

5.1.4. Adjustments

Observe the variables listed below and adjust the filter and the process according to different situations in order to reach the best results in all stages of the process.

NOTE! The exact adjustment gives the best result

The factors effecting to the filtration results

- filterability of the feed
- condition of the cloth
- openness of the filtrate channels
The amount of the cake also depends on
- solid contents of the feed
- feed pressure
- filtration time

The dryness of the cake also depends on
- particle size of the feed
- pressing pressure
- drying air pressure
- air drying time

The washing result also depends on
- wash liquid pressure
- washing time
- wash liquid properties
- cake permeability

5.1.5. Checks after start up

In order to reach the best possible results with minor possible problems, always pay attention to following:

- When the slurry valve opens, observe the pressure reading. If the pressure does not start rising, there are either closed valves on the feed pipeline, a pipe is blocked or the pump is not working properly
- If there is too much leakage between the plates during the filtering stage, a seal has been damaged or the filtrate piping has become clogged
- Observe the pressure of the water station
- When washing the cake, watch the wash liquid pressure reading (for the same reason as when pumping slurry)
- When drying with air, an air blow requires a sufficient amount of air. Check that at the beginning of the drying phase the pressure of the distribution pipe reaches at least 3 bar, which ensures that there is a sufficient amount of compressed air for all the chambers
- When the filter discharges, make sure that there is a cake formed on each filter plate. An empty space is a sign of a blockage either in the feed hose or in the feed joint of the filter plate
NOTICE

Blockages can cause the empty filter plates to bend under the pressure. Clear all blockages before carrying on with filter operation.

NOTE!

Check the condition of the filter cloth. An acid washing is necessary in certain processes occasionally

- Observe the cloth to be sure it remains undamaged. A damaged cloth must be mended immediately to prevent the particles for escaping through a broken cloth out of the filtrate flow channels
- Observe the diaphragms. They must remain undamaged
- Always use the lowest possible pressure to achieve the desired filtering result. An unnecessarily high pressure shortens the life of the diaphragm and other wearing parts
- Do not feed too much material into the filter (The maximum cake thickness is 40 mm for 45 mm high chambers, and 55 mm for 60 mm chambers): the feed pipe may get clogged, cake discharge become more difficult or, if the material is heavy, the cloth can break.

Do not feed too much material into the filter to avoid damage

- Do not let the feed hoses to block up. An empty filter chamber under pressure causes the plate to bend. A bent plate causes leakage, makes holes in the cloth and hampers the cake discharge

DANGER

Hazardous moving parts. The plate pack consists of several moving parts, which can cause serious injury or death. Never push anything in between the plates while the filter is in operation.

- Avoid high temperatures when a standard filter is in question. In temperatures above + 60 °C, a strong aging phenomenon affects to the rubber and the operating life of the rubber parts becomes shorter. When operating in temperatures over +60 °C, the manufacturer's instructions must be strictly followed.
Do not direct the pressure-water spray directly at the electrical devices when washing the filter

5.1.6. Maintenance

Maintenance of the standard parts

- According to the instructions given by the sub-suppliers attached to this manual.

General

- Flush the filter from outside when necessary, when the filter is not in operation.
- Keep the filter and its surroundings tidy and free from any unnecessary objects.
5.2. **Control panel**

The Control Panel is used to facilitate the operation of the OUTOTEC Pressure Filter. The Control Panel incorporates switches, push buttons and an operator interface terminal, which are required for the operation.

Each push-button, switch and indicator lamp is provided with a label briefly describing the function of the device.

The flow diagram is located in the display of the operator interface terminal. The indicator lamps show the present state of the actuator or motor in question.

Operator interface terminal with a flow diagram.

The Control Panel is illustrated on the following page.
5.3. **Operator interface**

Controlling and observing the operation of the filter, choosing the required filtering program, changing parameters and testing actuators are operated through the operator interface. In addition, the operator interface gives clear text information about alarms.

5.3.1. **Screen selection**

Touch buttons are used to select screens.

NEVER use objects like a screwdriver, pencil etc. to activate a touch button. The screen needs to be touched lightly and for an instant only. Some screens may seem to have a slight delay before performing the function requested, so it is a good idea to have a pause before touching again.

The HELP touch button [?] is always located in the top right hand corner of the display. When this area is touched, a screen containing the requested information is displayed.

To quit any HELP screen, the Previous screen touch button is used. This touch button is always located in the top left hand corner of the display.

The available screens of the operator interface are illustrated in a form of a diagram on the following page.
5.3.2. Operator interface structure

*) Direct access screens (inside the grey frame) can be accessed directly from any screen inside the frame or linked to it.
5.3.3. Cleaning the touch screen

It is an essential part of the unit maintenance to keep the screen clean. Even if great care is taken to touch the display with clean hands only, dirt will still collect on the display surface. For cleaning of the display (since all screens have at least some part of the display active), a screen has been programmed into the display unit. This screen is accessed from the TOOLS screen and it is called the Screen cleaning [CLS]. After the selected time the display will automatically return to the FILTER screen.

CLEANING THE SCREEN

To clean the display, use a soft cloth or paper towel and any ordinary window cleaner. To help prevent marring the plastic sheet on the surface of the display, carefully clean off any abrasive particles on the display surface, and then clean as advised above.
5.3.4. Drive mode

The [MODE] touch button is used to select a drive mode. The following drive modes are available:

REMOTE (OPTIONAL)

Sets the filter to remote control state and allows controlling the filter from the customer control system (DCS)

AUTO

The filter operates using the preset stage times.

MANUAL

The filter can be operated one stage at a time. This mode is used e.g. for optimizing the stage times.

END

When this mode is selected, the filter stops at the end of the cycle. This is used whenever the operator wishes to stop a filter running in auto mode.

RESET

Is used to e.g. stop a filtering cycle. In this case the filter starts filtering in a controlled manner from the very first stage.
5.3.5. Process

The PROCESS screen displays the main devices of the filtering process as well as the process diagram. In addition to the filter and the pressing water station, the slurry tank with level information, feed slurry pump, and cake conveyor are displayed.

The rest of the basic screens can be accessed by means of the touch buttons in the lower part of the display. The drive mode can also be selected directly from this screen.

List of symbols on the PROCESS screen:

- **M02** Pressing water pump motor
- **M06/M06.1** Cloth wash liquid pump motor
- **M08** Cake conveyor motor
- **M09** Slurry feed pump motor
- **M15** Cake wash liquid pump motor
- **V01** Filtrate outlet valve
- **V02** Slurry inlet valve
- **V04** Pressing water outlet valve
- **V05** Cake wash liquid inlet valve
- **V06** Drying air inlet valve
- **V07** Manifold drain inlet valve
- **V09** Cloth wash liquid inlet valve
- **B415** Feed manifold pressure
- **B419** Pressing manifold pressure
- **S516** Pressing water level
- **OK** Tank level OK
- **LOW** Tank level LOW
5.3.6. Filter

List of symbols on the FILTER screen:

- B415: Feed manifold pressure
- B419: Pressing manifold pressure
- B401: Hydraulic pressure
- B601: Hydraulic oil temperature
- B405: Hydraulic accumulator pressure
- S501: Hydraulic oil surface switch
- S15*: Plate pack open
- S25*: Plate pack closed
- S16*: Locking pins unlocked
- S26*: Locking pins locked
- B275: Seal plate position
- S332: Cloth seam detector
- Y51: Plate pack opening
- Y52: Plate pack closing
- Y511: Plate pack balancing
- Y61: Locking pins unlocked
- Y62: Locking pins locked
- Y71: Unsealing
- Y72: Sealing
- Y81: Cloth slackening
- Y82: Cloth tensioning
- Y91: Cloth drive forward
- Y92: Cloth drive reverse
- M07RT: Tracking motor right
- M07LT: Tracking motor left
- M01: Hydraulic unit motor
- R04: Hydraulic oil heater
5.3.7. **Recipe**

The RECIPE screen displays the filtering recipes the filter is provided with. The preset recipes (max. 10 pieces) can be scrolled, modified and activated.

The [PREV] and [NEXT] touch buttons are used to scroll the recipes. The title of the recipe is displayed in the RECIPE field above the [ACTIVATE] button (the first 18 digits).

To modify the control data, enter password from the keyboard and push [ENT]. The cursor will now move to the time value of the first stage. A new value is set accordingly. Use the arrow keys in the numerical keyboard in order to move to the previous/next stage. [CLR] is used to delete the field indicated by the cursor. If password is configured not to be in use, there is no need to enter it.
5.3.8. Change the recipe

The displayed recipe is activated by the [ACTIVATE] button. Confirmation screen is now displayed. Push [YES] to accept and [NO] to disregard.

The text field RECIPE (SELECTED FOR USE) in the upper part of the RECIPE screen displays the selected recipe. The selected recipe will be selected for use at the end of the 'plate pack closing' stage.

The rest of the basic screens can be accessed directly using the touch buttons in the lower part of the display.
5.3.9. **Parameter 1 and parameter 2**

The PARAMETER screens display the filter control parameters that are valid for any recipe. The parameters are distributed between two screens, which can be scrolled by means of the [PAGE 1] and [PAGE 2] touch buttons.

To modify the values, enter password from the keyboard and push [ENT]. The cursor will now move to the value of the first parameter. A new value is set accordingly. Use the arrow key in the numerical keyboard in order to move to the previous/next parameter. [CLR] is used to delete the field indicated by the cursor.

If the password has been entered in a RECIPE screen and a PARAMETER screen is selected next, there is no need to enter the password again.

The RECIPE field of the PARAMETER screen displays the title of the active recipe.

The rest of the basic screens can be accessed directly by means of the touch buttons in the lower part of the display. Drive mode can also be selected directly from this screen.
5.3.10. Messages

The Outotec Pressure Filter control system informs the operator about a number of operating situations by means of a message runner at the bottom of the screen, the colour of which is green. These kind of situations are e.g. such in which the filter seems to have stopped without any visible reason, like when waiting for a to discharge permission or some level information. The message text tells the reason for the message.

The messages automatically disappear as soon as the cause for a message is eliminated.
5.4. Switching on the voltage

1. Turn the MAIN SWITCH to the ON (1) position.
2. The S733/H733 button should be flashing and S708/H708 button should be illuminating now. In case they fail to do so, check the main switch and the fuse(s) inside the panel.
3. Check that there are no foreign objects between the filter plates.
4. Switch off the "Emergency Stop" buttons. The status of indicator lamps should be following:
   - S710/H710 = OFF
   - S708/H708 = ON
   - S733/H733 = FLASHING
5. Turn the HYDRAULIC UNIT switch S755 to position 1. The hydraulic unit is automatically started and stopped according the drive mode.
   In Test Mode, if no actuator or function is activated within five minutes, the hydraulic unit will stop. It will restart as soon as any actuator or function is being activated.
5.4.1. Description of the indicator light functions

**S701 EMERGENCY STOP**

EMERGENCY STOP push buttons are not illuminated

**S710/H710 READY/RUN**

When flashing slowly, it indicates that the filter is ready for operation.

When steadily illuminated, the filter is in operation (RUN)

**S708/H708 STOP/STOPPED**

When illuminated, it indicates that the filter is stopped.

In case of alarm, the alarm signal on top of the panel as well as the S733/H733 button start flashing and an alarm message will appear on the display.

When S733/H733 is pushed once the alarm signal will stop flashing, the second push will acknowledge it provided that the cause of the alarm has been eliminated.
5.5. Test mode

The Test mode is used during troubleshooting and routine maintenance of the filter. All valves and motors present on the pressure filter can be individually actuated (with some restrictions) when in the TEST Mode.

The Test Mode can be activated through KEY SWITCH (S780).
5.5.1. Using the remote test functions

Before operating the machine, make sure that no one is near the danger zones of the filter.

Outotec pressure filter is provided with a handheld test unit. The device can be connected to left side or right side of the filter. This allows the handheld unit to be brought to the actuator to be tested facilitating thus maintenance and adjustments of the actuator.

The handheld test unit has an Emergency Stop push button, test selector switch S714, and two push buttons S723 and S725.

Test mode can be selected only with key switch S780. After activated, the handheld test unit can be used.

When the test operation is over, turn the selector switch to position “A” in the handheld unit and put the handheld unit back to its suspension hook. The filter is ready for normal process use. Select Auto-mode on the control panel. (Remove test mode key switch)

After using test mode, remove key to prevent unauthorized test mode use.
Filter is equipped with several emergency stop buttons. If there is any danger, filter can be stopped immediately by pressing emergency stop button. Never release emergency stop button until it is safe to do so. After all emergency stop buttons are released, emergency stop circuit can be acknowledged by pressing alarm acknowledge push button (S733).

When filter is equipped with protective door system, all filter protective doors must be closed in order to operate filter automatically. If any door is opened during automatic operation filter will stop immediately. Only test mode functions are possible with doors opened.

Emergency stop buttons and protective door limit switches and related safety functions must be tested regularly.

5.5.2. Emergency stop description:

Emergency stop system consists mainly of:

- Programable safety relay KA100
- Expansion input unit KA101
- Expansion relay unit KA102
- Expansion relay unit KA110
- Expansion relay unit KA111
- Fieldbus unit to PLC KA130

Programmable safety relay, base unit, includes 20 digital inputs, 4 digital semiconductor outputs and 2 relay outputs (potential free contacts).

Expansion unit KA101 includes 8 digital inputs.

Expansion unit KA110 includes 8 relay contacts. KA110 is used for hydraulic unit.

Expansion unit KA111 includes 8 relay contacts. KA111 is used for equipments (pumps and motors) outside of filter.

Emergency stop system includes also:

- Emergency Stop Push Buttons S7**
- Door Switches S8**
- Acknowledge Pushbuttons with signal lights for door alarms S741/H741 and S742/H742
- Enable Switch S790

Base unit KA100 includes the safety program. The inputs as well as KA101 inputs are used for controlling the safety signals from safety devices and safety control devices. The outputs are used for controlling the expansion safety relays (KA110, KA111 and KA102) and other devices.

Fieldbus module KA130 is used for communication with PLC.
5.5.3. Emergency stop functions:

Auto mode:

In Auto mode (Key Switch S780 in Auto mode), the Hand Held unit must be connected in Right Side, near to the terminal box X2. Enable Switch S790 must be connected to opposite corner of the filter and the Enable Switch S790 must be released. The doors must be closed and the door alarms must be acknowledged. When these conditions are true and all the safety relays are ON (KA110, KA111, KA102), the Auto Ready signal is sent to PLC. In Auto mode the PLC together with Safety System controls the functions of filter and auxiliary equipments.

Test mode:

In Test Mode (Key Switch S780 in Test mode) it is possible to make the maintenance and test functions for the single devices of the filter. In Test mode the Hand Held can be connected on Right side or on Left side.

When Hand Held is connected to Right side, the doors can be open on Right side and similarly when connected to Left side the doors can be open on Left side. If the doors are opened on the other side, there will become a door alarm to that side. In that case close the doors and acknowledge the alarm.

If it is needed to open the doors on both sides, the Enable Switch S790 must be connected on the other side than Hand Held. After that it is possible to open the doors on both sides without alarm.

Alarms from safety system:

If there are any alarms in safety system ("S70* EMERGENCY STOP", "S8**LT DOORS LEFT SIDE NOT ACKNOWLEDGED" or "S8**RT DOOR RIGHT SIDE NOT ACKNOWLEDGED"), before any device or function can be activated the safety alarms must be acknowledged. All alarms are seen in OIU and can be acknowledged with push button S733. In case of door alarms (H741 or H742 illuminated), acknowledge it with Door Alarm Push Button S741 or S742 before acknowledge it from OIU with S733 (see chapter 5-9 Malfunctions and alarms). If H741 or H742 are flashing, door(s) are open.

Expansion safety relay KA110:

Emergency Stop Push Buttons are located in different units. S701 in Control cabin X1, S703 in pressing water station, S705 in hydraulic unit and S702 in Hand Held unit. There can be also some other Emergency stop Push Buttons.

KA110 is controlled only by Emergency Stop Push Buttons.

Expansion safety relay KA111:

Expansion Safety Relay KA111 is reserved for motors and equipments outside of filter. All motors and equipments that supply water, slurry or some other material to the filter and equipments that can cause harm or danger to filter or people, must have contact from KA111 for stopping those devises.
Expansion Safety Relay KA111 is not active in Test mode. In Auto mode it is ON every time when Auto ready conditions are.

**Feedback signal from MCC:**

Feedback signal from MCC must be ON before Emergency Safety Relay system is possible to get acknowledge. With this loop it is controlled that all the motors and equipments must be stopped before the safety system can be activated.

If MCC loop is not ON after emergency stop (by doors or EMS buttons), Emergency Stop relay will have O_FAULT and alarm is seen in OIU “KA100 FAULT IN EMERGENCY STOP RELAY”, when trying to acknowledge the alarm.

**Testing of devices:**

Testing of valves and hydraulic and pneumatic functions of the filter devices will be done with Hand Held unit. Later there is explanation of the Hand Held unit operation.

**Expansion safety relay KA102:**

In terminal box X2 in the filter there is Emergency Stop Expansion Relay KA102. Via this relay the power is supplied to solenoid valves and other devises in the filter.

In Test mode KA102 will be activated only when the Test Activate push Button S723 or S725 is pushed in HH unit.

If during test the doors are open on both sides, in the other side another operator must use Enable switch S790. If the Enable Switch is connected, the doors can be opened without alarm. When the doors are open on both sides, the enable switch must be kept in middle position, before KA102 and any device or function can be activated.

**Safety in testing:**

Hand Held unit can be connected to both sides of the filter, normally the connectors are in opposite corners. Home plac of HH unit is near to terminal box X2 and in Auto mode it must be connected to that side. Enable Switch S790 must be connected in Auto mode to opposite side.

When operator is testing alone, the doors can be open on that side where the HH is connected. For safety reasons the doors on the other side must be closed.

If it is necessary to open doors both sides, the other operator must use Enable switch S790.

If Enable switch is connected to other side, it is possible to open the doors without door alarm. For testing it must be pressed first the Enable switch in middle position by one operator and after that the other operator can push the test activate push button in HH unit. The operator can stop the test function by releasing the Enable Switch.
5.5.4. **Indications and alarms in safety relay KA100**

The RUN light must be on in relay. This means that the program is running. If there is some FAULTs in the system, the program will be stopped leading to safe condition.

**FAULT LED ON:**

External error on the base unit, leading to a safe condition, e.g. terminator not connected. The alarm can be seen in OIU.

**FAULT LED FLASHING:**

Internal error on the base unit. The alarm can be seen in OIU.

**I_FAULT LED ON:**

External error, leading to a safe condition, e.g. short across the contacts or error on safety mat input. The alarm can be seen in OIU.

**I_FAULT LED FLASHING:**

Internal error on the base unit. The alarm can be seen in OIU.

**O_FAULT LED ON:**

External error on the outputs of the base unit, e.g. short across the contacts, leading to a safe condition. The alarm can be seen in OIU.

**O_FAULT LED FLASHING:**

Internal error on the base unit. The alarm can be seen in OIU.
5.5.5. **Test selector S714**

The Test selector S714 has several functions:

1. When in AUTO position, the eventual alarms during testing can be acknowledged directly from the handheld test unit.

2. VALVE side positions permit the testing of the process valves as shown on switch S714. The left hand side push button S725 activates the valve V0*. The eventual parallel valve V1* can be activated by the right hand side push button S723.

3. HYDRAULIC side positions permit testing of the hydraulics and motors as shown on switch S714. Note that there may be two devices or two directions for each position of S714. In case of two devices, the left hand side push button S725 operates the device listed on the left and the right hand side push button S723 operates the device listed on the right. If there are two directions in which the device may operate, the left hand side push button S725 runs the device either upwards or forward and the right hand side push button S723 runs the device either downwards or reverse.

Three positions between V and H, are reserved for customer equipment test functions and are indicated by X1, X2 and X3.
5.5.6.  **S725/H725 and S723/H723**

* S725/H725 Yellow illuminated push button (leftmost button)

This push button activates the hydraulic cylinder or motor

Selected **up or forward** when S714 is positioned on the

HYDR side, and the valve V0* when S714 is positioned on

the VALVE side. This push button also operates as the

ALARM ACKNOWLEDGE push button when S714 is in AUTO.

