

# Membrane Filter Press PKF 100 NG-2



## Operating Instructions Operation – Maintenance – Repair

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# 1. Foreword

This Operating Manual is to be read very carefully prior to the installation and operation of the filter press. All instructions and directions for installation, operation, inspection and maintenance are to be followed. The manufacturer is not responsible for any damage that may result from failure to follow instructions in the Operating Manual. Such failure by the user releases the manufacturer from his warranty obligations.

Installation, operation, maintenance and repair work on the filter press must be carried out only by qualified personnel.

Warranty claims can only be recognized if all work on the press and all maintenance tasks have been carried out in a technically correct manner.

This Operating Manual belong to the filter press and must always be available to all personnel who are involved in any work on the press.

Warranty claims will be valid only when **original PUTSCH replacement parts, wear parts, filter plates and filter cloths** are used.

The press is used for dewatering of mud suspensions.

This is a fully automatic membrane filter press.

An OP170B controller is standard equipment on the PKF 100-A3-T. If the customer so desires, the filter press can be equipped with another controller.

The filter press is completely assembled by the manufacturer. After assembly a mechanical test run of the press and all its auxiliary units is carried out.

For shipping, some units are removed from the press. These units must be reinstalled on site.

The filter press is approved for an operating pressure of maximum 8 bar / 116 psi and a maximum membrane pressure of 15 bar / 217.5 psi.

All wear-parts and replacement parts are identified by a four-digit position number in the Operating Manual.

When ordering spare parts, please use the Spare Parts Catalog that accompanies the Filter Press. When ordering spare parts, be sure to give all pertinent information referring to the desired parts.

The first two digits identify the assembly and the remaining two digits identify the part number within the assembly.

Position number 04.28, for example, identifies part number 28 on assembly 04.

All position numbers given in the text of the Operating Manual are intended to describe and identify the parts in question. Position numbers in the text of the Operating Manual are identical to the position numbers on drawings and parts lists.

All numerical values given for pressure are gauge pressure. This fact is not specifically mentioned in the manual when a pressure reading is given.

## 2. Safety Regulations

If the filter press and its safety curtains are properly installed, the press itself presents no danger. If, however, leaks occur as a result of faulty installation, hot liquid spray, reaching a temperature of 80 to 90 °C could present a danger. Other dangers can occur as a result of improper installation of the electrical and hydraulic systems. Operating personnel should never reach into areas where moving parts could injure them.

The terms ” **Qualified Personnel**”, ”**Danger**” and ”**Caution**” are used throughout this manual. They are defined as follows:

### Qualified Personnel

Personnel who are familiar with the installation, construction, operation and maintenance of the filter press. In addition, these individuals must possess the following qualifications:

- documented training and authorization to operate the filter press;
- documented training and authorization to operate lifting devices;
- documented training in the use of safety mechanisms and features;
- Documented training in First Aid.



**Information about rules, regulations and prohibitions designed to prevent accidents, serious personal injury and significant equipment damage.**



**Information about rules, regulations and prohibitions designed to prevent less-serious personal injury and equipment damage.**

### General Information about Safety Considerations

The filter press is constructed in accordance with the latest technological design principles and incorporates well-established safety features.

In order to prevent personal injury and damage to the filter press or its auxiliary units, only qualified personnel should operate the filter press.

After installation the filter press is inspected and approved for operation by **PUTSCH personnel**.



Qualified employees of the factory are trained to operate and maintain the filter press.

Qualified plant personnel shall be assigned clearly defined areas of responsibility for the operation, maintenance and repair of the filter press.

Only qualified electricians may work on electrical installations.

Anyone who operates, maintains, services or repairs the filter press must read the Operating Manual before assuming his duties.

**Pay attention to safety notifications and warnings that are stated in the Operating Manual or attached to the filter press.**

Only **PUTSCH original parts** are to be used as replacement parts.

Do not make any changes in the filter press, which could adversely affect safety, without consulting the manufacturer.

The manufacturer does not accept responsibility for personal injury or for damage to the Filter Press or any other equipment that results from unauthorized changes made on the press itself or on its auxiliary equipment.

## **Appropriate Use**

The filter press is to be used exclusively for the filtration of suspensions. Any other use is inappropriate. The manufacturer is not responsible for any losses incurred as a result of inappropriate use.

## **Normal Operation**

Prior to starting the filter press, all connections on auxiliary units, pipes and valves, as well as the filter press itself must be inspected for leaks.

The filter press may only be operated when all safety devices are installed and operational. Prior to start-up, make certain, that no one can be endangered by the filter press as it begins to operate.

At least once per shift the station must be inspected for externally visible damage, defects and leaks. Any changes should be reported to a supervisor immediately.

Whenever maintenance and repair work is performed on the filter press, the manual valves are to be closed in order to prevent suspension from spraying out as a result of the accidental opening of an automatic valve.