* S723/H723 Green illuminated push button (rightmost button) This push button activates

the hydraulic cylinder or motor selected **down or reverse** when S714 is positioned on the

HYDR side, and the valve V1* (parallel to V0*) when S714 is positioned on the VALVE side.

Testing continues as long as the push button is switched on. Note that cloth drive is

provided with positions both with and without cloth tensioning.

5.5.7.  **Restrictions in testing the actuators**

- The quick action cylinders (up or down) will operate only when the locking pins are fully

  locked or unlocked.

- The cloth drive will operate only when the plate pack is fully open (one of the plate pack

  open sensors S152/S154 must be activated).

- Unsealing the plate pack does not work (lower pressing plate down) if there is pressure

  (pressure transmitter B419) in the pressing manifold.

5.5.8.  **List of symbols in handheld test unit**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>V01</td>
<td>FILTRATE OUTLET VALVE</td>
</tr>
<tr>
<td>V02</td>
<td>SLURRY INLET VALVE</td>
</tr>
<tr>
<td>V04</td>
<td>PRESSING WATER OUTLET VALVE</td>
</tr>
<tr>
<td>V05</td>
<td>CAKE WASH LIQUID INLET VALVE</td>
</tr>
<tr>
<td>V06</td>
<td>DRYING AIR INLET VALVE</td>
</tr>
<tr>
<td>V07</td>
<td>MANIFOLD DRAIN OUTLET VALVE</td>
</tr>
<tr>
<td>V08</td>
<td>PRE- WASH FILTRATE OUTLET VALVE</td>
</tr>
<tr>
<td>V09</td>
<td>CLOTH WASH LIQUID INLET VALVE</td>
</tr>
<tr>
<td>V10</td>
<td>SLURRY RECYCLE VALVE (OPTIONAL)</td>
</tr>
<tr>
<td>HC5</td>
<td>QUICK ACTION CYLINDERS</td>
</tr>
<tr>
<td>HC6</td>
<td>LOCKING PINS</td>
</tr>
<tr>
<td>HC7</td>
<td>SEALING CYLINDERS</td>
</tr>
<tr>
<td>HM8</td>
<td>CLOTH TENSIONING MOTOR</td>
</tr>
<tr>
<td>HM9</td>
<td>CLOTH DRIVE MOTOR</td>
</tr>
<tr>
<td>HC4</td>
<td>CLOTH TRACK CYLINDER</td>
</tr>
<tr>
<td>BAL</td>
<td>QUICK ACTION CYLINDER BALANCING</td>
</tr>
<tr>
<td>HC5&amp;BAL</td>
<td>QUICK ACTION CYLINDERS AND BALANCING</td>
</tr>
</tbody>
</table>
5.6. Man mode (manual mode)

The MAN mode can be used when the operator is searching for the optimal values of the process variables as well as when the sequence must be continued from a different point than from where it was stopped, or if the operator wants to run any stage longer than normally.

1. Select MAN MODE from the touch screen and turn the HYDRAULIC UNIT switch S755 to position 1. The hydraulic unit is automatically started and stopped by the control system according to the drive mode.
The MAN MODE field is now displayed. The field has the following elements:

- `[?]` Touch button to activate HELP-screen
- RECIPE Displays the current program
- STAGE Displays the number of the current stage.
- MODE Displays the current mode. MAN MODE.
- ELAPSED Displays the time elapsed in MAN MODE.
- STATUS Displays the current status, e.g. RUN, READY, ALARM, STOP
- `[< | ]` Touch button to reverse.
- `[ | >]` Touch button to forward.

2. For PRESSURE RELEASE proceed to step 4. For any other stage, use the `[< | ]` or `[> | ]` touch buttons for scrolling through the stages. Note that the `[< | ]` touch button does not forward the sequence from the beginning to the end, whereas the `[ | >]` touch button rewinds the sequence from the end to the beginning. Note also that this kind of selection process is possible only when the filter is stopped.

3. To start the filter, push the START button once. Note that prior to starting the filter, the START button should be flashing indicating that the filter is ready to begin operations. In case it fails to do so, make sure that there is no alarm on. Once the filter is running, the START button is illuminated.

   The time elapsed during filter operations will be displayed in the TIME ELAPSED area. Note that while in MAN MODE, this time will COUNT UP from zero to show actual time elapsed in the stage currently running.

4. To proceed to the next stage, push the START button once.

5. To stop the filter push STOP button. When you push the STOP button once, it is illuminated indicating that the filter has stopped.

6. To restart the filter from the stage it was stopped in, push the START button.
5.6.1. Restrictions

1. The filtration stage cannot be selected twice during one operation cycle. If filtration has been going on for 10 seconds or more and is stopped and restarted, the sequence will automatically skip over slurry feeding and continue from pipe and hose washing.

2. The process stages cannot be selected unless the plate pack is fully closed.

3. The discharge stage cannot be selected unless the plate pack is fully open.

### NOTICE

**Overfilling can cause serious damage to the filter plates. When in manual mode, supervise the prefiltration and filtration stages.**

### WARNING

**Hazardous moving parts. The plate pack consists of several moving parts, which can cause serious injury or death. Never leave the filter running by itself in MAN mode.**
5.7. **Auto mode (automatic)**

AUTO MODE is the normal operating mode of the filter. All necessary operations to run the filter are automatically executed by the control system.
4. Select AUTO MODE from the touch screen and turn the HYDRAULIC UNIT switch S755 to position 1. The hydraulic unit is automatically started and stopped by the control system according to the drive mode.

The AUTO MODE screen will be displayed. The screen has the following elements:

- TOUCH [?] button to activate HELP-screen
- RECIPE Displays the current program
- STAGE Displays the number of the current stage.
- MODE Displays the current mode. AUTO MODE.
- REMAINING Displays the time remaining in AUTO MODE.
- STATUS Displays the current status, e.g. RUN, READY, ALARM, STOP

5. To start the filter from the present stage, push the START button once. Note that prior to starting the filter, the START button should be flashing indicating that the filter is ready to begin operations. In case it fails to do so, make sure that there is no alarm on. Once the filter is running, the START button is illuminated.

- The time remaining during filter operations will be displayed in the REMAINING area. Note that while in AUTO MODE, this time will COUNT DOWN from the preset to show the time remaining in each stage.

6. If you want to start from another stage, see instructions for program RESET in section RESET MODE and MANUAL START in section MANUAL MODE.

5.7.1. How to stop the filter

7. To stop the filter push STOP button. When you push the STOP button once, it is illuminated indicating that the filter has stopped.

NOTE! The filter may be stopped due to an alarm or a voltage break.

If the filter has been stopped and been sitting idle for a long period of time, it is recommended that the filter to be driven in the discharge stage in MAN MODE until the full length of the filter cloth has been washed. Once the full length has been washed, the AUTO MODE can be switched on, operating the filter normally.

5.7.2. How to restart the filter with automatic drive

8. If the filter has been stopped due to an alarm or if the STOP button has been pushed, proceed as follows:

- Locate and eliminate the alarm or malfunction prior to restarting the filter (see MALFUNCTIONS AND ALARMS).
- Push the START button once. The filter restarts from the stage it was stopped in and continues the automatic operation.
5.8. **End Mode (stop at the end of cycle)**

The END mode is used to stop the filter automatically after complete cycle (after cake discharge), thereby freeing the operator from having to wait for the end of the present cycle.

In this mode the filter will perform an orderly stopping after the end of cake discharge.

All functions in END mode are similar to those in AUTO mode.

9. Select END mode from the touch screen.

10. The filter will continue its operation through the cycle as if in AUTO mode and stop after the end of cloth washing. At this time the filter will perform an orderly shutdown either by locking the moving press plate in the upper position or by closing the plate pack (according to the selection). The filter can be restarted at any time in either MAN mode or AUTO mode by pushing the START button (see MAN mode or AUTO mode). The filter will restart from CAKE DISCHARGE after END mode stop.
5.9. Reset mode (sequence reset)

The RESET MODE is used to reset the program sequence back to the PRESSURE RELEASE stage and load into the operational area of the program any new data that has been entered.

Note: Before starting the filter from another point than where it was stopped, the program sequence must be reset.

11. Select RESET mode from the touch screen. The program then asks for a confirmation and requests you to stop the filter.

12. Push STOP button S708/H708 to RESET the filter program sequence.

13. The default starting stage after resetting the filter program sequence is PRESSURE RELEASE unless the plate pack is fully open. If the plate pack is fully open, the default starting point is CAKE DISCHARGE. To start the filter from another stage, see MAN MODE.
5.10. Malfunctions and alarms

5.10.1. General

Extensive diagnostic functions have been programmed into the control system of OUTOTEC Filter.

ALARMS THAT STOP THE FILTER IMMEDIATELY

- Emergency stop
- Voltage break

ALARMS THAT STOP THE FILTER AFTER A PRESET DELAY

- Valve or sensor failure
- Motor failure
- Process pressures
- Cloth drive
- Plate pack movements
- CPU battery low
- Failure in hydraulics
- Level of process fluid tanks

5.10.2. Alarm acknowledgement

When in state of alarm, the filter will stop immediately. The ALARM BEACON on top of the control panel and the ALARM RESET button S733 will flash informing alarm or malfunction existing in the filter.

Push the ALARM RESET button once to stop the ALARM BEACON and the ALARM RESET button from flashing.

The ALARM RESET button remains illuminated.

Once the cause of the alarm has been located and eliminated, push the ALARM RESET button again to acknowledge the alarm. Then the filter can be restarted by pushing the START button S710.

Determine the cause of alarm before restarting the filter
Trouble shooting

If the cause of alarm and its corrective measures are not known, the display screen can provide the operator with extensive help in determining the possible reasons for the alarm, and the measures that can be taken to correct it.
## 5.10.3. Trouble shooting

<table>
<thead>
<tr>
<th>HOW DISTURBANCE APPEARS</th>
<th>CAUSE FOR DISTURBANCE</th>
<th>WHAT TO DO?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Leakage between plates during filtering.</td>
<td>Hardened of crystallized cake on seal surfaces under the cloth or foreign material between plates. Defective seal. Bent plate. Local deflection, which does not compensate. Counter-pressure in the filtrate side. Slurry feed greater than the filter's hydraulic capacity.</td>
<td>Open plate pack, clean plates and wash the cloth. Replace the seal. Replace or straighten the plate. Examine and straighten the sealing surface if necessary. Check pipelines. Decrease the slurry feed rate.</td>
</tr>
<tr>
<td>2. Cake wetter than normal.</td>
<td>Slurry properties have changed. Damaged diaphragm.</td>
<td>Install control equipment for slurry. Replace the diaphragm.</td>
</tr>
<tr>
<td>3. Pressing water station low level alarms and stops the filter.</td>
<td>Leakage in pressure water piping. Damaged diaphragm.</td>
<td>Locate and stop the leakage. Filtering must not be continued by adding water; the diaphragm must be changed.</td>
</tr>
<tr>
<td>4. Cloth slipping sideways off the rollers (displaced).</td>
<td>Cloth seam not perpendicular to the edges. Rollers not properly positioned.</td>
<td>Repair the cloth. Adjust the rollers.</td>
</tr>
<tr>
<td>5. Folding in the cloth.</td>
<td>Cake sticks to the rollers. Bad seam in the cloth.</td>
<td>Adjust roller scrapers closer to the rollers. Repair the clipper seam.</td>
</tr>
<tr>
<td>6. Cloth moves jerkily but without slipping on the drive roller.</td>
<td>Cloth seam gets caught on scrapers. Cloth scrapers retard the cloth. Water is left in the pressing diaphragms and presses the cloth.</td>
<td>Check the scrapers and adjust if necessary. Check clipper seam and change the cloth if the seam is damaged. Adjust the cloth scrapers. Remove the water from the diaphragms.</td>
</tr>
<tr>
<td>7. The cloth does not move and stops the filter.</td>
<td>The cloth slips on the drive roller due to insufficient cloth tensioning. Too much water remains in the pressing diaphragms pressing the cloth thus preventing the cloth from moving. Cakes are too thick.</td>
<td>Adjust the tensioning pressure. Close the pack carefully in TEST mode. Adjust a longer drying time. Remove the cakes manually check the plate feed inlets, check the slurry feed time.</td>
</tr>
<tr>
<td>8. Cake gathers on the rollers.</td>
<td>The cloth is insufficiently cleaned.</td>
<td>Adjust the cloth scrapers closer to the cloth. - Adjust the roller scrapers. - Check the cloth wash system.</td>
</tr>
<tr>
<td>HOW DISTURBANCE APPEARS</td>
<td>CAUSE FOR DISTURBANCE</td>
<td>WHAT TO DO?</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-----------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>9. To high solid content in the filtrate.</td>
<td>Hole in the cloth. Cloth wash does not operate properly.</td>
<td>Always patch the hole immediately! Check the cloth wash nozzles and their direction. Also check the direction of the nozzle pipes, clean or change clogged nozzles.</td>
</tr>
<tr>
<td>10. Blocked grids.</td>
<td>Hole in the cloth.</td>
<td>Always patch the hole immediately!</td>
</tr>
<tr>
<td>11. Filtrate outlets and pipes wear out fast.</td>
<td>Cloth wash does not operate properly.</td>
<td>Check the cloth wash nozzles and their direction. Also check the direction of the nozzle pipes, clean or change clogged nozzles.</td>
</tr>
<tr>
<td>12. A very thin cake or no cake at all.</td>
<td>Blocked slurry feed inlet.</td>
<td>Clean the slurry feed inlet and check the slurry sieve.</td>
</tr>
<tr>
<td>13. Cloth guiding is difficult, cloth edges get frayed, cloth limits give an alarm.</td>
<td>Slide pieces are worn or wrongly adjusted.</td>
<td>Adjust the slide pieces or replace them if necessary.</td>
</tr>
<tr>
<td>14. A roller does not rotate or rotates jerkily.</td>
<td>Bearing fail due to damaged seal.</td>
<td>Change the bearing.</td>
</tr>
<tr>
<td>15. The chains of the tensioning device do not stay on the sprockets.</td>
<td>The chains have stretched.</td>
<td>Tighten the chains.</td>
</tr>
<tr>
<td>16. The pinch valve leaks.</td>
<td>A broken pinch valve sleeve.</td>
<td>Change the sleeve and adjust the actuator.</td>
</tr>
<tr>
<td>17. Problems with the pressure water pump: wearing out, dropped pressure, increased cake moisture.</td>
<td>Broken diaphragm.</td>
<td>Change the diaphragm and clean the water station.</td>
</tr>
<tr>
<td>18. Cloth drive and centring is difficult and cloth life gets shorter.</td>
<td>Ageing of rubber (drive, press and centring rollers). Too high pressing force (between the drive and press rollers).</td>
<td>Change the roller(s). Adjust the coil springs of the press roller to the length of 55 mm and change the damaged roller(s).</td>
</tr>
<tr>
<td>19. Faults in sub-supplied parts.</td>
<td></td>
<td>See the manufacturer's instructions.</td>
</tr>
</tbody>
</table>
## 5.10.4. Alarm functions

<table>
<thead>
<tr>
<th>Name (Group)</th>
<th>Cause</th>
<th>Reason</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>S70* EMERGENCY STOP (D)</td>
<td>One or more of the several emergency stop buttons is engaged.</td>
<td>Emergency stop by the operator.</td>
<td>Find out the reason for the Emergency stop. Make sure that it is SAFE to restart the filter. Release the engaged button(s). Emergency-stop buttons are located in the control panel, filter, hand-held unit and on the pressing water station. If possible do not leave the emergency stop button activated for a longer time because the pinch valves may open, otherwise close the process line manual valves.</td>
</tr>
<tr>
<td>S801... S810 PROTECTIVE DOOR SENSOR (D)</td>
<td>Protective door sensor indicates that door is open.</td>
<td>Protective door is open. Sensor adjusted wrongly. Sensor fault.</td>
<td>Close protective door. Adjust/replace sensor. Check electrical system.</td>
</tr>
<tr>
<td>S8XXLT DOORS LEFT SIDE NOT ACKNOWLEDGED (D)</td>
<td>Protective doors in left side open or not acknowledged with blue push button in left side of the filter after closing.</td>
<td>Protective doors closed but not acknowledged.</td>
<td>Acknowledge “doors closed” with blue push button S741.</td>
</tr>
<tr>
<td>S8XXRT DOORS RIGHT SIDE NOT ACKNOWLEDGED (D)</td>
<td>Protective doors in right side open or not acknowledged with blue push button in right side of the filter after closing.</td>
<td>Protective doors closed but not acknowledged.</td>
<td>Acknowledge “doors closed” with blue push button S742.</td>
</tr>
<tr>
<td>POWER LOSS OR PLC RESTART (H)</td>
<td>PLC stopped and restarted.</td>
<td>Main voltage break. PLC has been in PROGRAM mode.</td>
<td>Check the reason for PLC stop.</td>
</tr>
<tr>
<td>PLC BATTERY LOW (H)</td>
<td>Voltage level of memory backup battery in the Programmable Logic Controller (PLC) has dropped too low. Alarm activated when filter stops.</td>
<td>Battery is low.</td>
<td>Change the backup battery. See PLC manufacturers instructions from the PLC operation manuals. NOTE! DO NOT REMOVE POWER TO THE FILTER WHILE THIS ALARM IS ACTIVE.</td>
</tr>
</tbody>
</table>

**NOTE!** DO NOT REMOVE POWER TO THE FILTER WHILE THIS ALARM IS ACTIVE.
<table>
<thead>
<tr>
<th>Name (Group)</th>
<th>Cause</th>
<th>Reason</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>B331 CLOTH INCREMENTAL ENCODER (B)</td>
<td>No impulses from incremental encoder when cloth drive activated.</td>
<td>Pressing roller is loose. Cloth is cut or too long. Tensioning mechanism inoperative. Cakes are too thick. Cloth cannot move forward. Water remains in the pressing diaphragms. Encoder has failed.</td>
<td>Adjust the pressing roller. Check the cloth, repair. Check the cloth tension. Check that the cloth can move freely. Replace encoder.</td>
</tr>
<tr>
<td>S332 CLIPPER SEAM SENSOR (B)</td>
<td>Seam not detected within one cloth revolution or detected in improper place.</td>
<td>Sensor not adjusted properly or has failed. Clipper seam not existing.</td>
<td>Adjust/replace sensor.</td>
</tr>
<tr>
<td>S838A OR S839A CLOTH DISPLASED TO LEFT OR RIGHT SENSOR (B)</td>
<td>The automatic cloth tracking system has failed to keep the cloth centered.</td>
<td>Cloth not adjusted properly. Tensioning roller displaced. Cloth seam in not straight. Material has accumulated on the rollers. Scrapers are not adjusted properly. Jammed roller(s) Press roller not evenly adjusted. Switch not adjusted properly or have failed.</td>
<td>Center the cloth using the tracking roller (If the cloth is badly displaced, loosen the cloth in TEST mode and manually center the cloth). Check tensioning roller. Check rollers and scrapers. Adjust press roller for evenly pressure against drive roller. Adjust/replace switch.</td>
</tr>
<tr>
<td>S873 TRACKING ROLLER RANGE SENSOR (B)</td>
<td>No signal from the track roller sensor S873.</td>
<td>The cloth is tracking badly causing excessive tracking roller response. Sensor S873 not adjusted properly or has failed.</td>
<td>Check the position of the track roller. Center the roller using TEST mode and activating M07 to desired direction. Adjust/replace sensor.</td>
</tr>
<tr>
<td>Name (Group)</td>
<td>Cause</td>
<td>Reason</td>
<td>Measures</td>
</tr>
<tr>
<td>-------------</td>
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</tr>
<tr>
<td>S252 OR S254 QUICK ACTION CYLINDER HC5.2/HC5.4 DOWN SENSOR (F)</td>
<td>Abnormal state of the displayed sensor when operating the quick-action opening or closing of the plate pack.</td>
<td>Upper pressing plate not moving properly. Hydraulic oil too cold. Hydraulic pressure too low. Hydraulic valve HV5 malfunction. Sensor not adjusted properly or has failed. Lower pressing plate not completely down</td>
<td>Check movement of upper pressing plate. Check hydraulic oil temperature and pressures. Adjust/replace sensor.</td>
</tr>
<tr>
<td>S161…S164 LOCKING PINS UNLOCKED SENSORS (F)</td>
<td>Abnormal state of the displayed sensor when operating the locking pins (locking or unlocking).</td>
<td>Locking pin jammed in the mid position. Hydraulic pressure too low. Mechanical failure. Sensor not adjusted properly or has failed.</td>
<td>Inspect locking pin assembly. Test locking pin movement. Check hydraulic pressures. Adjust/replace sensor.</td>
</tr>
<tr>
<td>[B472 SEALING PRESSURE (G)]</td>
<td>Sealing pressure transmitter B472 in the main hydraulic block is indicating low oil pressure during plate pack closing stage.</td>
<td>Proportional pressure control has failed. Transmitter B472 has failed</td>
<td>Check oil pressure. Adjust or replace proportional pressure control. Replace B472.</td>
</tr>
<tr>
<td>B275 Y LOWER PRESSING PLATE YIELDING (G)</td>
<td>Abnormal signal from the transmitter B275 when plate pack is pressurized (during pressing stage)</td>
<td>Hydraulic valves are leaking (yield). Transmitter not adjusted properly or has failed</td>
<td>Check movement of lower pressing plate. Check hydraulic valves. Adjust/replace transmitter.</td>
</tr>
<tr>
<td>B275S SEALING STROKE INCOMPLETE (G)</td>
<td>Abnormal signal from the sensor B275 when driving up (sealing) the sealing cylinders HC7 (too small movement).</td>
<td>Sealing plate not moving properly. Hydraulic pressure too low. Sensor not adjusted properly or has failed.</td>
<td>Check movement of sealing plate Check hydraulic pressures. Adjust/replace sensor</td>
</tr>
<tr>
<td>Name (Group)</td>
<td>Cause</td>
<td>Reason</td>
<td>Measures</td>
</tr>
<tr>
<td>--------------</td>
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</tr>
<tr>
<td>B275L SEALING PLATE LOW POSITION (G)</td>
<td>Abnormal state of the sensor B275 when driving down (unsealing) or up (sealing) the sealing cylinders HC7.</td>
<td>Sealing plate not moving properly. Hydraulic pressure too low. Sensor not adjusted properly or has failed.</td>
<td>Check movement of sealing plate. Check hydraulic solenoids. Check hydraulic pressures. Adjust/replace sensor.</td>
</tr>
<tr>
<td>B405 ACCUMULATOR RECHARGE PRESSURE (G)</td>
<td>The recharging of the pressure accumulator takes too long, or the recharging occurs too often.</td>
<td>Leak in the pipelines or hoses. Unsuitable oil type. Accumulator charge pressure is too low. Flow control block (FC1) assembly is leaking internally. B405 has failed.</td>
<td>Check the pipes and hoses. Check the oil type. Check accumulator charge pressure. Check that FC1 adjustment screws are completely set in and the lock nuts are tightened. Check the pressure from PG4 when recharging the accumulator. Replace B405.</td>
</tr>
<tr>
<td>S410 RETURN LINE OIL FILTER PRESSURE SWITCH (G) S411 PRESSURE LINE OIL FILTER PRESSURE SWITCH (G)</td>
<td>Pressure switch S410 or S411 signals a high differential pressure in the RETURN LINE / PRESSURE LINE oil filter.</td>
<td>Return line oil filter is clogged. Oil temp is too low or oil is too thick (improper viscosity). Cable is disconnected. Pressure switch S410 or S411 has failed.</td>
<td>Run the hydraulic unit to warm up the oil. If alarm is active when the oil is warm, replace the oil filter. Reconnect the cable. Replace S410 or S411.</td>
</tr>
<tr>
<td>S501 OIL LEVEL LOW (G)</td>
<td>Oil level switch S501 in hydraulic oil reservoir is indicating low oil level.</td>
<td>Leak in the hydraulic system. Level switch S501 has failed.</td>
<td>Check the oil level and add oil if necessary. Check system for oil leaks. Never run the hydraulic pump if the tank is empty. Replace S501.</td>
</tr>
<tr>
<td>B601L OIL TEMPERATURE LOW (G)</td>
<td>Oil temperature transmitter B601 in hydraulic oil reservoir is indicating low oil temperature (below 10°C).</td>
<td>Oil heater is not on. Ambient temperature is low. Transmitter B601 has failed</td>
<td>Check that the oil heater is on. Check oil temperature from the thermometer TM. Allow heater to warm up the oil for 30 minutes. Replace B601.</td>
</tr>
<tr>
<td>Name (Group)</td>
<td>Cause</td>
<td>Reason</td>
<td>Measures</td>
</tr>
<tr>
<td>-------------</td>
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</tr>
<tr>
<td>B601H OIL TEMPERATURE HIGH (G) S601 OIL TEMPERATURE HIGH HIGH THERMOSTAT (G)</td>
<td>Oil temp transmitter B601 in hydraulic oil tank or thermostat S601 is indicating high oil temperature (B601 above 650°C / S601 above 70°C).</td>
<td>Oil cooler is not on. Oil heater has failed on. Transmitter B601 has failed. Thermostat S601 not adjusted properly or has failed.</td>
<td>Check that the oil cooler is on. Check that the oil heater R04 is off. Check oil temperature from the thermometer TM. Allow cooler to cool down the oil for 30 minutes. Check adjustment of S601. Replace B601/S601.</td>
</tr>
<tr>
<td>B401 SYSTEM OIL PRESSURE HIGH (G)</td>
<td>Oil pressure transmitter B401 in the main hydraulic block is indicating high oil pressure (above approx. 240 bar).</td>
<td>Proportional pressure control (valve/amplifier plug) has failed. Max pressure relief valve has failed. Transmitter B401 has failed</td>
<td>Check oil pressure. Adjust or replace proportional pressure control (valve/amplifier plug). Adjust or replace max pressure relief valve. Replace B401.</td>
</tr>
<tr>
<td>M01 HYDRAULIC PUMP MOTOR (C) M05 OIL COOLER MOTOR (C) (OPTIONAL) M07 CLOTH TRACKING SYSTEM MOTOR (C)</td>
<td>No feedback signal after K1M** output turns on, or the feedback signal still on after K1M** output turns off. Alarm delay 2 sec.</td>
<td>Safety switch open. Fuse tripped.</td>
<td>Reset switches. Replace fuses. Test the motor in question with TEST mode. NOTE: plate pack must be closed if pressing water pump is tested.</td>
</tr>
<tr>
<td>M02 PRESSING WATER PUMP M06 CLOTH WASH PUMP MOTOR (C) (OPTIONAL) M08 CAKE CONVEYOR (C) M09 SLURRY PUMP MOTOR (C) M15 CAKE WASH PUMP MOTOR (C) (OPTIONAL)</td>
<td>No feedback signal after K1M** output turns on, or the feedback signal still on after K1M** output turns off. Alarm delay 5 sec.</td>
<td>Safety switch open. Fuse tripped.</td>
<td>Reset switches. Replace fuses.</td>
</tr>
<tr>
<td>R04 OIL HEATER (C)</td>
<td>No feedback signal after K1R04 output turns on, or the feedback signal still on after K1R04 output turns off. Alarm delay 2 sec.</td>
<td>Fuse tripped.</td>
<td>Replace fuses.</td>
</tr>
<tr>
<td>CONTROL VOLTAGE OVERLOAD (C)</td>
<td>Thermal overload protector for control voltage has tripped.</td>
<td>Overload. Short circuit. Lose wire connection.</td>
<td>Reset the tripped protector. Measure the current of the protector and find out the reason for the overload.</td>
</tr>
<tr>
<td>Name (Group)</td>
<td>Cause</td>
<td>Reason</td>
<td>Measures</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>--------------------------------</td>
<td>---------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>***F MOTOR OVERLOAD (C)</td>
<td>Thermal overload relay or motor protector has tripped.</td>
<td>Overload. Short circuit. Lose wire connection.</td>
<td>Reset the tripped device. Measure the current of the device and find out the reason for the overload. Clean the motor.</td>
</tr>
<tr>
<td>B415M FEED MANIFOLD PRESSURE HIGH (E)</td>
<td>Feed manifold pressure transmitter B415 is indicating too high pressure (above max. operating pressure setpoint in auxiliary parameters, typically 16.0 bar).</td>
<td>Slurry feed, wash water or drying air system produces excessive pressure. Transmitter B415 has failed.</td>
<td>Check feed manifold pressure from the pressure gauge. Correct the reason for over pressure. Replace B415.</td>
</tr>
<tr>
<td>B415F SLURRY FEED PRESSURE LOW (E)</td>
<td>Feed manifold pressure transmitter B415 is indicating low slurry feed pressure while slurry pump is running and slurry inlet valve V02 is open.</td>
<td>Slurry feed pump inoperative or cavitating. Slurry tank is empty. Manual valve closed. Pressure setpoint “MINIMUM FEED PRESSURE” incorrectly set. Transmitter B415 has failed.</td>
<td>Start the slurry feed pump. Maintain correct slurry level. Open the manual valve. Enter correct value into “MINIMUM FEED PRESSURE” setpoint. Adjust/replace pressure transmitter B415.</td>
</tr>
<tr>
<td>B415H HOSE WASH PRESSURE (E) LOW B415C CAKE WASH PRESSURE LOW (E)</td>
<td>Feed manifold pressure transmitter B415 is indicating low wash water pressure during HOSE WASH or CAKE WASH stage.</td>
<td>Wash water pump inoperative or cavitating. Wash water tank is empty. Manual valve closed. Pressure setpoint in Data 2 for HOSE WASH or CAKE WASH stage incorrectly set. Transmitter B415 has failed.</td>
<td>Start the wash water pump. Maintain correct wash liquid level. Open the manual valve. Enter correct value into Data 2 setpoint. Adjust/replace pressure transmitter B415.</td>
</tr>
<tr>
<td>Name (Group)</td>
<td>Cause</td>
<td>Reason</td>
<td>Measures</td>
</tr>
<tr>
<td>-------------</td>
<td>-------</td>
<td>--------</td>
<td>----------</td>
</tr>
<tr>
<td>B415N FEED MANIFOLD PRESSURE NOT RELEASED (E)</td>
<td>Feed manifold pressure transmitter B415 is indicating too high pressure after opening the drain valve V07.</td>
<td>Drain pipe is clogged. Slurry strainer is clogged. V07 valve failed. Transmitter B415 has failed</td>
<td>Ensure that pressure in feed manifold is released. Clean the pipeline. Check operation of valve V07. Adjust/replace pressure transmitter B415.</td>
</tr>
<tr>
<td>B419M PRESSING MANIFOLD PRESSURE HIGH (E)</td>
<td>Pressing manifold pressure transmitter B419 is indicating too high pressure (above max. operating pressure setpoint in auxiliary parameters, typically 16.0 BAR).</td>
<td>Pressing system produces excessive pressure. Transmitter B419 has failed</td>
<td>Check pressing manifold pressure from the pressure gauge. Correct the reason for overpressure. Replace B419</td>
</tr>
<tr>
<td>B419P PRESSING MANIFOLD PRESSURE NOT REACHED (E)</td>
<td>Transmitter B419 is indicating low pressing manifold pressure after closing the valve V04 and starting the pressing water pump M02.</td>
<td>Pump M02 not running or is cavitating. Manual valve closed. Valve V04 not closed. Pressure setpoint in “MIN. PRESSING PRESSURE” incorrectly set. Transm. B419 has failed.</td>
<td>Ensure pump M02 is operating normally. Open the manual valve. Enter correct value into “MIN. PRESSING PRESSURE” setpoint. Adjust/replace pressure transmitter B419.</td>
</tr>
<tr>
<td>B419N PRESSING MANIFOLD PRESSURE NOT RELEASED (E)</td>
<td>Pressing manifold pressure transmitter B419 is indicating too high pressure after opening the pressing water outlet valve V04.</td>
<td>Outlet pipe is clogged. V04 valve failed. Transmitter B419 has failed.</td>
<td>Ensure that pressure in manifold is released. Clean the pipeline. Check operation of valve V04. Adjust/replace pressure transmitter B419.</td>
</tr>
<tr>
<td>B415D FEED MANIFOLD PRESSURE TRANSMITTER DRIFT (E) B419D PRESSING MANIFOLD PRESSURE TRANSMITTER DRIFT (E)</td>
<td>Signal from transmitter that pressure does not fall below 0.5 bar when it should.</td>
<td>Feed manifold drain valve V07 inoperative. Drain pipeline blocked. Pressing water return valve V04 inoperative. Transmitter not adjusted properly or has failed.</td>
<td>Measure mA-signal (4-20 mA) when pipeline pressure is zero. \ Check feed manifold drain pipeline. Adjust/replace pressure transmitter.</td>
</tr>
<tr>
<td>S516 PRESSING WATER LEVEL LOW (E)</td>
<td>The pressing water level switch S516 in the pressing water tank does not give signal.</td>
<td>Tank water level is low. Discharge valve is open. Leak in diaphragms. Evaporation. Leak in pressing water hoses or pipelines. S516 not adjusted properly or has failed. Wiring problem.</td>
<td>Fill the tank (the water level should be at the level off the overflow). Follow the operation of the filter during pressing, try to find leak. Replace the damaged diaphragm(s). Replace the damaged hose. Adjust/replace sensor.</td>
</tr>
<tr>
<td>Name (Group)</td>
<td>Cause</td>
<td>Reason</td>
<td>Measures</td>
</tr>
<tr>
<td>------------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>SLLO SLURRY LEVEL LOW (E)</td>
<td>The signal from SLURRY TANK LOW LEVEL switch is missing and causes the filter to stop at the end of cycle.</td>
<td>Slurry tank is empty. Level switch is faulty adjusted or failed.</td>
<td>Check the slurry level and level switch. Check the signal coming to the control panel.</td>
</tr>
<tr>
<td>S418 INSTRUMENT AIR PRESSURE LOW (E)</td>
<td>The signal from pressure switch S418 is missing for more than 30 seconds.</td>
<td>Instrument air pressure low. Pressure switch faulty adjusted or failed.</td>
<td>Check instrument air pressure. Check pressure switch. Open manual valve. Start up compressor.</td>
</tr>
<tr>
<td>BxxxW TRANSMITTER WIRE BREAK</td>
<td>Analog signal of transmitter below 4mA.</td>
<td>- Wire break. - Transmitter failed. - Analog card failed.</td>
<td>- Check wires. - Check/replace transmitter. - Check/replace analog card.</td>
</tr>
</tbody>
</table>
5.11. **Automatic operation**

5.11.1. **Operation stages of OUTOTEC pressure filter**

**SBR01 PRESSURE RELEASE**

For security reasons, pressure release is always the first stage when starting a OUTOTEC PRESSURE FILTER. During this stage, the remaining pressure in the filter chambers is released for a safer plate pack opening. This stage is divided into two periods of time: in the first and main period the inlet valves are closed. During the second period, the manifold drain valve V07 is opened.

**SBR02 PLATE PACK OPENING**

On completion of the PRESSURE RELEASE the plate pack is unsealed by driving the sealing cylinders downwards. The quick action cylinders are then driven to release the pins from the column holes. The locking pins are unlocked (pins move into the upper pressure plate). After the locking pins have been unlocked, the plate pack is opened by driving the quick action cylinders upwards until the plate pack is fully open. The cloth strain starts at the same time as the plate pack opening.

**SBR03 CAKE DISCHARGE**

When the plate pack is fully open, the cloth drive motor HM09 is started and the cloth wash inlet valve V09 is opened. The cake formed on the cloth is then discharged into the cake chutes at both ends of the filter. After the first plate length of discharge, the speed of the cloth is increased reducing thus the cloth washing time.

**SBR04 RESTART OPERATIONS**

On completion of the discharge the clipper seam is placed outside the plate pack at a lower speed and the cloth drive motor HM09 stops.

**SBR05 PLATE PACK CLOSING PF-H**

On completion of the restart operations delay the filter begins to close the plate pack. First the quick action cylinders are moved downwards after which the locking pins are locked. Finally, the plate pack is sealed by driving the sealing cylinders upwards until the required sealing pressure is reached. The pressing water outlet valve V04 is kept open in order to ensure free discharge of pressing water in case any of it has remained in the diaphragms during the previous cycle.

**SBR06 PRE-FILTRATION**

When the filter plates are closed and sealed, the slurry is fed to the distribution pipe through V02 and further to each chamber through the feed collectors. The pressing water outlet valve V04 is held open thus ensuring a free discharge of the pressing water still present in the diaphragms from the previous cycle. The filtrate passes through the cloth into the filtrate pan and exits the filter chamber via filtrate collectors into the filtrate side pipe and out through the valve V08. Cake begins to form on the cloth. When the filtration time runs out, the filtration stage starts.
SBR07 FILTRATION (Slurry feed)

When the filter plates are closed and sealed, the slurry is fed through the distribution pipe to each chamber through the feed collectors. The pressing water outlet valve V04 is held open thus ensuring a free discharge of the pressing water still present in the diaphragms from the previous cycle. The filtrate passes through the cloth into the filtrate pan and exits the filter chamber via filtrate collectors into the filtrate side pipe and out through the valve V01. Cake begins to form on the cloth.

SBR08 PIPE WASHING

After the filtration stage, the distribution pipe is cleaned by opening the manifold drain valve V07 and feeding water through the pipe from cake wash inlet valve V05.

SBR09 HOSE WASHING

After the pipe washing stage, the slurry feed hoses are cleaned by opening the cake wash inlet valve V05 which forces water through the slurry feed hoses and into the filter chambers.

SBR10 PRESSING 1

In the pressing stage, the pressing water is pumped through the pressing water pipe and the hoses into the space above the rubber diaphragms. All the remaining liquid from the filter chamber above the formed cake is forced through the cake and it exits the filter. Finally the cake is pressed for elimination of any liquid mechanically disposable still present in the cake. Proceed now to cake washing.

SBR11 CAKE WASHING

The washing liquid is fed to the filter chamber through the wash liquid inlet valve V05. In order to ensure a free discharge of the pressing water the V04 is held open while the washing liquid enters the filter chamber. The washing liquid washes the cake and passes then through the cloth and into the filtrate side pipe.

SBR12 PRESSING 2

After the washing stage the washing liquid remaining in the filter chamber is pressed out by pumping the pressing water into the diaphragms, like in the Pressing 1 stage.

SBR13 DRAINAGE OF DISTRIBUTION PIPE

After the last pressing stage and before the cake air drying the distribution pipe is drained of water/slurry by opening V07.

SBR14 CAKE AIR DRYING

Drying of the cake is accomplished with compressed air. The air enters the distribution pipe through V06. Since the filter chamber is pressurized by the drying air V04 is held open for a free discharge of the pressing water. The air flowing through the cake reduces its moisture content to the optimum value simultaneously emptying the filter chamber from the pressing water.
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6. Maintenance instructions

Appropriate protective equipment, such as a safety helmet, goggles, protective overalls, protective footwear, safety gloves, ear protection, a respirator etc. must be used whenever needed.

When carrying out maintenance or repair work, make sure the machine cannot accidentally be turned on by performing the appropriate lockout-tagout procedures.

<table>
<thead>
<tr>
<th>DANGER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazardous moving parts. Moving parts of the machine will cause serious injury or death. Stop the machine completely before maintenance, repairs or disassembly.</td>
</tr>
<tr>
<td>Electrocution hazard. Electrocution will cause serious injury or death. Cut the power supply to the machine before maintenance, repairs or disassembly</td>
</tr>
<tr>
<td>Hydraulic fluid injection hazard. High-pressure hydraulic fluid spray can penetrate the skin and will cause death or serious injury.</td>
</tr>
</tbody>
</table>
### 6.1. General notes on maintenance work

Before starting any work:

- Make sure you know the structure of the filter.
- Get familiar with all different operation stages of the filter.
- Learn how to use the control panel push buttons.
- Follow all safety regulations.
- Carry out inspections regularly.

The filter operates automatically; never start any maintenance or repair work when the filter is energized.