Under no circumstances may the plate package in the filter press be opened during filtration. The spray curtains must be closed.

#### **Danger of injury by hot liquid spray.**

The membrane filter plates may only be subjected to membrane water when the filter press is closed and the filter chambers are sufficiently filled with filter cake.

#### **Danger of injury as the result of exploding membranes.**

**Under no circumstances may filtration pressure exceed 8 bar / 116 psi.**

**Under no circumstances can the membrane pressure exceed 15,5 bar / 225 psi.**

#### **Danger of injury by hot liquid spray.**

It is strictly forbidden to stay in the danger zone between the filter press and the safety curtains.

#### **Danger of crushing injury.**

#### **Caution in the vicinity of the membrane plates!**

Membrane water - pressure must be below 0.14 bar / 2 psi when the plate package is opened. At higher pressure the membranes can be over-stretched or they can burst.

### **Maintenance and Repair**

If it is necessary to remove safety devices in order to change filter cloths, perform maintenance or to carry out repairs on the filter press, the safety devices **must be reinstalled and tested** immediately following completion of the work.

Filter press operators are to be given timely notification when maintenance and repair work is to be carried out.

#### **Warning signs must be posted!**

The instructions and directions given in the Operating Manual are to be followed whenever work is performed on the filter press. This applies to all aspects of operation, adjustment, production-adaptation, maintenance, servicing, repair work and work on the electrical circuitry.

When maintenance or repair work is performed, The filter press or the entire station is shut down. After a shutdown, steps must be taken to prevent an unexpected start-up:

- Turn main switch (501) to "0".
- Put lockout device on.
- Post warning signs.

When Individual parts and larger assemblies are replaced, they are to be carefully and safely moved by the lifting device. The lifting device must be suitable for the task and must be in excellent operating condition.

**Do not stand or work under suspended loads.**

When performing work on the press that is above head level, use only stable steps, scaffolds and ladders.

When performing maintenance or repair work, do not step on the chute covers.

**Electrical System**

The electrical system is to be inspected and maintained at regular intervals according to VDE and UVV. Any problems that are discovered should be dealt with immediately.

If problems develop in the power delivery system, shut down the filter press immediately.

If a regulation or directive exists, that requires a machine or unit to be disconnected from its power source prior to inspection, maintenance or repair work, such instructions must be followed. Furthermore, the machines or units must be tested for the presence of electrical current before the work can begin.

If it is necessary to work on an electrified part, a second qualified person must be present on site in order that he can activate **the emergency-off switch or the main switch** in an emergency situation. In addition, the work area is to be cordoned off by means of a red and white security chain and surrounded by warning signs. (Colours of security cordon may differ by country.) Only insulated tools may be used.

**Pneumatic and Hydraulic Systems**

Regularly inspect pipes, hoses and connections for leaks and damage.

Release pressure on pressure lines before making repairs.

**Danger of injury by hydraulic fluid spray and uncontrolled machine movement.**

**Hydraulic fluid spray can cause fires.**

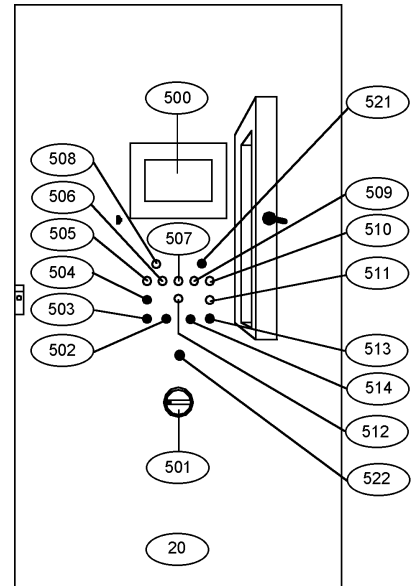


Figure 1

### 3. Construction and Description of the Filter Press

The membrane filter press is horizontally mounted and operates fully automatically. It removes solids from suspension and produces a washed and dried filter cake in the form.

#### 3.1. Description of the Components

All components of the filter press, including the control system, the hydraulic system and the washing machine are mounted as assemblies (01 to 37) on a main frame and, for the most part, are covered by safety covers and curtains.

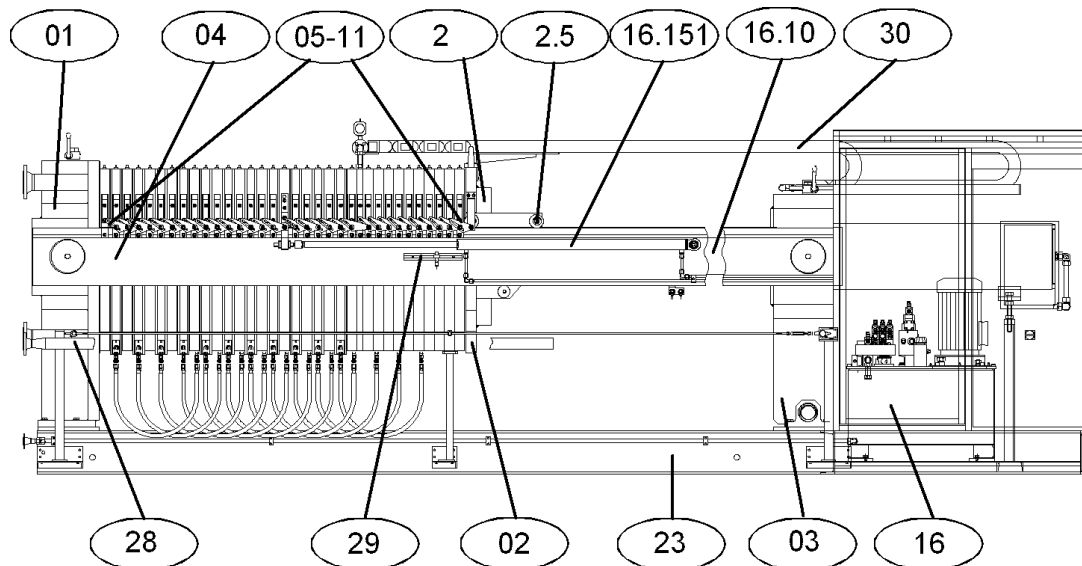


Figure 2 PKF, Front View

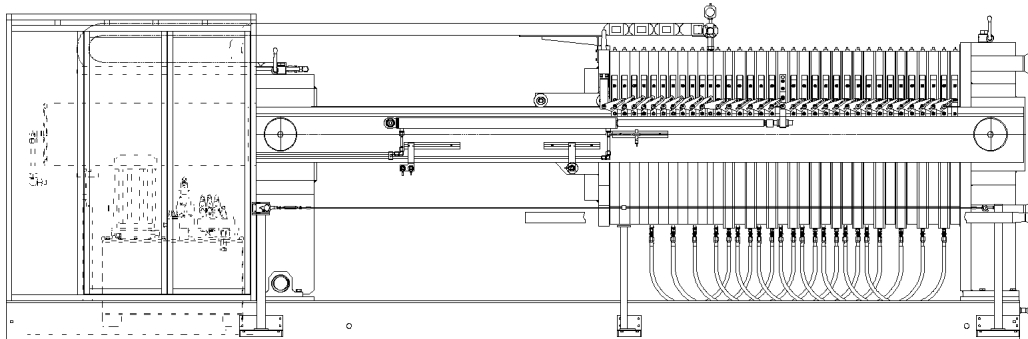


Figure 3 PKF, Rear View

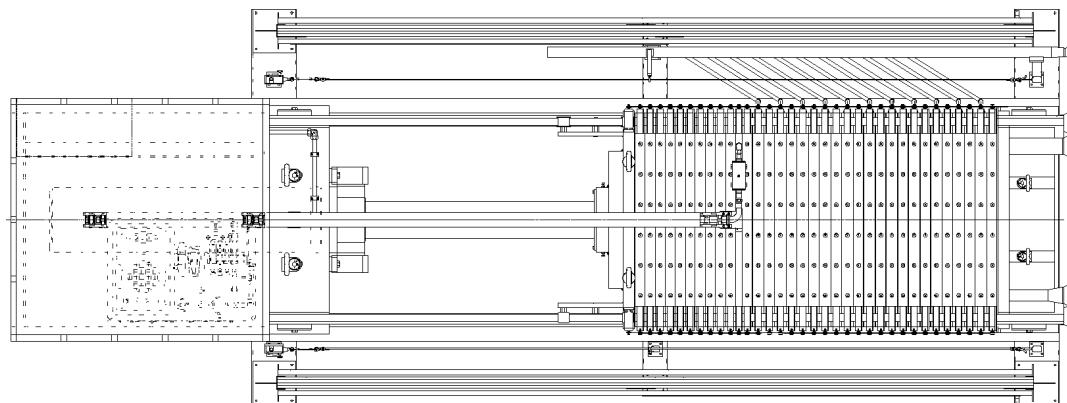


Figure 4 PKF, Top View

### 3.1.1. Main Frame

The head piece (01), the movable traverse (03), the hydraulic unit (16), the chute covers (22) and the control cabinet (20) are mounted on the main frame (23).

The Squeeze water manifold (28), the lanyard emergency switch and the safety curtains are mounted alongside the filter press support frame.

### 3.1.2. Head Piece

The head piece (01) is firmly bolted to the main frame (23). There are two bolts (01.28) on the headpiece, to which the two crossbeams (04) are fastened. Also on the head piece are flanges for suspension (41), filtrate from the membrane plates (42, 44), filtrate from the pressure plates (43) and compressed air for drying filter cake (44).