**NOTE!** Before starting any maintenance or repair work, always open the main switch and lock it open until the maintenance or repair work is completed. Close all the manually actuated process valves.

In possible emergency situations, there are several emergency stop switches. They are situated on the control panel, side of the filter cloth conveyor unit casing, pressure water station and HH unit. The emergency stop switches stop the filter immediately. Before a new start, release the switch itself.

**NOTE!** Inspect the condition of the distribution pipelines and hoses for wear and tear, as well as their joints.

The filter uses hydraulic pressures so in case of possible failure the pressure is released immediately. The filter is always open on its filtrate side.

Check the hose guards are in place, as they are meant to receive the force of the pressure blow in case of possible hose damage.

When changing the filter cloth, beware of the pinch points formed by the rollers.

Carefully follow the instructions for changing the filter cloth given in the Operation and Maintenance Manual.
In case the filter is located in a place where there is a danger of explosion, make sure the filter cloth does not move before it is wetted all around with conductive liquid, e.g. water.

**NOTE!** If the filter cloth is moved while dry, there must be no hazardous gases, dust or any other explosively sensitive materials in the same space with the filter.

The reason for these safety precautions is a possibility of electrical charging of the filter cloth. The filter cloth can be charged with static electricity under some process conditions. If particles attaching to the filter cloth are electrically non-conductive which can generate static charge, this would create a spark associated with rapid electrostatic discharge (ESD).
### 6.2. Maintenance schedule

<table>
<thead>
<tr>
<th>MAINTENANCE PERIOD x FILTERING CYCLE OR LIFETIME</th>
<th>A = DAILY</th>
<th>B = WEEKLY</th>
<th>C = MONTHLY</th>
<th>D = SEMI-ANNUALLY 15 000 x</th>
<th>E = YEARLY 30 000 x</th>
<th>OPERATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>OBJECT</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>OPERATION</td>
</tr>
<tr>
<td>ADJUSTING VALVE OF PRESS.WATER PRESSURE</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td>ADJUST IF NECESSARY</td>
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<tr>
<td>ALARMS</td>
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</tr>
<tr>
<td>CONTROL PANEL</td>
<td></td>
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<td>CLEAN IF NECESSARY</td>
</tr>
<tr>
<td>DIAPHRAGM</td>
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<td></td>
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<td>2</td>
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</tr>
<tr>
<td>EMERGENCY STOP SWITCHES</td>
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<td></td>
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</tr>
<tr>
<td>FASTENING OF ROLLERS</td>
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<td></td>
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</tr>
<tr>
<td>FILTER CLOTH</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>FILTER CLOTH CONDITION / CENTERING</td>
</tr>
<tr>
<td>SEAM OF FILTER CLOTH</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td>CHECK CONDITION OF SEAM WIRE</td>
</tr>
<tr>
<td>FILTER PLATES</td>
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<td></td>
<td>1</td>
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<td></td>
<td>CHECK GRIDS + PLATES STRAIGHTNESS</td>
</tr>
<tr>
<td>GREASE NIPPLES</td>
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<td>LUBRICATION</td>
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<td>HOSES</td>
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<td>HOSE FIXING</td>
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<tr>
<td>HYDRAULIC UNIT</td>
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<td>CHECK THE LEAKS</td>
</tr>
<tr>
<td>HYDRAULIC PIPING AND HOSES</td>
<td></td>
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<td>1</td>
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<td>CHECK CONNECTIONS CHANGE HOSES IN EVERY 3 YEARS</td>
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<tr>
<td>HYDRAULIC CYLINDERS</td>
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<td>CHECK IF MOUNTED PROPERLY</td>
</tr>
<tr>
<td>HYDRAULIC MOTORS</td>
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<td></td>
<td>CHECK WARMING UP AND SOUND</td>
</tr>
</tbody>
</table>
## MAINTENANCE PERIOD x FILTERING CYCLE OR LIFETIME

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>OPERATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>HYDRAULIC MOTOR COUPLINGS</td>
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<td>CHECK FLEXIBLE ELEMENT AND CHANGE IF NECESSARY</td>
</tr>
<tr>
<td>HYDRAULIC OIL</td>
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<td>CHANGE OR FINEFILTER THE OIL</td>
</tr>
<tr>
<td>LEVEL CONTROLLERS</td>
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<td>LIMIT SWITCHES</td>
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<td>PRESSING WATER TANK</td>
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<td>ADJUST AND CHANGE IF NECESSARY</td>
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<td>WASH NOZZLES + FILTER</td>
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<td>CLEAN</td>
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</table>
6.3. Plate pack maintenance

---

**DANGER**

Hazardous moving parts. Moving parts of the machine will cause serious injury or death. Always when maintaining the plate pack, make sure that the filter is stopped, the manual valves of the pipes are closed and the emergency stop switch of the hand held unit is pressed down.

---

**WARNING**

Crushing hazard. Falling filter plates can cause death or serious injury. When working between the plates, secure the open position of the plate pack by blocking it with 4 supports delivered with the filter.
6.3.1. **Filter plate replacement**

Position yourself so the filter is in front of you and the filter cloth tensioning device is located on the left side of the filter, see the picture below. Now there are two kinds of filter plates in the plate pack. The ones with the roller on left side from your point of view are called left handed filter plates. The ones with the roller on right side are called right handed filter plates.

1. **Filter cloth tensioning device**
   - A  Left handed side
   - B  Right handed side
   - 1. Filter cloth tensioning device

1. If you’re taking a right handed filter plate out of the plate pack, the filter cloth needs to be cut from the seam. First drive the filter cloth so that the seam is positioned on the roller of filter plate to be removed.

2. Loosen the filter cloth by driving the tensioning roller to its uppermost position. Lock the tensioning roller in place by using the throttle check valve. See the picture in next page.
1. **Throttle check valve**

3. Split the filter cloth from the seam in case of removing the right handed filter plate.

4. Drive the plate pack to closed position and remove four pairs of suspension plates so the plate to be removed is the lowest one still attached to plate pack.

5. Remove slurry, filtrate and pressing water hoses from the plate to be removed.

6. Drive the plate pack to open position and lock it in place.

7. Insert four pcs of steel tubes with a minimum diameter of 60mm under the filter plate to be removed as shown in the picture below.

![Diagram](image_url)

**NOTE!** Note the wall thickness of the steel tubes has to be at least 4-5mm to support the filter plate(s).

8. Lower the plate to be removed carefully on top of the steel tubes. Depending on the plate to be removed you will need to lower 2 or 3 of the lowest plates on top of the tubes to be able to remove the suspension plates from the plate to be removed.

9. Remove the suspension plates from the plate to be removed. Drive the plate pack to open position and lock it in place.
10. Release the guide bars of the plate pack from the brackets in columns and loosen the fixing screws on the upper end of the guide bars.

11. Draw the guide bars sideways to their extreme position and secure them in place.

12. Install a chain tackle and two lifting ropes to the suspension pins on the plate to be removed.

13. Pull the filter plate carefully out of the plate pack. Make sure not to pull it all the way out yet. See the pictures A and B.

NOTE!

If the filter plate to be removed is left handed and has auxiliary drive attached to it, the motor has to be removed before the filter plate can be taken out of the plate pack.
14. Install two more lifting ropes of equal length to the support pins on the plate to be removed. In case of right handed plate use the slide pieces pins. For the left handed filter plate use the pins located on the back corners of the filter plate. See the picture C.

15. Adjust the chain tackle so the filter plate is in balance. Hoist the filter plate out of the plate back. See the picture D.
NOTE! It is recommended to have one person operating the crane, second one to use the chain tackle and third one to observe that the filter plate moves steadily and is in balance.

16. Install a new filter plate in reverse order.

17. Adjust slide pieces and make sure the suspension plates move properly. The slide bars and pieces have been originally adjusted and pinned by Outotec and should be reassembled identically.

6.3.2. Localization of leaking diaphragms

Wear safety goggles when searching for a leaking diaphragm. Do not open the feed pipe when the plate pack is closed.

A defective diaphragm is localized as follows: when the plate pack is open, the filtrate pipe is opened at its upper end. Then the plate pack is closed and sealed. After this, the pressing water motor M02 is started. By looking into the pipe it can be checked from which connecting piece the water comes out. The defective diaphragm is located above this connecting piece.
6.3.3. **Diaphragm replacement**

Filter plate has to be removed from the plate pack in order to change a diaphragm.

1. Remove the filter plate containing defective diaphragm according to the Replacement of filter plate section.

2. Place the filter plate down on wooden planks or similar flat plane. Be careful not to damage the seal on the bottom of the plate.

3. You may now remove the plate fixing screws using a pneumatic wrench delivered with the filter. Bolt size is 24mm.

4. After all the screws are loosened and removed, hoist the upper part of the filter plate away from the suspension pins.

5. The defective diaphragm can now be replaced. Make sure to install the new one properly in its place!
NOTE! As the diaphragm is not symmetric the nubbly side must be facing up and the reinforced area on the feed port side.

6. Hoist the upper part of the filter plate back on top of the plate frame and fix it in place with the screws. Apply anti-seizing compound on the screws to prevent seizing of the threads.

7. Tighten the screws with a torque wrench. The correct value for torque is 250 Nm.

8. Install the serviced filter plate back to the plate pack according to the Replacement of filter plate section.

9. After cleaning and filling the pressure water tank start the filter.

If there still are leakages on the edges of the diaphragm, add an O-ring strip in a groove of the frame before assembling the diaphragm. A suitable O-ring strip size is 6 mm by diameter.

6.3.4. Seal replacement

To change a seal (4), remove the filter plate from the plate pack the same way as when changing a diaphragm.

1. Place the filter plate upside down on a wooden planks or similar flat plane. Be careful not to damage the sealing surface of the filter plate.

2. Remove defective seal from its groove.

3. Clean the groove carefully from any leftover parts.

4. Start the installing of new seal from the corners (points A in the picture).

5. The seal is first fixed for the length of 100 mm at each corner.

6. It is then pressed into its groove at the mid points of the frame (points B in the picture) again for the length of 100 mm.

7. After that the same procedure is repeated (points C in the picture). This way the seal will be evenly tensioned.

8. When the new seal is completely assembled the filter plate can be installed back to the plate pack according to the Replacement of the filter plate section.
6.3.5. Slide piece replacement and adjustment

Wearing of guide pieces makes the plates move in direction of their longitudinal axes and thus the roller arms run into the back of the upper plate during the sealing stage. Seals can no longer press freely together and this may cause leakages in the plate pack.

Observe the slide pieces for possible wear, and adjust whenever necessary. Instructions for adjustment are given below. When there is no adjustment allowance left, replace the slide pieces by new ones, following these instructions:

- Unscrew the fixing nuts and eccentric sleeves and remove the slide pieces.
- Insert and adjust new slide pieces. Adjust the plates lengthwise with the slide pieces (dim. A). A should be as big as possible and the same at both ends of the roller according to the drawing.
- Tighten as shown by the arrow (counterclockwise). This secures the pressing force on the slide piece does not open the locking nut.
- Check the adjusting nut of the eccentric sleeve does not bump into the guide bar support when the plate pack moves.
Incorrect hoisting may also cause damage to the machinery. When choosing the steel tubes keep in mind the weight of one filter plate is about xx kg.
6.3.6. Rollers

6.3.6.1. Plate roller replacement

**DANGER**

Hazardous moving parts. Moving parts of the machine will cause serious injury or death. Make sure that there are no persons or foreign objects in between the moving parts.

Hazardous moving parts. Moving parts of the machine will cause serious injury or death. Always keep the EMERGENCY-STOP button pushed down (for preventing the manual and remote starts), when the activation functions of the filter are not necessary.

Ensure the working conditions are safe. Inform the operating personnel when maintaining the unit, and close the manual valves in the process piping.

Wear proper protective clothing.

**Note!** The filter plate roller weighs about 40 kg, so a crane is highly recommended for the work.

**Note!** Because the uppermost rollers of the plate pack are located quite high, extreme caution is needed when replacing them. Use a lifting platform to guarantee safe working conditions.
Necessary maintenance tools for replacement of the plate roller

1. **Lifting belt (2 pcs)**

1. The roller is located at the end of the filter plate in a "loop" formed by the filter cloth. There are two possible ways to get the roller out.

2. The first one is to drive the cloth so the clipper seam stops at the roller to be changed. The seam is opened and the roller can be changed.

3. Another and more recommendable possibility is to gather so much loose cloth at the roller, which is to be changed by using the "extra" cloth in the tensioning device. The cloth can be drawn over the end of the roller to either side of the filter plate. Proceed as follows:

4. Stop the filter, and drive the plate pack completely open with the HH unit. Drive the locking pins into their holes. Refer to Operation instructions section if needed.

5. If the roller is at the free end of the filter, remove the upper part of the cake chute according to paragraph. Removing the upper part of the cake chute.

6. Slacken the filter cloth according to paragraph Slackening the filter cloth. Draw the loosened cloth over the roller’s end sidewards from the filter plate.

7. Remove scrapers from the plate pack frame.
   - Roller scraper (1): Loosen the adjusting screws (2). Remove the locking nuts (5) and adjusting pieces (6) at end of the axle. Pull the holder of scraper out from the roller fixing lugs and remove the scraper.
   - Cloth scraper (3): Loosen the fixing screws of the cloth scraper (4) and remove the cloth scraper. Refer to picture on the next page.
1. Roller scraper
2. Adjusting screw (Hex socket M8)
3. Cloth scraper
4. Fixing screw of cloth scraper (M10)
5. Locking nut (M12)
6. Adjusting piece

1. Remove scrapers from the plate pack 45 & 60 mm (flat diaphragm).
   - Roller scraper (2): Loosen the rubber cushion (1) and the adjusting screw (3). Remove the adjusting levers (4). Turn the scraper so that the knife of scraper is outside the roller fixing lug. Move the scraper laterally and release it from the roller fixing lugs.

1. Rubber cushion
2. Roller scraper
3. Adjusting screw (M10)
4. Adjusting lever
11. Scraper
20, 22, 27. Washer, hex screw, nyloc nut
23. Hex screw
2. Use lifting belts for lifting. The roller must be lifted up as straight as possible to avoid bending of the lug. If the roller tends to get stuck during the lift, hit the roller lightly with a rubber hammer. Lower the roller down on the platform on the cake chute.

Side of the filter cloth drive unit:
Insert the lifting belt around the top pressing plate and install two lifting belts to it. Lower the roller down on the platform on the cake chute.

3. Install a new roller in a reversed order.
See pictures of lifting below and on the next page

Plate roller lifting at the free end of the filter

1. Lifting belts
2. Cloth loop drawn sideward from the filter plate
A  Lifting the guide roller
Plate roller lifting at the side of the cloth drive unit

1. Lifting belts
2. Cloth loop drawn sideward from the filter plate
3. Lifting belt around the top pressing plate
4. Cover the cake chute with platform

A Lifting the guide roller
6.3.6.2. **Pressing roller replacement**

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<tr>
<th>DANGER</th>
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<tr>
<td>Hazardous moving parts. Moving parts of the machine will cause serious injury or death. Make sure there are no persons or foreign objects in between the moving parts</td>
</tr>
<tr>
<td>Hazardous moving parts. Moving parts of the machine will cause serious injury or death. Always keep the emergency stop button pushed down (for preventing the manual and remote starts), when the activation functions of the filter are not necessary.</td>
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</table>

Make sure the working conditions are safe. Inform the operating personnel when maintaining the unit, and close the manual valves in the process piping.

Wear proper protective clothing.

**Note!** The filter plate roller weighs about 50 kg, so a crane is highly recommended for the work.

**Note!** Because the uppermost rollers of the plate pack are located quite high, extreme caution is needed when replacing them. Use a lifting platform to guarantee safe working conditions.
Necessary maintenance tools for the pressing roller replacement:

1. **Lifting belt (2 pcs)**

   1. The pressing roller is located under the drive roller in the cloth conveyor unit. There are two possible ways to get the roller out.
      - The first one is to drive the cloth so the clipper seam stops at the roller to be changed. The seam is opened and the roller can be changed.
      - Another and more recommendable possibility is to gather so much loose cloth at the roller, which is to be changed by using the "extra" cloth in the tensioning device. The cloth can be drawn over the end of the roller to either side of the filter plate. Proceed as follows:
   2. Stop the filter when the filter cloth is in a suitable position. Refer to **Operation instructions** section if needed.
   3. Draw the loosened filter cloth over the roller’s end sideward or open the clipper seam; see step one.
   4. Loosen the pressing roller fastening/pressing screws.
   5. Use lifting belts for lifting. The roller must be lifted up as straight as possible to avoid bending the lug. If the roller tends to get stuck during the lift, hit the roller lightly with a rubber hammer.
   6. Install a new roller in a reversed order.
   7. See picture of the lifting below.
1. Lifting belt
2. Pressing roller
A. Lifting the pressing roller
6.3.7. **Plate roller bearing replacement**

1. Remove the plate roller requiring maintenance according to section **Plate roller replacing**.
2. Remove retaining ring (10) (figure A).
3. It is recommended to use a pull-out tool (11) to remove the seal housing (3). The other way is to hit the other end of the roller with a rubber hammer, in order to release the seal housing and bearing (7) (figure B).
4. Remove the seal housing (3), seals (5, 6 & 8) and bearing (7) (figure C).
5. If the seal sleeve (4) is damaged replace it. Lock it with LOCTITE 641, WEICON AN 306-41 or equivalent.
6. Clean all parts and install a new bearing in a reversed order. Replace the seals and the O-ring (Look at the spare part list). Lubricate bearing with SKF LGFP2.

**Note!** It is recommended to replace both roller bearings at the same time.

See picture below.
1. Shaft
2. Roller housing
3. Seal housing
4. Seal sleeve (bushing)
5. Roller seal kit
6. Seal, shaft
7. Bearing
8. O-ring
9. Grease nipple
10. Retaining ring
11. Pull-out tool
6.3.7.1. Plate roller positioning

The following drawings present four different roller shaft positions in which they can be installed. Different positions change the height of the roller in relation to the filter plate top surface.

Position 1

The upper edge of the roller is above the filter plate top surface whereby filter cloth conveyance tends to lift the filter cloth from above the filter plate thus decreasing friction between the filter cloth and the grid. This position is used when filtering heavy materials.

Positions 2 and 3

The upper edge of the roller is below the filter plate top surface whereby the filter cloth shuffles on the top surface of the filter plate thus cleaning the sealing plate surfaces. These positions are generally used when filtering light materials which tend to get stuck on the sealing surfaces.

Position 4

“Normal” position. The roller does not lift or press the filter cloth in relation to the filter plate.
6.3.8. Scraper adjustment

Adjust the filter cloth scrapers to touch the filter cloth so that after scraping the filter cloth is as clean as possible and grids and rollers are free from too many particles.

To adjust filter cloth the filter cloth scrapers, loosen the fixing bolts sufficiently to allow tapping the scraper into a desired position. Ensure the scraper does not move while tightening.

Adjust the roller scraper so there is a small gap between the scraper and the roller (see the figure below). Adjust the tolerance with the eccentric pieces on both ends of the scraper.

When you turn the triangular scraper by a screwdriver (the scraper is slotted at both ends), position of the scraper can be kept as shown in the figure below.

The scraper is locked in its place with the screws in the eccentric pieces. Tighten the nuts on both ends of the scraper as well as the locking screws.
6.3.9. **Plate pack cleaning**

The plate pack must be washed daily with water. It is important to wash the rollers and scrapers as well. This ensures the filter cloth tracking functions properly and that the plate pack stays tight.

6.3.10. **Suspension plate inspection and replacement**

Check all suspension plates annually for possible cracks and replace damaged ones. The designed maximum service life of suspension plate is 5 years. (Variations to both directions are possible depending of several reasons; number of working cycles, cake weight, number of filter plates, environmental factors etc…)

**Omitting the inspection and possible replacement of the suspension plates may lead to personal injury or damaged property which Outotec cannot be held responsible.**

Checking/replacing of the suspension plates:

1. Close the plate pack.
2. Remove the retaining rings and washers of the topmost suspension plates.
3. Remove all suspension plates from the plate pack.
4. Clean all suspension plates in a meticulous manner.
5. Check suspension plates visually and replace the damaged ones.
Pay attention to the possible cracks in the suspension plates. Slight battering and polishing of the pinholes is acceptable. Areas A and B (see picture below) where the biggest stresses affect are most likely to break first.