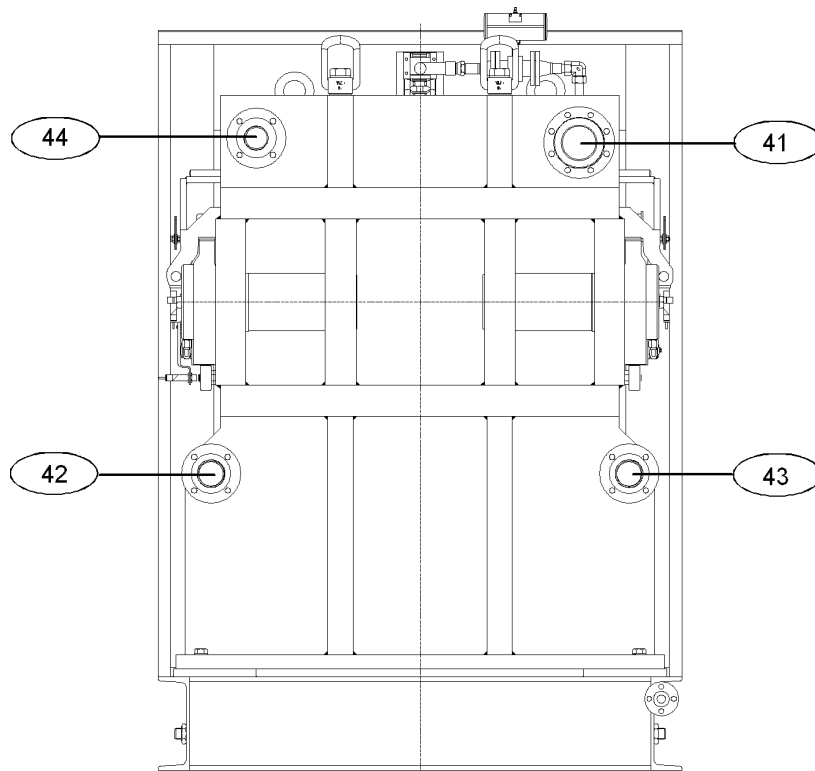


Fig. 5

### 3.1.3. Traverse

The movable traverse (03) is located on the side opposite the headpiece.

There are two bolts (01.28) on the sides of the traverse, to which the two crossbeams (04) are attached.

The traverse (03) is bolted to the main frame by means of two swivel-bushings (03.16). These bushings permit the traverse to move slightly in order to compensate for the differing longitudinal expansion rates of the main frame and the crossbeams.

A hydraulic cylinder (16.10) is built into the traverse. The filter plate package is closed by this cylinder, which can develop closing pressures up to 240 bar / 3481 psi.

The maximum pressure of 280 bar (4060 psi) should not be exceeded.

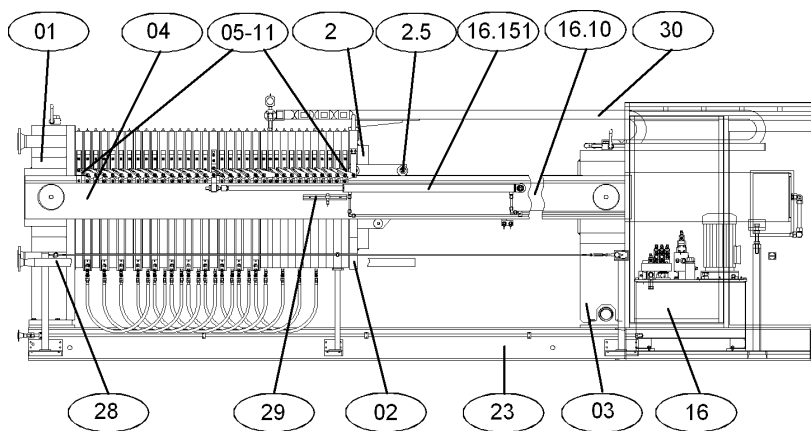


Fig. 6

### 3.1.4. End Piece

The end piece (02) transfers the closing force of the hydraulic cylinder (16.10) to the plate package (05 to 11).

On each side of the end piece there is a set of rollers (02.55). The rollers allow the end piece to move back and forth on the crossbeams (04).

The filter plates are pushed together between the end piece (02) and the head piece (01).

### 3.1.5. Crossbeams

The pressing device (16) and the head piece (01) are coupled by means of the crossbeams (04). They also support the plate package (05 to 11) and the movable end piece (02). In addition, the plate transport cylinders (16.151) are attached to the sides of the crossbeams.

### 3.1.6. Plate Package

The press will be delivered with a plate package consisting of 22 chambers. If necessary it can be expanded to 32 chambers. The chambers are divided into 2 blocks.

The 1. block consists of between 6 and 16 chambers.

The 2. block consists of 16 chambers.

In 5 steps the chamber number can be increased to 32 chambers: 22-24-26-28-30-32. This entails moving the end plate with the blind plate to the desired position. The pressure plate located in front of the end plate must be replaced with a membrane plate. The maximum number of chambers in each block is 16.

All filter plates are made of polypropylene. All descriptions of connections, openings, handles and other parts are given from the viewpoint of an observer standing at the headpiece and looking toward the end piece. One exception to this rule is the head plate, which is observed and described from the inside of the press.

A handle is bolted onto each side of the filter plate (06.01, 06.03). The filter plates are hung by these handles between the two crossbeams (04). The handles differ by the way they glide on the crossbeams. Handle (06.01) on the operating side (suspension inlet side) of the press glides firmly on the crossbeam; handle (06.03) on the backside glides loosely.

Each handle is also bolted to the linking pieces of the plate-transport system (17).

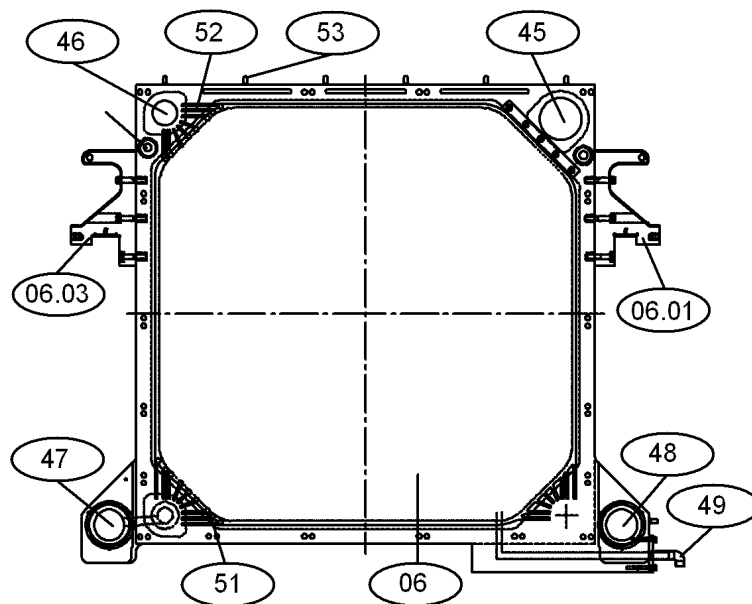


Fig. 7



### 3.1.6.1. Membrane Plate

The main components of the membrane plates (24) are: membrane frame (24.1), 2 exchangeable membranes (24.0) and 2 handles (06.01) (06.03).

There are openings in the frames for suspension (45), air for blow drying (46), filtrate from the membrane plates (47), filtrate from the pressure plates (48) and for water for membrane plates (49).

When the membrane plate and pressure plate create a chamber, an indentation in the pressure plate forms an inlet to allow the suspension to flow into the chamber (50). The filtrate runs out at the top and the bottom through openings (51) on both sides of the filter plate. Opening (52) allows compressed air into the filter chamber for blow drying the filter cake.

On the top of the filter frames there are cloth attachment pins (53) to which the filter cloths (25) are fastened. The pins securing the cloths to the membrane plates are blue (06), the pins securing the cloths to the pressure plates are red (07) to differentiate the membrane plates (06) from the pressure plates (07).

In order to form seals between the filter plates, sealing rings (06.29) (06.30) are installed on both sides of the membrane plates in the openings for filtrate from the membrane plates (47), filtrate from the pressure plates (48).

Instructions for changing membranes can be found in the appendix.