6. After inspection, mark the inspected suspension plate with a nail punch. When there are five marks made by nail punch, replace the suspension plate.

Check the condition of each suspension pin and its joint to the filter plate. Cracks in the welding area and excessive bending of the pin needs to be fixed before reassembly. Slight battering and polishing of the pins is acceptable.

Suspension plate
A = possible failure area at the circular hole
B = possible failure area at the end of the elongate hole

7. Assemble suspension plates in their places from top to bottom. Remember to install retaining rings in their places.
Assembly order of the suspension plates:
A Assemble the inner suspension plates (1, 2, 3).
B Assemble the top suspension plate (1) and the midmost suspension plates (2, 3, 4…)
C Assemble the outer suspension plates and retaining rings.

The correct order of suspension plates

8. After reassembly check the movement of suspension plates.
6.3.11. **Hose replacement**

Pay attention to the following when changing feed, filtrate and pressing water hoses:

- The right type and length of the hose (see figure below).
- Mount the hoses when the pack is open. Close the pack and tighten the hose clips.
- No sharp bends in the hoses are allowed.
- Pressure rating of the slurry feed hoses must be 25 bar (or more).
- Use the original spare parts as reserve hoses.
6.3.12. Pressing transmitters

B415 FEED MANIFOLD PRESSURE TRANSMITTER

Location

The B415 pressure transmitter is located on the top section of the feed manifold, in the left side of the filter. The transmitter is measuring feed manifold pressure.

Set points

The transmitter signal is used for multiple purposes and the following set points are used to trigger respective functions.

1. B415>MAXOPPR; Feed manifold pressure has exceeded maximum operating pressure setpoint “MAXOPPRE” in auxiliary parameters. This pressure is typically 16.0 bar but can be adjusted lower if necessary. This setpoint will trigger an alarm B415MALM, which stops the filter.

2. B415>MINFEED (FILTRATION); the feed manifold pressure is monitored during filtration (slurry feed) where a minimum pressure setpoint “MINFEED” in auxiliary parameters must be reached. If the pressure does not raise above the setpoint an alarm B415FALM will be triggered.

3. B415>D2SP (HOSE WASH); the feed manifold pressure is monitored during hose wash where a minimum pressure setpoint in Data 2 must be reached. If pressure does not raise above the setpoint an alarm B415HALM will be triggered.

4. B415>D2SP (CAKE WASH); the feed manifold pressure is monitored during the cake wash where a minimum pressure setpoint in Data 2 must be reached. If pressure does not raise above the setpoint an alarm B415CALM will be triggered.
5. B415>MINDRY; Minimum drying air pressure setpoint in Data 2 has been reached. This is monitored in the beginning of drying stage immediately after V06 is opened. If the drying air minimum pressure is not reached within 3 seconds, an alarm B415AALM is triggered.

6. B415<1BAR Feed manifold pressure below 1 bar; this is used to interlock the operation of sealing cylinders HC7 and also ensure that pressure is released after V07 is opened. This is a safety function, if sealing cylinders are operated with higher pressure, serious damage may occur. If the pressure has not dropped to below 1 bar within 30 seconds after V07 is open (S107), an alarm B415NALM is triggered.

7. B415<DRYAIRSP; drying air pressure setpoint in auxiliary parameters “DRYAIRSP”, pressure has fallen below the SP and drying can be ended.

8. B415>D2SP (FILTRATION); the feed manifold pressure is monitored during filtration (slurry feed). If the pressure setpoint in Data 2 is reached the D2SP auxiliary will turn on and cause the sequence to proceed to the next step (Maximum feed pressure).

9. G-POINT (1 and 2) provides setpoints for the G-Point delta pressure. During the pressing (1 and 2) stage, the feed manifold pressure measured from B415 follows closely the pressing manifold pressure measured from B419. When the cake is de-watered enough and the fluid bridge from pressing diaphragms to the feed manifold (through the feed ports) is discontinued, the feed manifold pressure begins to drop quite rapidly. The G-point value is a pressure difference between the signals from B415 and B419. The value must be determined in case by case basis and it must be lower than the pressing pressure setpoint.

10. B415DRIFT is 0.5 bar setpoint used to determine that B415 needs to be recalibrated or replaced. To avoid confusing displays, the B415ENG pressure value will be zeroed out when the system is known to be un-pressurized. If the raw signal from B415 does not fall below 0.5 bar when it is expected, an alarm B415DALM will be triggered.
PIC142019 (B419)  PRESSING MANIFOLD PRESSURE TRANSMITTER

Location

The B419 pressure transmitter is located on the bottom section of the pressing manifold, in the right side of the filter. The transmitter is measuring pressing manifold pressure.

Setpoints

The transmitter signal is used for multiple purposes and the following set points are used to trigger respective functions.

1. B419>MAXOPPR; pressing manifold pressure has exceeded maximum operating pressure. This pressure is typically 16.0 Bar but can be adjusted lower if necessary. This setpoint will trigger an alarm B419MALM, which stops the filter.

2. B419>MINPRPRE; Minimum pressing pressure has been reached. This is monitored during pressing stage once pressing water pump M02 is started. If the minimum pressing pressure is not reached within 180 seconds, an alarm B419PALM is triggered.

3. B419<1BAR pressing manifold pressure below 1 bar, this is used to interlock the operation of sealing cylinders HC7 and to ensure the pressure is released after V04 is opened. This is a safety function; if sealing cylinders are operated with higher pressure, serious damage may occur. If the pressure has not dropped to below 1 bar within 30 seconds after V04 is open (S104), an alarm B419NALM is triggered.

4. B419 signal is also used when determining the G-point. See B415 for more details of G-point.
6.3.13. Valve position sensors adjustment

General information
All the process valves are equipped with two limit switches
S1** = valve OPEN
S2** = valve CLOSED
** = valve number e.g. 02 = slurry inlet valve

Location
The limit switches are always located on the valve body

![Diagram of valve and limit switches]

Use the TEST MODE to change the position of the valve.
Remember to close the manually operated hand valves.

6.3.14. Pipeline inspections

The sieve of the slurry pipe should be checked once a month. Do this by opening one feed hose at the lower part of the slurry pipe. Ensure the sieve is undamaged and that the holes are open. The slurry hoses must be checked once a month. However, if too thick cake has been driven, it is necessary to check all the feed holes are open.

The condition of the filtrate hoses should also be checked once a month.
6.4. **Pressing water station maintenance**

6.4.1. **Pressure adjusting**

In case diaphragm pressing pressure should be increased, proceed as follows:

Open the cover of the safety valve, loosen the locking nut under the pressure adjusting screw, and turn the adjusting screw downwards. If you wish to lower the pressure, turn the screw upwards, the pressure can be checked in a gauge at the water station. It is quite normal that water comes out from the middle of the adjusting screw. Remember the pressure in the filter is smaller due to the height difference between the water station and filtration level.

6.4.2. **Pressing water station inspections**

The water level is checked using the level control switch S516. If so much water has run out that the S516 triggers an alarm message, the reason may be; damaged diaphragm(s), leakage in the pipeline, evaporation, S516 is damaged.

If the color of the water starts to look similar to the slurry, it may be some of the slurry has entered that pressing water hose through a damaged diaphragm. If you suspect a leak, you should carry out a diaphragm test. Slurry/impurities may damage the pump because this is only designed for clean water.

If slurry has got into the tank, empty it and clean it out. Make sure that you bleed the pump after you have filled the tank (fill the tank, open the square headed plug at the upper end of the pump – there are two, but you only need to open one of them), turn the pump shaft (the EMERGENCY STOP must be activated) and the air will hiss out. As soon as the air is replaced by water, screw the plug back into place.

6.4.3. **Pressing water hose maintenance**

Check the hoses and replace worn hoses immediately.

---

**When replacing the pressing water hoses, ensure there is no pressure in the line: switch the pump off and open the plate pack. Replace hoses the same way as the slurry and filtrate hoses.**
6.5. Control panel maintenance

Only an expert is allowed to de-energize the control panel and open its door.

When performing any type of maintenance work or inspection service to the filter, it is recommended an emergency stop button is engaged to prevent accidental operation of the equipment.

The control panel main switch can be locked in open position by fixing a lock through the hole on the end of the handle.

- Keep the control panel clean. When using water, do not throw/spray it directly on the control panel. Before cleaning check the seals on both the window and the door.

- Any dust inside the control panel should be removed with a vacuum cleaner or clean, dry compressed air (low pressure).

- If the PLC memory back-up battery gives an alarm, the voltage feed to the control panel must not be cut off, but only for a moment. In such a case, the door may be opened by turning the locking handle located in the main switch S700 to the side with the help of a screwdriver through the hole in the switch. Replace PLC back-up batteries immediately.

- Check the operation of the signal lamps at least in connection with maintenance by pressing the alarm acknowledge button for three seconds to light all signal lamps.

- If the inside of the control panel is dirty or dusty, check the circuits of the screen unit. A build-up of dust on the circuits and the heat sinks may lead to a disruption in the heat dissipation. This can subsequently cause the panel to malfunction. A build-up of dust on the electronic circuit boards may cause a short circuit. If dust has built up, use a vacuum cleaner or clean, dry compressed air (low pressure) to remove the dust.

- If the unit is installed in a location which may be subject to vibrations, or if the control panel door is opened frequently, check the connections to the screen regularly.

- The screen unit requires an unimpeded flow of air in order to keep it at the correct operating temperature. This air flow circulates from the floor of the control panel up through the touch screen unit and back down to the floor of the control panel. Any type of obstruction (drawings, manuals etc) that may hinder this air flow should be removed immediately.

Do not place this unit in the vicinity of loud devices.

Keep the touch screen clean.
- Use a soft filter cloth or paper towels and a conventional window cleaner to clean the screen. To ensure you don't scratch the screen, remove any potentially damaging particles from the plastic surface before cleaning in the manner described above.

- If the screen indicates an error in communication with the PLC, check the connections of the data cables. Only remove a connection when the power supply has been switched off.

6.6. **Hydraulic system maintenance**

Always wear safety goggles when carrying out maintenance work on the hydraulic system.

<table>
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<tbody>
<tr>
<td>Hydraulic fluid injection hazard. High pressure hydraulic fluid spray can penetrate the skin and will cause death or serious injury. Always when opening the hydraulic system, turn off the electricity and close the manual valves.</td>
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</table>

<table>
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<tr>
<th>NOTICE</th>
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<tbody>
<tr>
<td>Make sure the oil is clean in order to avoid damage to the machinery. Change the oil filter immediately when the pressure switch gives an alarm.</td>
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</tbody>
</table>

The hydraulic system of the Outotec pressing filter machine has been carefully constructed, cleaned and tested in the factory. After testing, the container was emptied and the oil pressure of the accumulator released for transportation.
6.6.1. **Filling the oil container**

Before filling the oil container, ensure the inside of the container is perfectly clean. The container is filled to the upper limit of the filling level indicator with oil in accordance with the recommendations. Filling must be carried out using a separate filtration pump with a maximum of 5 µm abs. full flow filter. The quick coupling for filling in the hydraulic unit is connection with a return flow filter. Filling with an open tank is not permitted.

The barrel oil delivered by oil companies is not clean enough for the hydraulic system, if use it without separate filtration, the oil filter will block within a few days’ time. The blocking of the return oil filter will cause the filter to stop at the end of the filtration cycle through the pressure switch S410 and high pressure oil filter S411.

6.6.2. **Hydraulic system start-up**

Before putting the hydraulic system into operation, the following points must be checked:

- Check neither the hydraulic hoses nor components have been damaged in transit
- Check the power supply voltage and frequency are correct
- Check pre-charging pressure of the accumulator (90 bar of nitrogen N2)

Incorrect procedure when putting the system into operation can damage the pump within seconds. This is why you must avoid starting the axial piston pump while oil temperature is below 10 °C when the oil viscosity class is 46 cSt. Before starting the motor, the immersion heater of the container must warm the oil to a temperature of at least 20°C.

6.6.3. **Adjustments**

All hydraulic valves are pre-adjusted at factory.

Check and adjust all valves when the filter is in TEST MODE.
6.6.4. **Calibration of Bosch proportional plug**

Calibration / adjusting function is programmed so the user can, in TEST MODE, select S714HC5 position and enter into calibration mode by selecting TOOLS/CALIBRATION (calibration function is protected by a password). In this position, only the quick action movement can be activated and only by using the hand held unit. From the OIU, the user can enter pre-programmed flow (1, 20, 40 and 80 l/min) and pressure (5, 40, 100 and 180 Bar) values into QSET and PSET registers. This sets the system into CALIBRATION mode, which overrides the normal TEST MODE settings.

When you start to adjust plug amplifiers, drive the plate pack to its low position. (Keep the pins unlocked).
Start adjusting by turning both amplifier plug potentiometers of both of the volume flow and pressure proportional valves to the following positions (see the picture):

6.6.5. Adjusting elements

![Adjusting elements diagram]

- **P1** Ramp time
- **P2** Gain
- **P3** Zero
- **P4** Dither frequency
- **St1** Terminal
- **LED Display**

Proportional valve P1:

- **Ramp** Turn counterclockwise to its minimum position.

This is a helical potentiometer, i.e. it is in its minimum position. When turning counterclockwise you can hear a slight click every round.

- **Gain** Turn halfway
- **Zero** Turn counterclockwise to its minimum position
- **Dither** Turn counterclockwise to its minimum position

Volume flow proportional plug Q1:

- **Ramp** Turn counterclockwise to its minimum position
This is a helical potentiometer, i.e. it is in its minimum position. When turning counterclockwise you can hear a slight click every round.

- Gain
  - Turn halfway

- Zero
  - Turn halfway

- Dither
  - Turn counterclockwise to its minimum position

Choose 40 bar pressure, 40 l/min flow and drive quick-action down during test drive (HC5) (the plate pack in its low position with limits S252 and S254 adjusted). Adjust the P1 potentiometer plug “Gain” and Q1 potentiometer plug “Zero” until the “MEASURED PRESSURE” B401 shows the required reading. Do the same in the 100 bar value. Adjust the actual pressure with the plug P1 “Gain” potentiometer and if/when the pressure no longer rises; turn the Q1 plug “Zero” clockwise which will allow you to adjust the pressure again.

=> Amplifier plug of the pressure proportional valve has been adjusted.

In case the pressure will not rise, it means the plug potentiometer (Gain) of the volume flow proportional valve Q1 is adjusted too low, i.e. it must be slightly turned clockwise whereby the coil feed flow increases and the pressure proportional valve can be adjusted.

**Adjust the flow**

After a basic adjustment, the plug of the volume flow proportional valve Q1 must be fine adjusted. The best way to do this is to drive the quick action cylinders up and down in test drive (HC5) at the same time measuring the time used for the stroke length. The length of the stroke is marked on the label fixed on the side of the cylinder. The following table presents the time used for quick-action in test drive, flow chosen 40l/min, with different filter sizes:

<table>
<thead>
<tr>
<th>Structure Size</th>
<th>12.5</th>
<th>19</th>
<th>25</th>
<th>32</th>
<th>38</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke Length</td>
<td>430</td>
<td>630</td>
<td>830</td>
<td>1035</td>
<td>1235</td>
</tr>
<tr>
<td>Time (50 mm/sec)</td>
<td>7-9</td>
<td>11-13</td>
<td>15-17</td>
<td>18-20</td>
<td>22-24</td>
</tr>
</tbody>
</table>

The speed is adjusted to the above values by means of the potentiometer “Gain” in the volume flow proportional valve and if/when the speed no longer raises; turn the Q1 plug “Zero” clockwise which allows you to adjust the flow again.

Finally the correct adjustment of the pressure proportional valve can be checked by locking the plate pack in its closed position and sealing it. The sealing pressure should be about 50 +/- 5 bar.
Selected values are valid until S714 is turned away from the S714HC5 position. After that the system automatically exits from CALMODE by resetting the QSET and PSET registers.

6.6.6. **Controlling the filter cloth driving speed**

When discharging cake the pump pressure is at 140 bar. If you need to regulate the speed of the cake discharge, modify the through-flow values of the pump using the touch screen. The numbers in the program refer to the percentage rate of the maximum through-flow value.

- Default value = 30%
- Minimum value = 10%
- Maximum value = 50%

The name of the storage location is:

AUXILIARY PARAMETER IN OPERATOR INTERFACE TERMINAL

The name of the parameter is: Discharge speed <\%>

6.6.7. **Filter cloth washing speed control**

The filter cloth washing speed can be modified by changing the value of the representative data memory value. For this, please contact the manufacturer.

- Default value = 50%
- Minimum value = 10%
- Maximum value = 100%
6.6.8. Sealing force adjustment

The sealing of the plate pack is always carried out at full through flow value. The sealing force can be modified by setting the pressure. If necessary, please contact the manufacturer.

- Default value = 50 bar
- Minimum value = 40 bar
- Maximum value = 60 bar

6.6.9. Pump adjustments

The hydraulic pump in the system is set at the factory. It does not usually need to subsequently have settings made to it. In case the maximum pressure, the maximum through flow or the load sensing pressure needs to be regulated, the instructions may be obtained from Outotec.

6.6.10. Hydraulic unit service

- Cleanliness is extremely important for the hydraulic system.
- The cleanliness classification of the oil is defined in the ISO 4406-standard.
- The cleanliness requirement for hydraulic oil is ISO 4406 class 16/13, which corresponds to the NAS class 7. The cleanliness of new oil is not always sufficient. Therefore, it is very important to fill the system using a filtration aggregate.
- The filtration aggregate must have a 5 micron filter.
- The input hose of the filtration aggregate is fitted to a quick coupling unit, which is located on the top of the hydraulic unit. The hose must have an R 3/4 male thread connector.
The oil in the hydraulic system must be changed using the filtration aggregate mentioned above. The same oil can be used for up to three years provided its cleanliness and water content is checked regularly (three times a year).

The first oil analysis must be carried one month after the machine is first put into operation.

The oil cleanliness must remain at 16/13 as discussed above.

The permitted water content is less than 200 ppm, however, between 200 and 500 ppm is still acceptable. As soon as it exceeds 500 ppm, the oil must be replaced immediately.

If you do not have access to laboratory equipment, both the cleanliness and water content can be measured in the laboratory of an oil company. The degree of oil viscosity must be 46 (ISO 3448).

The table below and the sticker show the recommendations for oil for hydraulic units. The volume of oil in the hydraulic unit container is approximately 180 liters and the amount of oil required by the hoses of the pipelines and the cylinders is approximately 75 liters.

Never pour oil into the hydraulic unit directly, always use the filtration aggregate – even when topping up.

Do not overfill the hydraulic unit. (Absolute limit in the oil level indicator glass)

<table>
<thead>
<tr>
<th>Oil company</th>
<th>Ambient temp./ operating temp.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+10... +40°C / +40... +65°C</td>
</tr>
<tr>
<td></td>
<td>+50...+105°F / +105...+150°F</td>
</tr>
<tr>
<td>BP</td>
<td>Energol HLP 46</td>
</tr>
<tr>
<td>Castrol</td>
<td>Hyspin AWS 46</td>
</tr>
<tr>
<td>Exxon / Esso</td>
<td>Nuto H 46</td>
</tr>
<tr>
<td>Gulf</td>
<td>Harmony 46 AW</td>
</tr>
<tr>
<td>Mobil</td>
<td>Mobil DTE 25</td>
</tr>
<tr>
<td>Neste</td>
<td>Paine 46</td>
</tr>
<tr>
<td>Shell</td>
<td>Shell Tellus Oil S 46</td>
</tr>
<tr>
<td>Raisio</td>
<td>Bio Safe 32</td>
</tr>
<tr>
<td>Sunoco</td>
<td>Hydrol 821</td>
</tr>
<tr>
<td></td>
<td>Hyvis 32 S</td>
</tr>
</tbody>
</table>

The return high pressure filters are supplied with an electric contamination indicator and the filter cartridge must be changed, at the latest, when the alarm is issued. Cold oils may cause "false" alarms. A reserve cartridge for the return filter and one for the high pressure filter is supplied with the new pressure filter; it is sensible to change the cartridge after approximately 250 - 500 filtration cycles. On the top of the filter, there is an indicator for blockages in the air filter. When the indicator goes up, the filter must be changed.
6.6.11. Quick action cylinder bleeding

Before bleeding the quick action cylinders the plate pack has to be in its low position. If not, lower the plate pack with crane so the plates lay one on the other. Lowering is possible by opening the counterbalance valve CB 511.