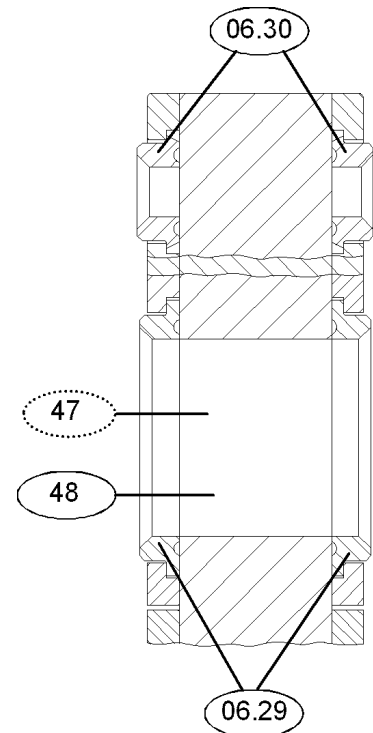


Fig. 10

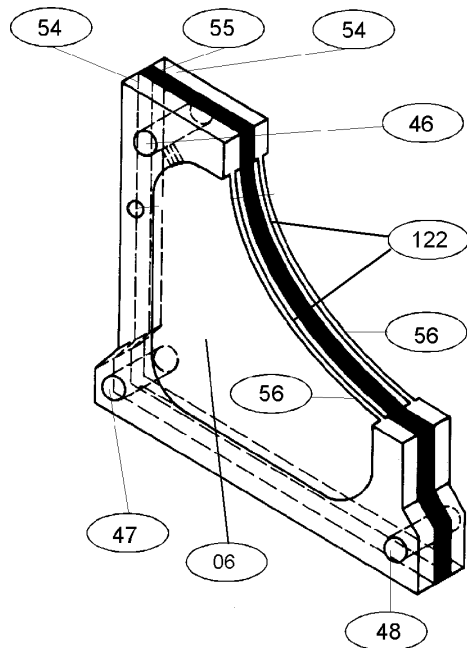


Fig. 8

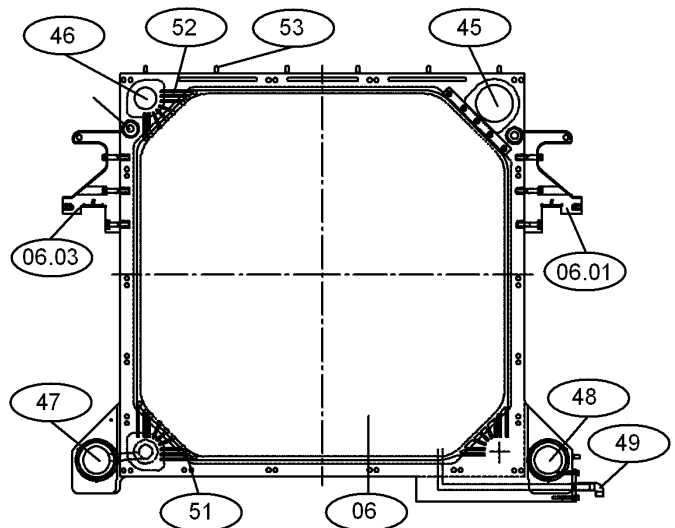


Fig. 9

### 3.1.6.2. Pressure Plate

The pressure plate (07) consists of a massive plate with grooves on both sides, which determine the depth of the chamber. The inner surfaces are covered with nubs to guarantee good filtrate removal.

There are openings in the frames for suspension (59), filtrate from the membrane plates (61), and filtrate from the pressure plates (62).

Suspension is delivered into the filter chambers through grooves in both sides of the frame (64). Filtrate flows out at the top and the bottom through openings on both sides of the filter plate (65).

Red cloth holding pins (66) are on top of the filter plate frame. The filter cloths are secured on these.

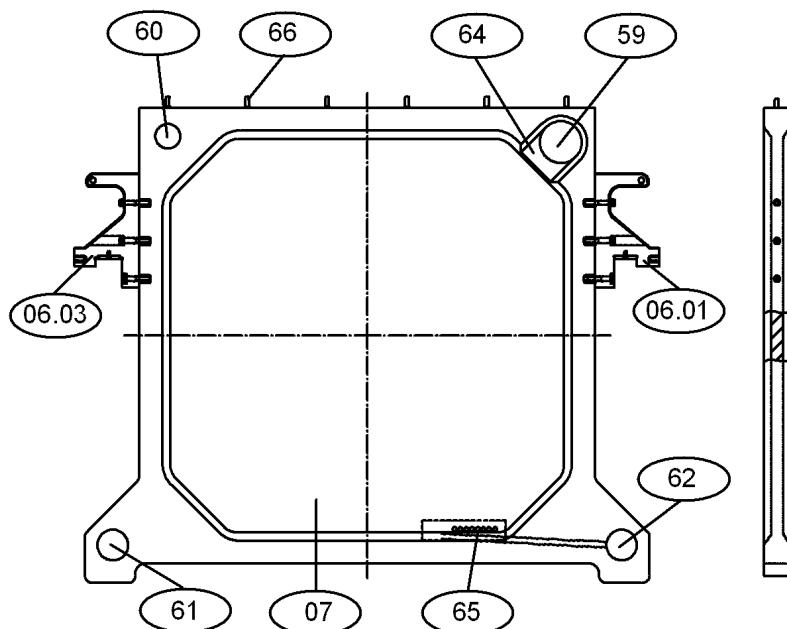


Fig. 11

### 3.1.6.3. Head Plate

The head plate (08) is a solid plate with a groove on the inside only. The outside of the head plate is smooth and serves as mounting surface for the head piece. There are openings in the frame for suspension (67), filtrate from the membrane plates (69), and filtrate from the pressure plates (70).

With its outside against the headpiece (01), the head plate is bolted to the headpiece through boltholes (72). Sealing rings (73) are installed in the positions (73, 74, 75) located on the outside of the head plate.

Suspension is delivered into the filter chamber through a slot (76) (groove in the frame). Filtrate flows out at the top and the bottom through boreholes (77) in the filter plate.

The head plate hangs between the two crossbeams (04) by its handles (06.01, 06.03) and is firmly bolted to the head piece (01). Each handle is also connected to the linking pieces of the plate-transport system (17) (see Fig. 20).

On top of the head piece (08) are black cloths holding pins (78). To secure the filter cloth, there are eyelets (08.18) on both sides, as well as below.

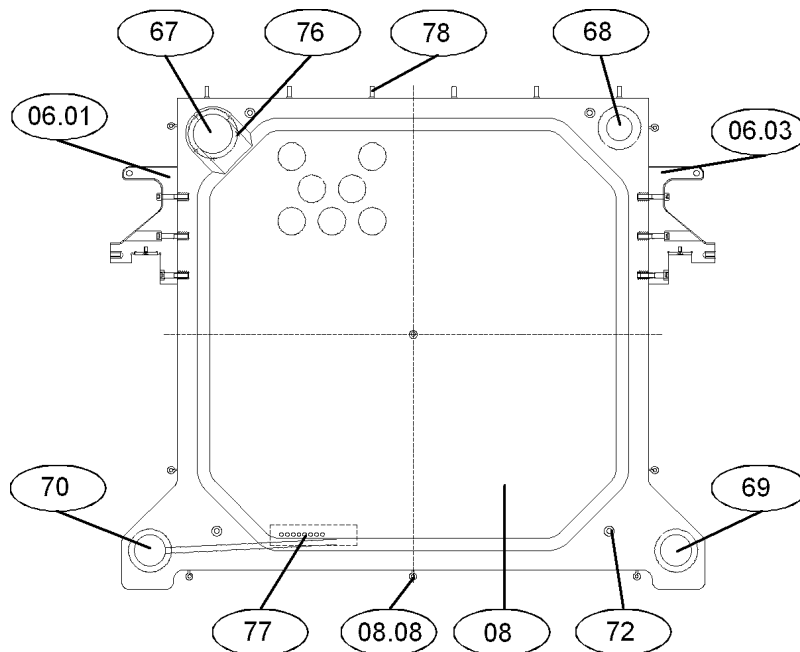


Fig. 13

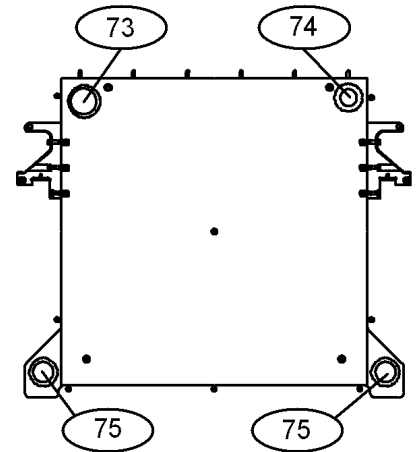


Fig. 12

### 3.1.6.4. End Plate

The end plate (09) consists of a solid plate, which has a groove on the inside only. The outside of the end plate serves as a connecting surface for the head piece. There are openings in the frame for suspension (79), and filtrate (80).

With its smooth side positioned against the end piece (02), the end plate is bolted to the end piece (81). Sealing rings are installed in positions (82, 128) on the back side of the end plate.

The suspension flows into the filter chamber through an indentation in the frame (84).

The wash-filtrate from filter cake washing is discharged through holes (85).

Compressed air for emptying the mud channel is injected through hole (128).

Handle (06.01, 06.03) are attached to either side of the end plate (09).

The end plate hangs between the crossbeams (04) by these handles (06.01, 06.03) and is bolted to the end piece (81).

On top of the end plate (09) are black cloth holding pins (86) and on both sides, as well as below, are eyelets (08.08) for securing the filter cloth.