1. Turn the act selector of the HH unit to its BLEEDING position.
2. Drive the plate pack down for approx. 3 seconds with the HH unit by pressing the green push button S723.
3. Open the caps of the bleeding fittings (see next page) and put the bleeding hose to the bleeding fittings on lines 5.1.2, 5.2.2, 5.3.2 and 5.4.2 at the upper ends of the cylinder rods. Let the oil flow until air no longer comes out.
4. Repeat the preceding steps if necessary.
5. Take the bleeding hose off and shut the caps of the bled fittings.
6. Lock the locking pins in test mode.
7. Drive the plate pack upwards for approx. 3 seconds with the HH unit by pressing the yellow push button S725.
8. Change the bleeding hose to the bleeding fittings of lines 5.1.1, 5.2.1, 5.3.1 and 5.4.1 at the upper ends of the cylinders. Let the oil flow until air no longer comes out.
9. Repeat if necessary.
10. Close the bleeding fittings.
6.6.12. Sealing cylinder bleeding

1. Open the plate pack.
2. Bleed the sealing cylinders by driving them up and down (full strokes) in TEST MODE a couple of times. The air is carried to the hydraulic unit where it exhausts from the system.

Air exhausts from other parts of the hydraulic system during operation.

6.6.13. Closing device limit switch adjustment

Opening and closing of the closing device has three functions; quick action, locking/unlocking of locking pins and sealing/unsealing.

Markings of the hydraulic lines are:

- HC4 = tracking cylinder
- HC5 = quick action
- HC6 = locking pins
- HC7 = sealing cylinders

All functions are double acting functions and they are marked with "1" and "2".

- 1 = opening
- 2 = closing
- Location

Quick action position switches:

- S152 quick action open (plates opened) in column _2
- S154 quick action open (plates opened) in column _4
- S252 quick action closed (plates closed) in column _2
- S254 quick action closed (plates closed) in column _4
Locking pin position switches:

- S161 locking pin unlocked, column _1
- S162 locking pin unlocked, column _2
- S163 locking pin unlocked, column _3
- S164 locking pin unlocked, column _4
- S261 locking pin locked, column _1
- S262 locking pin locked, column _2
- S263 locking pin locked, column _3
- S264 locking pin locked, column _4

Sealing cylinders position pressure transmitters:

- B275 sealing plate position
- B472 sealing pressure, in the main hydraulic block
- S152, plate pack open
- S154, deceleration when opening, about 25 mm before S152
- S252, deceleration when closing, about 25 mm before S254
- S254, plate pack closed
- S163, S164, S261, S262, S263, S264 about 1.5-2.5 mm from the sensor block when the locking pins are locked (S261, S262, S263, S264) or unlocked (S161, S162, S163, S164)
- B275, when the sealing plate is in its lowest position, the distance between the sensor and the sealing plate should be approximately 7-8 mm.
- B472, the transmitter does not have any field adjustments.
6.7. **Closing device maintenance**

6.7.1. **Closing device inspections**

Pay special attention to the condition of the piston rods in the quick action cylinders. Do not damage the rods and ensure they are clean. Dirty rods must be cleaned immediately. This directly affects the life time of seals. Observing possible oil leakage is a part of the check-ups. If a leakage is noticed, it is a sign of some seal damage.

The maintenance of sealing cylinders is normally sufficient when check-ups for possible oil leakage are made once a month.

The locking pins should be greased once a month and at the same time it should be checked that there are no oil leakage in their cylinders.

6.7.2. **Guide rails**

The guide rails are essential for the proper action of the closing device. They are located on both sides of the plate pack. They act as support surfaces for slide pieces attached to the filter plates.

It is important the guide rails are accurately vertical and parallel. They have been properly adjusted before the start-up by Outotec personnel but later after every loosening of guide rails it is necessary to make sure their alignment is correct. An acceptable tolerance is 1 mm/m to both directions.

Guide rails should be washed daily simultaneously with the plate pack.
6.7.3. **Quick action cylinder replacement**

**Necessary equipment:**

- 3 pcs. wooden beams (150x100, L=2000)
- Torque wrench with presettable torque (700Nm)
- Cylinder lifting tool 2 pcs (included in Outotec delivery maintenance tools)
- Hex head driver: size 19mm
- Pneumatic wrench (included in Outotec delivery maintenance tools)
- Support (included in Outotec maintenance tools)
- Two lifting belts: preferable different length

1. Drive the plate pack to its close position.
2. Drive the upper pressing plate carefully upwards until the wooden beams will be fitted under it.
3. Install three wooden beams under the upper pressing plate and drive the plate down on the wooden beams.

150x100, L=2000 wooden beams (1) installed between the top pressing plate and the filling plate

4. Remove fixing plate (7), shaft nut (4), nut (5) and ring (6) on the top end of the cylinder body. Refer to figure B on the next page.
5. Drive the cylinder manually to the lower end position.
6. Remove the hydraulic pipe's T-connectors from the end of the piston rod.
Wear safety goggles when disconnecting fittings in the hydraulic system.

Make sure the pressure in the hydraulic pipeline is below 5 bar before opening the connections. The hydraulic oil pressure can be checked from the measuring connections at the upper end of the piston rod by using a measuring tube with a pressure meter. Refer to figure below.

7. Remove the fixing flange (2) from the lower end of the cylinder and the fixing screw of cover (3). Refer to figure A on the next page.

8. Remove the fixing flange (8) at the top end of the cylinder. Refer to figure C on the next page.
9. Attach the cylinder lifting tools (included in Outotec maintenance tools) into the end of the piston rod (M16 threads). Refer to figure below. Lifting tools must be tightened to a torque of 10 Nm.

10. Attach two (2) lifting belts (shorter and longer) to the lifting tools.

![Lifting tools](image)

**NOTICE**

Incorrect hoisting may cause damage to the machinery. Verify the load of the crane. The weight of the hydraulic cylinder is approx. 1300 kg. Use rotating lifting points for hoisting. Make sure the platform, on which the cylinder is lowered can support the weight.

11. Lift the cylinder rod upwards carefully until the piston rod end is above the fixing hole of the lower frame. Lift the cylinder cover with screwdriver in order to see the piston rod.

![Lift the cylinder](image)
12. Pull the end of the cylinder piston rod from between the brackets with lifting belt.

13. Lower the cylinder carefully down until the upper end of the piston rod is below the upper frame. Refer to figures B and C on the next page.

14. Install the support (included in Outotec maintenance tools) and attach the shorter lifting belt to it.

15. Lower the cylinder down, so it hangs from the shorter lifting belt. Refer to figure C on the next page.

16. Move the longer lifting belt outside of the top frame. Lift the cylinder until you can remove the shorter lifting belt from the cylinder. Refer to figure D on the next page.

17. Lift the cylinder away. Refer to figure E on the next page.
18. Install the cylinder in a reversed order. See the positions of the hydraulic couplings from picture below. Black arrow shows the side of the cloth conveyor unit.
6.7.4. **QAC seal replacement**

Remove the quick action cylinder as described in section *Quick action cylinder replacement*.

**A Remove the seals:**

1. Clean the cylinder externally.
2. Place the cylinder on the floor or on a worktop vertically with the shaft facing upwards.
3. Open six pcs of hexagonal socket screws (8) and lift the mouthpiece (4) off. Remove the wiper (19) and the o-ring (13).
4. Open 15 pcs of hexagonal socket screws (7) and lift the piston rod (2), the piston (6) and the packing tube (3) off from the cylinder frame (1).
5. Pull the packing tube (3) off from the piston rod (2) and remove the seals (11, 12, and 14).
6. Place the piston rod assembly horizontally on a soft surface. Remove the piston seal (17) and the guide (18).
7. Heat the piston (6) to temperature of 200°C to destroy the glue on the piston. Remove the piston from the shaft by rotating it.
8. Check the piston rods chrome surface and the cylinder tubes inner surface; they must be undamaged and smooth. If any damage is found, there might be need for repairs. Only install new seals on components with flawless surfaces.
B Install new seals:

Do not use sharp tools or excessive force to install the seals.

Every step must be done with absolute cleanliness and care to prevent damaging the seals and impurities entering the cylinder.

1. Clean the parts very carefully. Oil the dismantled parts and the new seals with hydraulic oil.
2. Install the seals into their slots according to the detailed figures and take into account the directions and order of the seals. Allow the Teflon bronze seals (12, 17) to settle few hours before the cylinder assembly.
3. Clean the pistons fastening threads with acetone or similar grease dissolving cleaning agent.
4. Glue the pistons thread with thread locking compound LOCTITE 270 / 2701.
5. Screw the piston (6) on its place and tighten it. Glue dries completely in room temperature in about three hours.
6. Oil the cylinder tube mouth thoroughly with hydraulic oil and place the cylinder tube vertically on a worktop with the open end upwards.
7. Place the piston shaft / piston assembly on the worktop vertically with the shaft pointing upwards and lower the packing tube (3) with its seals on the shaft.
8. Lower the cover (4) with its seals on the shaft and install and tighten it with fixing screws (8).
9. Lower the shaft assembly into the cylinder body (1).
10. Position the fixing screw (7) holes by rotating the fastening ring (5). Leave a gap of 1...2 mm between the packing tube (3) and the fastening ring (5), even after tightening of the screws. See figure below.
<table>
<thead>
<tr>
<th>Item</th>
<th>Qty</th>
<th>Number</th>
<th>Description</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2337</td>
<td>SEAL KIT</td>
<td>POS. 11 ... 19</td>
</tr>
<tr>
<td>19</td>
<td>1</td>
<td>WIPER</td>
<td>P8-110</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>1</td>
<td>GUIDE</td>
<td>PWR/S 220×214×19,5</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>1</td>
<td>PISTON SEAL</td>
<td>PO-55-210-2200</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>1</td>
<td>O-RING</td>
<td>OR 109,2×5,7</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>1</td>
<td>O-RING</td>
<td>OR 209,3×5,7</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>1</td>
<td>BACK-UP-RING</td>
<td>TR 210/220×1,7</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>1</td>
<td>O-RING</td>
<td>OR 119,3×5,7</td>
<td></td>
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<tr>
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<td>1</td>
<td>ROD SEAL</td>
<td>PO-55-170-1100</td>
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<tr>
<td>11</td>
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<td>ROD SEAL</td>
<td>B3 -110/130×14,5</td>
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<td>10</td>
<td>1</td>
<td>29126</td>
<td>SEEGER-RING</td>
<td>135×4</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>2-1135/2</td>
<td>GUIDE</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>6</td>
<td>24790</td>
<td>SCREW</td>
<td>M10×35 12,9 DIN912</td>
</tr>
<tr>
<td>7</td>
<td>15</td>
<td>24786</td>
<td>SCREW</td>
<td>M20×110 12,9 DIN912</td>
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<td>6</td>
<td>1</td>
<td>2-29273</td>
<td>PISTON</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>3-16034</td>
<td>FASTENING RING</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>2-23799</td>
<td>COVER</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>3-23797</td>
<td>PACKING TUBE</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>2-29272</td>
<td>PISTON ROD</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>3-25025</td>
<td>CYLINDER BODY</td>
<td></td>
</tr>
</tbody>
</table>

Quick action cylinder positions
6.8. Filter cloth maintenance

6.8.1. Filter cloth tensioning

The change in the filter cloth length taking place during the opening of the plate pack and filter cloth travel is compensated by a tensioning device where a torque brought about by a hydraulic motor tightens a pair of chains fixed to the tensioning roller.

Observe the pressure used by the tensioning device motor and compare it to the pressure set at the start-up. You may increase the torque by rising pressure and decrease by lowering pressure.

The filter cloth tensioning force is produced by a hydraulic motor (1) and a tensioning roller (3) fixed on the chain pair (2) in the tensioning device.

Diagram showing a tensioning device
The hydraulic motor revolves the shaft (4) situated in the lower part of the tensioning device to which the chain wheels have been attached. In the upper part of the tensioning device there are sprockets (5) for the chain. When the motor rotates counterclockwise, the tensioning roller moves downwards to tension the filter cloth.

The operation pressure of the hydraulic motor has been pre-adjusted so the tensioning force of the filter cloth is approx. 5 kN (500 kg).

When the torque of the hydraulic motor stays constant, the filter cloth tensioning force stays constant as well in spite of the tensioning roller position.

When closing the plate pack, the rotation direction of the hydraulic motor is changed with the control valves. The tensioning roller moves up thus giving the filter cloth the additional length needed.

The tensioning and loosening of the filter cloth is carried out automatically when the filter cloth is moving and the plate pack is closing.

6.8.2. Filter cloth seam positioning

After discharge, the clipper seam should stay outside the sealing surfaces of the filter plates. The seam can be positioned so that while in the plate pack, it remains either on the same side or on the other side of the plate back.

A recommendable way is to choose the discharge plates (odd number) so the seam by turns remains on the different sides of the pack. The cake in turns forms on both sides of the filter cloth and gets washed by the counter flow principle.

If the desired result is as clear filtrate as possible, the discharge distance (plates) should be chosen so the seam always gets positioned on the same side of the plate pack. The discharge distance (plates) should be such that the filter cloth moves at least four plate lengths during it. Thus in a normal case even all scraping remnants have had time to drop into the cake chute.

In case the seam remains inside the sealing surfaces, it can be damaged by closing force and thus the change of filter cloth may become difficult. The slurry has also a direct route to the filtration chamber and affects the clarity of the filtrate, capacity and cake moisture.

Following sensors control seam positioning: B331 (incremental encoder) and S332 (clipper seam sensor). B331 is located on the top of the impulse roller and is fixed to upper frame. The shaft of encoder is attached a wheel which is lying against the impulse roller. B331 sends out impulses, the distances A-B and B-C (shown in the drawing) are measured by these impulses. S332 zeros the seam positioning at point A. S332 is located under the B331, between the tensioning device frame and the filter cloth.
The number of pulses corresponding to the distances A-B (place of the seam) and B-C (plate length) are given through an operator's interface. One pulse corresponds to 25 mm.

The automatic positioning of the clipper seam only functions when the filter is in automatic drive. The test drive of filter cloth does not include the positioning function, thus when returning to automatic drive (cake discharge subroutine), the filter cloth is driven so long the seam is acceptable for closing plate pack. Note that if seam is not OK for closing plate pack (in SBR05) there will be S332 alarm, due to security reasons it cannot be acknowledged until program is reset.

When the cake discharge starts, the filter cloth is at first driven forward one plate length at cake discharge speed. When the first plate length is done, the rest of discharge is done by filter cloth wash speed. When the whole discharge is done the filter cloth stops to the next roller. Thus the seam always gets positioned at the end of the filter plate.

In case the seam passes by the seam detector S332 after the discharge has done, the seam stops under the upper roller of the plate pack, i.e. at point B.

In case "End mode" has been chosen as the drive mode, the positioning of the filter cloth takes place only after the full length of the filter cloth has been washed. The number of revolutions can be changed from parameter screen. Normally one revolution is enough.

The length of the filter cloth is given in meters (e.g. 68.0) through the operator's interface on the basis of which the number of pulses for the whole filter cloth length is calculated. In case S332 does not receive an impulse from the seam after the set number of pulses, an alarm S332 "clipper seam alarm" is given.

In case the filter cloth is changed and seam positioning has worked properly with the previous filter cloth, there is no need to change the parameters.
In case the length of the filter cloth is changed (filter plate pairs have been added to the filter), the new length in meters should be given through the operator interface and the filter program should be reset and started in automatic mode.

PLC measures the filter cloth (and compare it to the given filter cloth length) and positions clipper seam. This initialization can take a maximum of two full filter cloth lengths depending on the current position of the clipper seam. During the initialization process there is a message “searching clipper seam” in operator interface screen.

To sustain the filter cloths filtering properties, it is spray washed by pressurized water after every filtration cycle. Washing is automatic and simultaneous with the filter cloth travel.

Make sure the nozzles do not get clogged and that the sprays are directed towards the filter cloth at a correct angle, so the filter cloth is evenly sprayed throughout. The wash liquid filter should be checked once a month and cleaned if necessary.
Water consumption depends on the water pressure. For an efficient wash, the water pressure must be minimum 5 bars. Water is consumed only when the filter cloth is moving. Water consumption at 15 bar pressure is approx. 230 l/min. The filter cloth wash time varies depending on application, the minimum being 30 seconds.

Due to efficient operation of nozzles the pressure must be at least 5 bars.
6.8.3. **Filter cloth patching**

Use a sewing machine to patch the filter cloth. A suitable sewing machine type is SINGER 20U43 equipped with a greasing device (silicone oil).

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Notice Icon] Inappropriate filter cloth may cause damage to the machinery. Patch all holes immediately.</td>
</tr>
</tbody>
</table>

**NOTE!** It is easiest to patch the filter cloth, when the holes are still small.

Patch the filter cloth as follows:

1. Drive the hole to the lower part of the tensioning device, approx. 1/2 m over the pressing roller.
2. Wash the filter cloth approx. 10 cm x 10 cm around the hole with a high pressure washer.
3. Dry the washed area with pressure air.
4. Slacken the filter cloth.
5. Sew a patch on the hole. Pay special attention to the front edge of the patch, because this seam is strained most by the scrapers.
6. First sew the holes edges tightly on the patch and then make a couple of sews crosswise over the patch.
6.8.4. **Filter cloth replacement**

**Caution**: Do not leave your fingers in between the plates. Lock the plate pack (upper position). Close the manually actuated process valves.

1. Drive the clipper seam up to the pressing roller (10) and halfway to the centering roller (1).
2. Slacken the filter cloth.
3. Detach the clipper seam by removing the seam thread.
4. Fix the end of the new filter cloth to the upper end of the old filter cloth by joining the clipper-seam halves together.
5. Tighten the filter cloth.
6. Drive the new filter cloth carefully into the filter at the same time folding the old filter cloth from the drive roller (9) in front of the filter.
7. Stop the seam at the midpoint of the pressing roller and centering roller.
8. Slacken the filter cloth.
9. Detach the clipper-seam from between the new and old filter cloth and join the ends of the new filter cloth together.
10. Tighten the filter cloth.
11. Check the filter cloth centering by driving the filter cloth several rounds around.
1. Centering roller
2. Tensioning device roller
3. Tensioning roller
4. Impulse roller
5. Guide roller
6. Scraper
7. Vat roller
8. Filter cloth wash nozzles
9. Drive roller
10. Pressing roller
11. Cake
12. Seam detector
13. Encoder
6.8.5. **Filter cloth limit adjustment**

**General Information**

The filter cloth is guided by the following limit switches:

- B331 = CLOTH INCREMENTAL ENCODER
- S332 = CLIPPER SEAM DETECTOR
- S838 = CLOTH CONTROL LIMIT SENSOR, LEFT
- S839 = CLOTH CONTROL LIMIT SENSOR, RIGHT
- S873 = TRACK ROLLER IN PROPER RANGE
- S838A = CLOTH ALARM LIMIT SWITCH, LEFT
- S839A = CLOTH ALARM LIMIT SWITCH, RIGHT

The lengthwise adjustment (seam placing) is controlled by the encoder B331 and sensor S332 by means of the motors HM9 and HM8. The sideways adjustment is controlled by S838, S839 and S873 by means of the tracking motor M07. The switches S838A and S839A are for filter cloth displaced alarms.

**Location**

- B331 is located by the impulse roller at the upper end of the tensioning device.
- S332 is installed between the filter cloth and the frame of the filter cloth tensioning device.
- S838A and S839A are located on the upper part of the filter cloth tensioning frame.
- S838 and S839 are located inside the filter cloth drive unit.
- S873 is installed at the tracking motor side end of the filter cloth drive unit.
6.8.6. **Filter cloth wash water spray adjustment**

For filter cloth wash nozzles use type ACM 6 spray nozzles manufactured by Delavan. The direction of the spray in regard to the filter cloth can be adjusted by turning the nozzle by its thread.

Adjust the sprays to the whole width of the filter cloth and make sure the sprays do not touch each other.

![Diagram of filter cloth wash water spray adjustment]

6.8.7. **Filter cloth tracking**

In order to guarantee the correct functioning of the filter cloth centering unit, you must take the following points into account:

- The rollers are not stuck
- Solids are not allowed to build up on the rollers (cleaning and setting the scraper)
- Check and set the sliding pieces
- Sufficient filter cloth tension

6.8.8. **Filter cloth tensioning device maintenance**

Check the following in the filter cloth tensioning device:

- The tension roller must be level. If not, correct it by opening the socket of the drive shaft and moving the chains.
- During a chain replacement, check the turnbuckle and tensioning roller shaft do not touch the chain wheels even in the upper position.
- Grease the chains once a month.
### 6.9. Lubricant recommendations

These lubrication instructions are general and do not refer to measures taken in special conditions.

![Diagram of mechanical components](image)

#### LUBRICATION CHART

<table>
<thead>
<tr>
<th>POINT</th>
<th>LUBE</th>
<th>AMOUNT</th>
<th>INTERVAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 3, 4, and 6 NIPPLES IN VAT ROLLER BEARINGS</td>
<td>NLGI-2</td>
<td>16 g</td>
<td>1 x MONTH</td>
</tr>
<tr>
<td>2 AND 5 NIPPLES IN TENSION SHAFT BEARINGS</td>
<td>NLGI-2</td>
<td>LUBE WITH BRUSH</td>
<td>1 x MONTH</td>
</tr>
<tr>
<td>7 AND 8 NIPPLES IN DRIVE SHAFT BEARINGS</td>
<td>NLGI-2</td>
<td>LUBE WITH BRUSH</td>
<td>1 x MONTH</td>
</tr>
<tr>
<td>9 AND 10 NIPPLES IN BELT TRACKING DEVICE</td>
<td>NLGI-2</td>
<td>LUBE WITH BRUSH</td>
<td>1 x MONTH</td>
</tr>
</tbody>
</table>

TOTAL NUMBER OF LUBRICATION POINTS INCLUDING TENSIONING DEVICE CHAINS AND LOCKING PINS IS 18.
6.10. **Spare parts**

6.10.1. **Storing instructions for rubber parts**

The properties of vulcanized rubber parts change during storing. Careful storing minimizes the damages.

- Pay attention to the following:
- Temperature, the storing temperature should not exceed +25°C, preferably below +15°C.
- Humidity, avoid high moisture contents in the surrounding air. Prevent water from condensing on products.
- Light, avoid ultraviolet light. Protect the products against straight sunlight.
- Oxygen and ozone, remove all equipment developing ozone from the room where products are stored. Minimize the store room ventilation.
- Deformation, store rubber and polyurethane parts (diaphragms, plate seals, rollers, scrapers) straight (not rolled), this would enable them free from tension.
- Solutions and vapors from solvents, keep the rubber parts off the chemical effect of solutions and solvent vapors.
- Stock circulation; try to keep the storing time of rubber parts as short as possible. Always use the material which has been longest in stock first.

In addition, take into consideration the following when storing the rubber parts:

- Coming into contact with certain metals.
- Compatibility of different rubber qualities.
- Storing methods used.

For further information refer to standard ISO 2230 and the standard proposal SFS 3553 or contact the manufacturer of the rubber parts.

We refer you to the guidelines of the DIN 7716 standard "Caoutchouc and rubber products - requirements for storage, cleaning and maintenance" and, in particular, to par. 3 and 4 of the DIN 7716 standard if the storage will last longer than 6 months. If these prescriptions and requirements are complied with, the usability of the membranes will not undergo any substantial change within a 2 years' storage time.

In case of a longer storage time, the membranes must be additionally protected against damages with strong tarpaulins.
6.10.2. How to order spare parts

When ordering spare parts always state the type and serial number of the filter in question and specify the spare parts as shown below:

<table>
<thead>
<tr>
<th>Filter type</th>
<th>Serial No</th>
<th>Part code</th>
<th>Part name</th>
<th>Description (material, type)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PF 32 A2 H</td>
<td>Ser. No. 395</td>
<td>P24412</td>
<td>Rubber diaphragm</td>
<td>NR 900x1750</td>
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</tbody>
</table>

6.10.3. Spare parts recommendation

<table>
<thead>
<tr>
<th>SPARE PARTS</th>
<th>PF FILTER SIZE</th>
<th>6.5</th>
<th>9.5</th>
<th>12.5</th>
<th>16</th>
<th>19</th>
<th>22</th>
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<th>32</th>
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<tbody>
<tr>
<td>Filter plate, right handed</td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
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<td>1</td>
<td>1</td>
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<tr>
<td>Plate frame</td>
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<td>Guide roller</td>
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<td>Filtrate hose</td>
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<tr>
<td>Pressing water hose</td>
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</tr>
<tr>
<td>Guide piece for plate</td>
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<td>44</td>
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<td>76</td>
<td>84</td>
<td>92</td>
</tr>
</tbody>
</table>
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7. Special instructions

7.1. Transport instructions

Only qualified personnel are allowed to attach loads and do transporting duties.

7.1.1. Filter protection for sea shipments

Individually identified parts in each Outotec (Filters) Oy filter are specially protected during transportation.

7.1.2. Protected parts

Delivery as a whole filter:
- Piston rods of hydraulic cylinders
- Hydraulic blocks/valves/connectors
- Column holes
- Locking pins

Delivery as dismantled filter and spare parts:
- in addition to the above, all machined, uncovered (not painted) surfaces

7.1.3. How to remove protection

A tin of thinner is delivered with each filter for removing protection.

The person who starts up the filter removes the protection from the piston rods of the hydraulic cylinders, locking pins and column holes.
7.2. Checking delivery

Inspect the machine and accessories after delivery for transport damage. Report any damage immediately to the carrier, insurance company and the supplier. Check the entire delivery against the attached delivery note to make sure it is complete.

We refer to our terms of sale and delivery.

The assembly and connection material for the interfaces of the dismounted components is included in the delivery. All the other accessories are appropriately packed and included with the delivery.

Dispose of packing and insulating material properly and in an environmentally compatible manner. National regulations are to be observed.

7.3. Storage

These instructions are to give a basis to prepare your fast opening filter press for storage. Site specific actions have to be decided by your own experts. This instruction will not overrule local operating instructions of single equipment.

7.3.1. Storage of machine

When preparing the machine for storage, all liquid must be removed from the machine parts to prevent freezing, corrosion and other damage. Use appropriate means to protect all bright or uncoated parts.

Minimum temperature: -15°C
Maximum temperature: +65°C

The storeroom must be dry, shady and kept at a constant temperature. Solvents, oils or paints cannot be stored in the same room.

Protect filter plates from frost, direct sunlight or heat. Make sure they do not come into contact with oil or solvents.
- De-pressurize all pipelines.
- Grease the plate shifter chain.
- Open the plate pack closing cylinder in half open position.
- Position the pinch valves to be in open position to avoid formation of pinch valve hose.
- Open the swivel plates. This reduces static load on motors.
- Turn the main switch in off position and lock it.
- Check the purity of the filter and the surrounding equipment. If needed, wash all equipments well to prevent corrosion. Note the IP rating of equipment when cleaning the filter and use only proper methods for cleaning.
- Wax all non protected surfaces like piston rods and the side bar slide strips.
- Cover the filter with tarpaulin.

7.3.2. **Storage of filter parts**

The filter plates are delivered lying flat on pallets if they are not installed onto the machine.

- Remove the packing and undo the wrapping tape (be careful when using sharp or hard tools).
- Check every filter plate for transport damage.
- Take filter plates off from the pallet and suspend them in the skeleton. Never store the plates vertically, but in horizontal plane on a smooth surface. Suspend the plates one by one. Handle the filter plates with care.
- Filter plates made from synthetic material must not be exposed to solvents, frost, direct sunlight or heat. Until they are mounted, store them in a dry and shady place at a constant temperature.
- Damaged or disfigured filter plates must not be installed in the machine.

**Always store filter plates flat on a smooth base and never in an upright position. Protect filter plates from frost, direct sunlight or heat. Make sure they do not come into contact with oil or solvents.**

- Membranes made from soft rubber must be packed on pallets or in crates, stacked in a flat plane. When packing the membranes on pallets, use several layers of corrugated board and wood ledges to protect the edges, and then band the membranes with packing hoop steel. Put cardboard layers between the individual membranes.
- Transport and store pallets or crates with membranes only with the membranes lying flat and do not pile up the loaded pallets. Avoid compression, friction and shock stresses.
- Unpack the rubber membranes carefully one by one.
Store them in darkened rooms which are kept at a moderate temperature. The best storage temperature is 12…25°C. The air moisture has no influence on the physical properties.

- Put the membranes flat one upon the other with layers of strong cardboard in between them (if possible, on a flagged floor), but do not superpose more than 5 membranes.

- As for the rest, we refer you to the guidelines of the DIN 7716 standard "Caoutchouc and rubber products -requirements for storage, cleaning and maintenance" and, in particular, to par. 3 and 4 of the DIN 7716 standard if the storage will last longer than 6 months. If these prescriptions and requirements are complied with, the usability of the membranes will not undergo any substantial change within a 2 years' storage time.

- In case of a longer storage time, the membranes must be additionally protected against damages by strong tarpaulins.

### 7.4. Preparation of the hydraulic unit for storage

- Disconnect the hydraulic power pack from the electric power supply.
- Check the hydraulic power pack is unpressurized.
- Fill up the oil reservoir almost full (two centimeters from the top level). Purpose is to reduce air volume in the reservoir and to avoid condensation.
- Remove air breather and plug the connection in the reservoir.

### 7.5. Restart after long term storage

- Inspect all wearing parts and change all worn out components before starting the filter again.
- Clean all waxed surfaces and remove the motor hoods (inhibitor plastic).
- Drain an additional amount of hydraulic oil to gain the proper oil level. Ensure the oil is in proper condition and if needed, change the oil.
- Reinstall an air breather into the oil reservoir.
- Follow the instructions given in section *Mechanical commissioning*.

### 7.6. Disposal of filter components

Dispose of the filter parts according to local regulations. Separate the plastic and metal parts of the filter and recycle them appropriately.
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8. Optional devices

8.1. Load cell module

Load cell transducers are constructed of stainless steel. This figure illustrates a typical load cell configuration. The transducers are made to operate in industrial, wash down environments, require no periodic maintenance, and are immune to electrical noise due to high level output voltage. Load cell transducers wire to signal processors, which convert the transducer’s voltage outputs to weight measurement.

Load cells transducers will be installed between the filter and customers foundation with mounting kits. Some of filter may have separate weighing beam between the filter and the load cell mounting kit in order to stabilize load to load cells.
8.1.1. **Hardware installation**

To achieve the most accurate weight measurement from the load cell transducers, there are factors to consider before installation:

- The surfaces where the base plates bolt down must be flat and horizontal with less than one degree of slope in any direction. Also, the surface must be clean and smooth.

- The foundation on which a filter rests must be of concrete or steel so that it does not allow excessive movement when the weight in the filter changes.

- Shock loads can damage load cells. If the load cell mounting kit can be struck by forklifts, trucks, etc., install protective barriers or stops to prevent vehicles from hitting the mounting kit.
8.1.2. Important installation notes

- During filter installation do not put all filter load on one transducer.
- Position load cell transducers so that the transducer cable cannot be snagged or chafed, and can be easily routed to the terminal box.
- In case you need to weld near to the load cell, be sure the ground path is not trough the load cell. The ground cable should be close to the welding, in between the welding and the load cell, i.e. the welding current must not in any conditions run trough the load cell. Also be careful with the heat. The load cell must always be so cool that you can touch it. Further, it is recommendable to disconnect the wires from the sensor, to avoid a ground loop via the electronics.
- Supporting structures of the pipelines connected to the filter should also carry the load of the filter’s pipelines. After the erection work, the filter’s pipelines are then released from the filter to stay on the supports of the pipelines connected to filter. Also, other vertical supports fixed to the filter, which may affect the process control system, have to be replaced by new supporting structures and disconnected from the filter.

8.1.3. Operation instructions

The process control system can be activated to control FILTRATION stage. If the system is not activated, stages are controlled by preset time.

To activate the system to control the filtration stage, set parameter “MAX FILLING WEIGHT (kg)” in parameter screen No. 3. If parameter is Zero, control is not on.

When the process control is activated, filtration (filling the chambers) is controlled by time, weight or maximum pumping pressure. Whatever reaches the set value first, stops filling. The weight set point is set into parameter “MAX FILLING WEIGHT (kg)”.

To get access to capacity information select REPORT screen and press HISTORY report button in the operator interface panel.

Screen information:

1. Production per hour. Cumulative cake weights of the last hour. kg
2. Production per shift. Cumulative cake weights of the current 8 hour period. t
3. Production per day. Cumulative cake weights of the current day. t
4. Production per week. Cumulative cake weights of the current week. t
5. Production per month. Cumulative cake weights of the current month. t
6. Production per year. Cumulative cake weights of the current year. t
7. Total cake production from the start-up of the filter. t

Note:

Production per shift is reset according to the shift start time parameters (PARAMETER screen No. 3).
Select “B91*” from process screen and from there “Param”.
In info screen all load cell (each load cell separately) related data (signal, reference voltage, weight) can be monitored:

This screen is only for information to monitor weighing system operation.
8.1.4. Alarms

Minimum weight alarm

Cause:
- Cake weight after pressing is less than minimum cake weight set in parameters.

Reason:
- Slurry pump is failed.
- Slurry feed time is too short
- Slurry density is too low.
- Weight sensor or amplifier has failed.

Measures:
- Skip over air drying stage for avoid filtration plates pending
- Repair or replace weight sensor/amplifier.

Tare alarm

Cause:
- Measured weight is greater than max tare weight after plate pack closing stage.

Reason:
- Extra mass has been gathered to filter.
- Weight sensor or amplifier has failed.

Measure:
- Remove extra mass from filter.
- Repair or replace weight sensor/amplifier.

Note:
If the parameter “MAX TARE WEIGHT (kg) is set to zero, the alarm is not in use.
8.2. **Changing the cloth wash pump control (M06 / M06.1)**

Change is possible only when filter is stopped and neither of the pump motors is running.

Changing:

- Touch the cloth wash pump motor symbol in the process screen.

- Select the pump motor to be used (one in use is indicated with green).

- Confirm the change.

- Pump motor in use is shown in the process screen.
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9. Appendices

9.1. Filter datasheet
CUSTOMER  
K'enyuka / Mareesburg concentrator

APPLICATION  
Platinum concentrate

LAROX PF M12 SERIES AUTOMATIC PRESSURE FILTER

Type  Larox PF 19/25 M12 1 45
Filtration area  19 m²

DRAWINGS  
According to Document Index Record list

MARKING

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<th>FILTER TYPE</th>
<th>PF</th>
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<td>FILTER SERIES</td>
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<td>CONSTRUCTION MATERIAL</td>
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<td>CHAMBER HEIGHT</td>
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PROGRAM

Short program
1. Filtration
2. Pressing
3. Drying
4. Cake discharge

CONSTRUCTION MATERIALS

1 = all metal parts in contact with slurry, material AISI 304L or equal

PRESSURES

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<td>Air drying pressure</td>
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<td>Cake washing pressure</td>
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<tr>
<td>Instrument air pressure</td>
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CONSTRUCTION DESCRIPTION

Item numbers are according to the dimensional drawing.

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<tr>
<th>Item</th>
<th>Description</th>
<th>Material information</th>
<th>Further information</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Frame assembly</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- U-beam frame</td>
<td>Mild steel</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- liquid collecting vat</td>
<td>AISI 304</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Foundation assembly</td>
<td></td>
<td>Qty 4 pcs, hard chromed piston rods, plastic bellows</td>
</tr>
<tr>
<td></td>
<td>- foundation plate</td>
<td>Mild steel</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- hydraulic cylinders for sealing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Lower pressing plate</td>
<td>Mild steel</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- guards</td>
<td>AISI 316</td>
<td></td>
</tr>
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<td>4</td>
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<td>Qty 12 pcs</td>
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<td>- body plate</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>- diaphragm</td>
<td>Natural rubber</td>
<td>Max. temp 60 °C</td>
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<td>- grid</td>
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<td>- guide roller</td>
<td>Polyurethane lining</td>
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<td></td>
<td>- cloth scraper</td>
<td>Polyethylene edge</td>
<td>AISI 316 frame</td>
</tr>
<tr>
<td></td>
<td>- roller scraper</td>
<td>Polyurethane edge</td>
<td>AISI 316 frame</td>
</tr>
<tr>
<td></td>
<td>- adjustable slide piece</td>
<td>HDPE</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Column assembly</td>
<td></td>
<td>Qty 4 pcs, hard chromed piston rods</td>
</tr>
<tr>
<td></td>
<td>- columns</td>
<td>Mild steel</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- guide bars</td>
<td>AISI 304</td>
<td></td>
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<td></td>
<td>- hydraulic cylinders for quick action</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Upper pressing plate, assembly</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- upper pressing plate</td>
<td>Mild steel</td>
<td>partial AISI 316 lining against plate pack</td>
</tr>
<tr>
<td></td>
<td>- locking pins</td>
<td>Mild steel</td>
<td>Qty 4 pcs</td>
</tr>
<tr>
<td></td>
<td>- hydraulic cylinders for locking pins</td>
<td>Mild steel</td>
<td>Qty 2 pcs, hard chromed piston rods</td>
</tr>
<tr>
<td>7</td>
<td>Top frame</td>
<td>Mild steel</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Cake chute</td>
<td>AISI 304</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Cloth tensioning device</td>
<td>AISI 304</td>
<td>Hydraulic motor drive</td>
</tr>
</tbody>
</table>
TECHNICAL DESCRIPTION for PF1041

RIKAHO    DOC25942 Rev. C
Status: CERTIFIED     21th October, 2011  3 (8)

10 Cloth drive unit
   - automatically controlled
   cloth centering roller
   * worm gear
   Mild steel
   Hydraulic motor drive
   Rubber lining

11 Hydraulic unit
   - oil tank
   AISI 304
   Vol. 150 l
   - variable displacement
   axial piston pump
   Max. press. 180 bar
   Hydraulic unit will be delivered without oil. First filling at site by the customer.

12 Process pipelines
   Flanges DIN 2501
   - slurry feed pipe
     AISI 304L
     PN 16
   - pressing water distribution pipe
     AISI 304
     PN 16
   - filtrate collection pipe
     AISI 304L
     PN 16
   - filter cloth wash piping
     AISI 304
     PN 16
   - slurry hoses
     EPDM
   - pressing water hoses
     SBR
   - filtrate hoses
     EPDM
   - LAROX-pinch valves
     Hydraulic actuators
     * housing
     ALSi
     Qty 2 pcs
     * sleeve
     SBRT
     Qty 2 pcs
     * PVE 40, PN16
     Qty 1 pce
     * PVE 65, PN16
     * PVE 100, PN16

13 Covers for hoses
   - frame
     AISI 304
   - plates
     Polycarbonate

14 Filter cloth
   The delivery includes one filter cloth. The installed cloth is for factory test and start-up purposes only.
   AINO T30 or equal
   1,05 x 38 m

15 Pressing water station
   - water tank
     AISI 304
     Vol. 1500 l
   - pipelines and valves
     AISI 304
   - multistage centrifugal pump
     Grundfos CR 15-12
     Max.pressure 16 bar
   - butterfly valve
     Pneumatic actuator
     * housing
     lined cast iron
     Qty 1 pce
     * disc
     AISI 316
     * DN50 and DN65, PN 16
AUTOMATION AND ELECTRIFICATION

For the control of all functions of the filter as well as quoted accessories and process control functions.

The control panel is to be regarded as interface between automatic pressure filter and the operator. The panel can be used for
- Displaying the status of position sensors
- Displaying the status of valves and motors
- Displaying the flow diagram including process valves, showing the status and process pressures
- Supplying of recipes and parameters

Selection of modes
- Test mode
- Manual mode
- Automatic mode
- End mode

Language for screen text English and desired one

Electrification and instrumentation is designed acc. to European standards.

Material of construction
- Control panel Coated mild steel, IP65
- Terminal boxes AISI 304, IP66
- Terminal box, in hydraulic unit Coated mild steel, IP65

PLC system Allen Bradley Control Logix

Operator interface unit (OIU) Proface AGP3500 10,4”

Voltage supply to the system 110 VAC 50 Hz 1-phase

The control panel requires voltage supply from which following field voltages are internally generated:
- Instrumentation 24 VDC
- Control solenoids 24 VDC

ELECTRIC MOTORS AND CABLELING

Motor starters, cabling external to the filter and its associate parts is excluded from the Outotec delivery.

The limits for supply of electrical components and cabling shall be as shown in cabling diagram.
Auxiliary I/O controls for Outotec supplied process motors and auxiliary devices are included in Outotec automation control system.

Motor voltage 550 VAC 50Hz 3-phase
- Hydraulic unit 18.5 kW, 1500 rpm (50 Hz) IP55
- Pressing water pump 11 kW, 3000 rpm (50 Hz) IP55
- Cloth centering 0.55 kW, 1500 rpm (50 Hz) IP55

WELDING PROCESS

The following welding procedures are used at Outotec: electrode (111), MAG (135), TIG (141) (ISO 857-1). The weldings are carried out according to welding class C at the minimum (SFS-EN ISO 5817). A welding co-ordinator is responsible for welding (IWE 00132 FIN) and he has full authority over any necessary action. Welders competence is based on (SFS-EN 287-1). Welding instructions have been accepted according to SFS-EN ISO 15614-1, SFS-EN ISO 15610, SFS-EN ISO 15611. Weldings are checked visually and the parts in plate pack which are in contact with slurry are tested for tightness (pressure water 16 bar / pressure air 6 bar). In addition, parent material traceability for the above parts is secured. A final inspection is carried out with a complete product according to ISO 9001:2000.

PAINTING

Mild steel parts are epoxy painted, stainless steel and plastic parts are not painted.

Parts with heavy corrosion and abrasion environment conditions:

SFS-EN ISO 12944-5/S7.03/C5-M/M (EP 300/2-FeSa 2½)
- surface treatment epoxy painting, 2 coats of epoxy,
  2 x 150 microns, total paint thickness 300 microns

Other parts with normal corrosion and abrasion environment conditions:

SFS-EN ISO 12944-5/S7.02/C5-M/L (EP 200/3-FeSa 2½)
- surface treatment epoxy painting, 2 coats of primer
  * primer paint 1 x 60 & 1 x 80 microns, 140 microns
  * 1 coat of epoxy paint 60 microns
  * total paint thickness 200 microns

Colors: Window Grey RAL 7040
        Basalt Grey RAL 7012

More details in the painting instruction of the filter.
CLOTH WASH WATER CONSUMPTION

<table>
<thead>
<tr>
<th>Water pressure (bar)</th>
<th>Flow rate (l/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>120...130</td>
</tr>
<tr>
<td>10</td>
<td>180...190</td>
</tr>
<tr>
<td>15</td>
<td>210...220</td>
</tr>
</tbody>
</table>

Flow is required only during cloth advancement which is from 0.5 to 1.5 minutes per cycle.

INSTRUMENT AIR

Air pressure: 6 - 10 bar (overpressure)
Air temperature: 5 °C - 80 °C

Compressed air quality according to ISO 8573-1 class 4.4.4.
- Dirt: max. particle size 15 μm, max. concentration 8 mg/m³
- Water: max. pressure dew point +3 °C
- Oil: max. concentration 5 mg/m³

Air consumption:
- average consumption while operation 2 l/min
- maximum instantaneous flow 70 l/min

DRYING AIR

Air temperature: 10 °C - 80 °C
Compressed air quality according to ISO 8573-1 class 4.7.4.
- Dirt: max. particle size 15 μm, max. concentration 8 mg/m³
- Water: no requirements
- Oil: max. concentration 5 mg/m³
- air pressures and consumptions according to filter’s sizing report
CONSTRUCTION

The filtration elements (i.e. plates) of the PF filter are placed horizontally between two pressure plates. During filtration the plate pack is pressed together, and the pack is opened for cake discharge.

The plate pack is opened and closed by means of hydraulic cylinders.

The endless filter cloth zigzags between the filter plates, which results in the filtered cake being formed on either side of the cloth. The filter cloth is thus automatically back flushed and any particles adhering to it or lodged in the filter cloth from the previous filtration cycle are washed out when filtering on the reverse side of the cloth.

The cloth transports the cakes off the filter and, at the same time, the cloth is cleaned on both sides by high pressure water sprays. The cloth moving device is driven by the hydraulic motor which actuates the cloth drive roller. When the filter plates are opening and closing, the tension of the filter cloth is maintained at a constant level by a simple cloth tensioning device. The cloth tensioning device does not operate when the plate pack is closed.

Slurry is fed into sealed filter chambers through the distribution piping. Wash water and compressed air are fed in through the same pipe. The feed pipe is emptied through a drain valve on completion of the feed pumping cycle.

The operation of the filter is controlled automatically by the operation unit containing the programmable logics and indicator lamps for all operations.

The actuators of the automatically controlled valves are hydraulic and electromagnetic.
OPERATION

1. Filtration

When the filter plate pack has been closed, slurry is pumped into the filter and fed simultaneously into each filter chamber through the distribution pipes. Filtrate flows through cloth into the filtrate collection area, then out through the discharge pipe. The filtered material is collected on the cloth surface and forms the filter cake.

2. Pressing I

Pressing water is pumped in behind the rubber diaphragm. The diaphragm presses the cake against the cloth surface, thus pressing the filtrate from the cake through the cloth.

3. Washing (optional)

Wash liquid is pumped into the filter chambers in the same way as slurry. As the liquid fills the filtration chamber, the diaphragm is lifted up and water is forced out from the upper side of the diaphragm. The wash liquid flows into the discharge pipes after passing through the filter cake and the cloth.

4. Pressing II (optional)

The wash liquid remaining in the chamber after the washing stage is pressed out of the cake as in stage two above.

5. Drying

The final drying of the cake is accomplished with compressed air. The air which enters through the distribution pipe fills the filter chamber, raises the diaphragm and forces the pressing water above the diaphragm out of the filter. The air flow through the cake reduces its moisture content to the optimum and, at the same time, empties the filtrate chamber.

6. Cake discharge

When the air drying has been completed, the plate pack is opened and the cloth moving mechanism started. The filter cake on the cloth is discharged from the filter.
9.2. Error Report for the Documentation

We have provided this form to help us track any errors that may exist in our manuals. Should you find an error in this manual, please describe it in the space below and fax this form to us, telefax No. +358 20 529 4439. We appreciate your input.

Current Information

PF No. ____________ Page number(s): ______________ Figure number(s): ____________

Information as currently printed:

__________________________________________________________________________

__________________________________________________________________________

Proposed Change

Information as it should be printed:

__________________________________________________________________________

__________________________________________________________________________

Any additional information:

__________________________________________________________________________

__________________________________________________________________________

Address (optional):

Name

Title

Company

Address

Telephone

Telefax

Date Received

Date resolved

Manner Resolved
## 9.3. Error Report for the Filter

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<th>Claim</th>
<th>Returned Goods</th>
<th>Date:</th>
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<td>✔</td>
<td>✘</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Customer’s name/Contact</th>
<th>Affiliate or distributor</th>
<th>Outotec (Filters) Oy</th>
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<table>
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<th>Address</th>
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</tr>
</thead>
<tbody>
<tr>
<td>P.O.Box 29</td>
<td>+358 20 529 4236</td>
<td><a href="mailto:info@Outotec.com">info@Outotec.com</a></td>
<td>+358 20 529 4439</td>
<td><a href="http://www.Outotec.com">www.Outotec.com</a></td>
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<thead>
<tr>
<th>Filter type</th>
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<th>Part No.</th>
<th>Operating cycles or time</th>
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<th>Business unit</th>
<th>Type of operation</th>
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</tbody>
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<table>
<thead>
<tr>
<th>Description of the case, place, circumstances, etc.</th>
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### Goods to be returned

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<th>Qty.</th>
<th>Code</th>
<th>Description</th>
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<tr>
<td>other delivery date:</td>
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<table>
<thead>
<tr>
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<table>
<thead>
<tr>
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<th>Warranty status</th>
<th>Warranty period</th>
<th>Yes</th>
<th>No</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Actions | | Warranty status | Warranty period | Yes | No |
|---------| |-----------------|-----------------|-----|----|
| To be repaired | Date | By |
| To be scrapped | Claim returned for completion |
| To be delivered to supplier for inspection | Claim accepted | Rejected |
| Date | By | Date of credit | Credit invoice |

---
9.4. **Start-up Report**

Add after start-up.
9.5. **Order form for Manuals**

Additional copies of these documents can be ordered from the manufacturer. Please note that further copies are not free of charge.

All rights expressly reserved. Reproduction or communication to third parties, no matter in which form, is not permitted without our written consent.

When ordering additional copies, always state serial number of the filter in question and specify the needed documents as shown below:

<table>
<thead>
<tr>
<th>Serial no</th>
<th>Document</th>
<th>Pcs</th>
<th>Description (delivery type)</th>
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<tr>
<td>1041</td>
<td>IOM manual</td>
<td>1</td>
<td>1 x paper file 1 x CD</td>
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<tr>
<td>1041</td>
<td>eCatalogue</td>
<td>1</td>
<td>1 x CD, 1 x paper file</td>
</tr>
<tr>
<td>1041</td>
<td>OEM documents</td>
<td>2</td>
<td>2 x paper file</td>
</tr>
</tbody>
</table>
9.6. Mechanical drawings
Recommended minimum floor area for maintenance. To facilitate the cleaning of the PP Filter, it is recommended that this part of the platform is constructed with proper declinations and drain ditches as well as the cascade chute openings and the through holes of the pipelines should be equipped with edge strips.

Minimum opening for maintenance. Doors can lift away from working area.

NOTE 1

When there is a control room close to the filter, the panel can be located there. Visual connection from the control panel to the filter is useful but not essential.

Customer: RHODIUM REEFS LTD
Supplier ref. No. B100255F1
Supplier work No. 9025
Serial No. 1041

Outotec

Recommended layout
PP1041
PF19/23 M12 145
F651732

Date: 19.09.2011
ARJMAL

Signature: [Signature]

Date: 19.09.2011
ARJMAL

Signature: [Signature]

PRELIMINARY
For APPROVAL: [ ]
CERTIFIED: [X]
AS-BUILT: [ ]

Change: [ ]

Pcs: [ ]

Mark: [ ]

K'ENYUKA DRG. No
05120008 8720 07 0018 01
STEELE FOUNDATION
U-BEAM FRAME
OF THE FILTER

CONCRETE FOUNDATION
U-BEAM FRAME
OF THE FILTER

Assembly plate (excluded from Outotec delivery)
(Recommended size: 200 x 360 x 30 mm)
Bolts M16x45, 24 pcs excluded from Outotec delivery
GENERAL PIPING RECOMMENDATIONS FOR PF-H FILTERS
(COMPARE WITH FLOW SHEET, PIPING AND P & I-DRAWINGS)

- All valid general standards and instructions concerning piping designing and building have to be taken into consideration in designing.
- Possible pressure shocks caused by filter operation have to be taken into consideration in designing of piping supports.
- Plastic pipes are not recommended to be used in process lines.

FILTERATE LINE
- In the filtrate line it is recommended to always have a 1/100 declining at the minimum.
- It is not allowed to install extra closing valves in the filtrate line.
- The pipe size of the gravity drain piping must be equal or larger than the associated piping of the filter to eliminate back pressure at the filter. Pipelines should be as short as possible to eliminate back pressure. The maximum length of the filtrate pipe should be approx. 10 m.
- The air release tank is strongly recommended to be installed in the filtrate line, as close to the filter as possible. The air line upwards from the tank should have enough vertical piping (2 - 3 m at least) to optimize the air/liquid separation.
- The filtrate pipe must not be connected to the discharge lines of vat or distribution pipes. In case several filters are installed do not connect filtrate lines from separate filters together prior to air release tank.

SLURRY INFED LINE (Valve V2)
- A separate pumping tank with mixer should always be used in the slurry infed line. The tank must be equipped with a strainer, Φ max. 5 mm, which prevents the access of foreign particles via tank to the filter.
- Filter's operation in cycles should be taken into consideration in designing. Especially in case of slurries with "setting" properties, vertical rises should be prevented. Recycling between tank and filter is sometimes needed.

SLURRY DRAIN LINE (Valve V2)
- In the slurry drain line it is recommended to have a 1/100 declining at the minimum. The recommended maximum length is approx. 10 m.
- The slurry drain line should be directed back to the slurry tank. If the height difference between slurry tank and filter cannot be arranged it is recommended to use a separate tank to which the slurry discharge pipe can be emptied. The connection should be arranged to minimize possible splashing of drainage.

PRESSING WATER LINE (Valve V6)
- The pressing water station should be located at a lower level than the filter. The recommended height difference is 3 - 10 m.
- The pressing water line is recommended to have also manual shutoff valve to ease the adjusting of water pressure.

VAT DRAIN LINES
- In vat drain lines there should always be a 1/100 declining at the minimum.
- VAT drain pipes can be connected together.

CAKE WASHING AND AIR DRYING LINES (Valves V5 & V6)
- In V5 and V6 lines check valves are recommended prior to air and water valves. By installing these valves possible back flow through the air or water supply lines is prevented in case of failure or accidental opening of either valves. The pressure in the slurry feed pipe line can rise up to 16 bar.
- Lines under continuous pressure must also have manual shutoff valves prior to the filter to enable complete isolation of the filter. Easy access to these valves is vital.
- It is recommended to have a strainer, Φ 5 mm, in the lines.
- Slurry feed pipe and slurry hoses are usually flushed with water. Flush water is led into the filter via cake wash water valve V5. Even if there is no cake washing in the program, the water line has always to be connected. Also filtrate can be used as flush water. Flush pressure should be at least 1 bar higher than the slurry infeed pressure.

CLOTH WASHING LINE (Valve V9)
- The pressure in the cloth washing line should be at least 5 bar to ensure the operation of spray nozzles.
- Cloth wash water has a purity requirement. The maximum particle size is 40 mm and the maximum solids content 300 mg/l.
- The connection of cooling water for hydraulic unit can be taken from the cloth washing line, but it must be separate, if the cloth wash water temperature is over +25 °C or the cloth wash liquid is unsuitable for this purpose.
- The maximum temperature of cloth wash water is +60 °C. If there is need to use water with temperature of over +60 °C, the maximum temperature has to be checked case by case.
HYDRAULIC POWER UNIT IS DELIVERED WITHOUT OIL,
- HIGH QUALITY OILS (EQUIVALENT TO THE SAE 15W)
- CLEARANCE 6 (CLASSIFICATION 6 @ 85°C OR CLASS 7 @ 40°C)
- OIL VISCOSITY 66 SST (WHEN AMBIENT TEMPERATURE UNDER 30°C)

THE FILLING UP OF THE HYDRAULIC POWER UNIT:
- WITH PIERCE FILTERING UNIT (CLASSIFICATION 6 @ 85°C OR 6 @ 40°C) THROUGH RETURN LINE FILTERS THROUGH CAP LID FILTERING OR
- WITH FILTERED OIL (CLEARANCE CLASSIFICATION 6 @ 85°C OR)

WEIGHT: 650 kg (without oil), 880 kg with oil

LENGTH OF HYDRAULIC PIPING BETWEEN THE PF-FILTER AND HYDRAULIC UNIT: 10 m
LENGTH OF HYDRAULIC PIPING BETWEEN THE PF-FILTER AND HYDRAULIC UNIT: 15 - 30 m

<table>
<thead>
<tr>
<th>Pipe No.</th>
<th>Thread</th>
<th>Min. Pipe Size (inch)</th>
<th>Min. Pipe Size (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T 1</td>
<td>R 1/4</td>
<td>20 x 2</td>
<td>50.8 x 5.0</td>
</tr>
<tr>
<td>T 1</td>
<td>R 1/2</td>
<td>15 x 1</td>
<td>38.1 x 2.5</td>
</tr>
</tbody>
</table>

In the hydraulic piping between PF-filters and hydraulic unit, it is recommended to use seamless hydraulic tubes.

P 1 Main pressure line
T 1 Main return line
PF 1 Pressure for filter,
valve actuators (connected to hydraulic
The tank for filter valve actuators

K'ENYUKA DRG. No
05120008 8720 07 0010 01
Connections bases to be supported about 0.7 m intervals, fixing clamps to be fitted with the delivered thread bolt to suitable supports.
Recommended location
3-10 m lower level than the filter

NET. VOL.: 1500 L
WEIGHT: 650 kg without water
MOTOR: 11 kW
PUMP: 60 Hz, CR 15-12, 3000 m³/min
TYPE: FF
FLANGES: DIN 2501 (PN 16)
9.7. Electrical drawings
CUSTOMER'S DISTRIBUTION BOARD (CUSTOMER'S MAIN VOLTAGE, 3-PHASE)

550V 50Hz

CUSTOMER

+PF1041+X11-S711

L1, L2, L3, PE

+PF1041+X11-F001

M

+PF1041+X11-F002

M

+PF1041+X11-F004

M

+PF1041+X11-F007

L

MCC

FILTER

-Q001

3~

3-PE

Hydraulic unit motor, 18.5 kW, 1500 rpm
Specified by mechanical designer

-Q002

3~

3-PE

Procing water pump motor, 11 kW, 3000 rpm
Specified by mechanical designer

-Q004

3~

3-PE

Oil heater, 1 kW
Specified by mechanical designer

-Q007

3~

3-PE

Cloth tracking motor, 0.55 kW, 1500 rpm
Specified by electrical designer

-M001

-M002

-M007

1) CABLES IN CUSTOMER'S DELIVERY

1)
OUTER INTERFACE UNIT
PS = LOGIC POWER SUPPLY
CPU = LOGIC CPU
ETH = ETHERNET CARD
DEV = DEVICES CARD
UPS = UPS FOR PLC
SW1 = ETHERNET SWITCH
H1 = ALARM BEACON
H2 = CABIN LIGHT
E1 = SOCKET
C1 = COUNTER
KAI1** = EMERGENCY STOP RELAYS
T1 = POWER SUPPLY 24 VDC
AC.X1 = VOLTAGE SUPPLY 110VAC
AC.X2 = VOLTAGE DISTRIBUTION 110VAC FOR X2
XCR.1 = TERMINALS FOR CUSTOMER MCC
XCR.2 = TERMINALS FOR MCC X11
X8.* = TERMINALS FOR EMERGENCY STOP CIRCUITS
UPS.OUT = UPS POWER SUPPLY TERMINALS FOR PLC
AC.X** = VOLTAGE DISTRIBUTION 110VAC (AUTOMATIC FUSES)
N.11 = NEUTRAL FOR 110VAC
FDCY/F** = VOLTAGE DISTRIBUTION 24VDC (AUTOMATIC FUSES)
DC* = VOLTAGE SUPPLY 24VDC
VDC = TERMINALS FOR 0VDC
I/O MODULES = BUS UNIT AND REMOTE I/O MODULES
PE = POTENTIAL EARTH TERMINALS
S700 = MAIN SWITCH
S701 = EMERGENCY STOP PUSH-BUTTON
S708 = STOP PUSH-BUTTON
S710 = START PUSH-BUTTON
S733 = ALARM RESET PUSH-BUTTON
S755 = HYDRAULIC UNIT MODE SWITCH
S780 = MODE SELECTION (AUTOM. - TEST MODE)

*NOTE : UPS must be rotated to fix in X1, keep free space about 10-15 cm from back and front side of UPS!

PANEL MEASURES : (1000x1800x400) mm + SOCLE (1000x1000x400) mm
MATERIAL : MILD STEEL, RAL9002, IP66

Page description: Control cabin layout, LOG_AB
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9.8. Diagrams