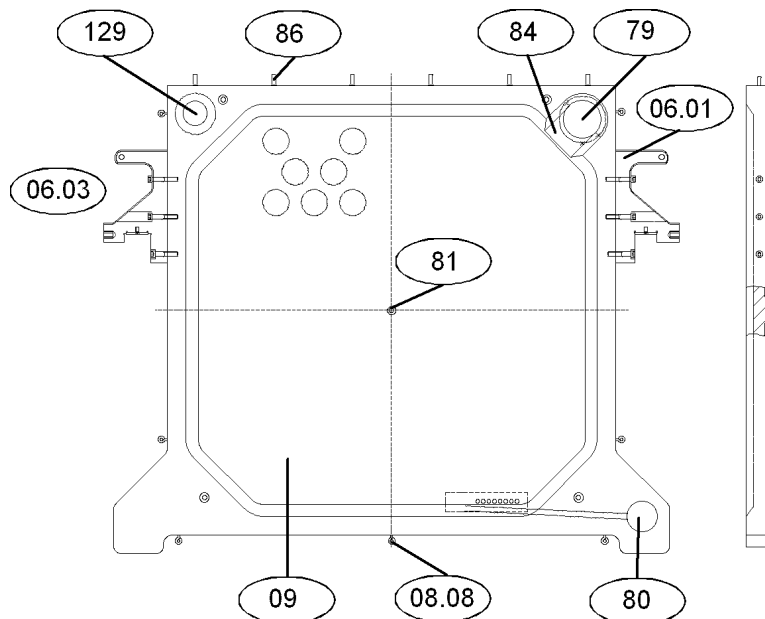


Fig. 14

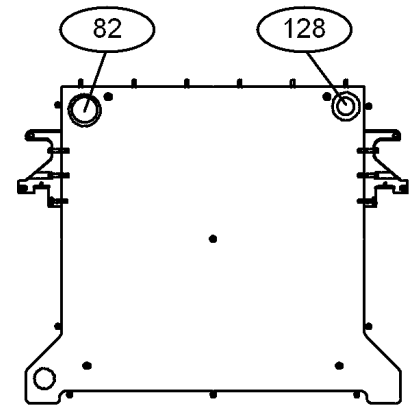


Fig. 14.1

### 3.1.6.5. Movement of Plates

In order to empty the filter chambers it is necessary to move the filter plates and the end piece (02) horizontally on the crossbeams (04). The 1. and 2. block are always opened separately.

In order to empty the first block (106), (at the end piece), the second block (107) must first be locked in its basic position by means of two hydraulic cylinders (16.151), which are located on both sides of the crossbeams. Next, the hydraulically controlled closing cylinder (16.10) pulls the end piece (02) and the attached end plate (09) away from the plate package and opens the first block.

The filter plates are connected to one another by means of metal linking pieces (17). The linking pieces are connected to the end piece (02) and the head piece (01).

All filter plates are fastened to each other with metal linking pieces (17). The metal linking pieces are connected to the end piece (02).

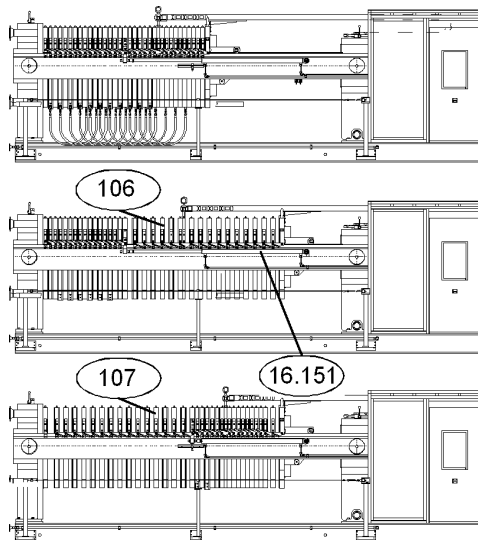


Fig. 19

When the plate package is opened further, the filter plates are pulled away from the package one after the other so that the filter chambers are emptied.

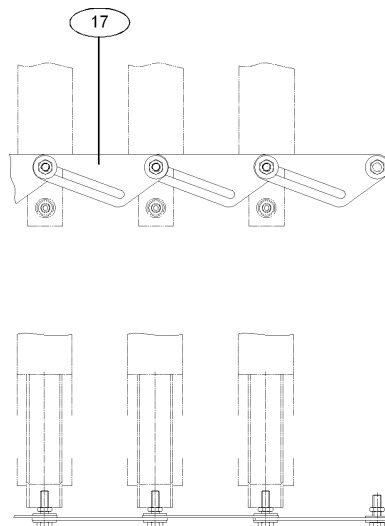


Fig. 20

When all filter chambers in the first block (106) have been opened and emptied, the filter plates in the second block (107) are opened by the cylinder. At the same time the filter plates in the first block are pushed together again.

Finally, both blocks are closed again. A hydraulic diagram is included among the enclosures.

### 3.1.7. Filter Cloths

Different kinds and grades of filter cloths (25) are mounted on the filter plates. They are clearly marked on one side with an unmistakable identifying code.

#### 3.1.7.1. Filter Cloths for Membrane Plates

The filter cloths (double cloths) for membrane plates (25.02) have identifying numbers 7 D 52/66 Q 45 .

A filter cloth consists of two pieces, which are connected to one another by a neck piece (93) in the area of the suspension opening. There is only one way to attach the filter cloth to the membrane plate (06). One half of the filter cloth must be folded, rolled up, pushed through the hole for the suspension channel (45) and then unrolled on the other side of the membrane plate. Then the openings (94) in the upper edge of the filter cloth are lined up with the cloth attachment pins (53) on the plate. Finally, the two parts of the filter cloth are smoothed out, stretched over the filter plate and fastened in place by means of Velcro fasteners (95).

The filter cloth are fastened on the bottom by velcro straps.

To prevent the filter cloth from sliding off the cloth holding pins, rubber washers are pressed onto the pins.

After dressing the plate with the cloth, check to make sure that the opening for air drying (96) lines up with hole in the filter plate (06).

To assure a good seal, a thin coat of sealing agent must be spread on the inside edges of the filter cloth (98).

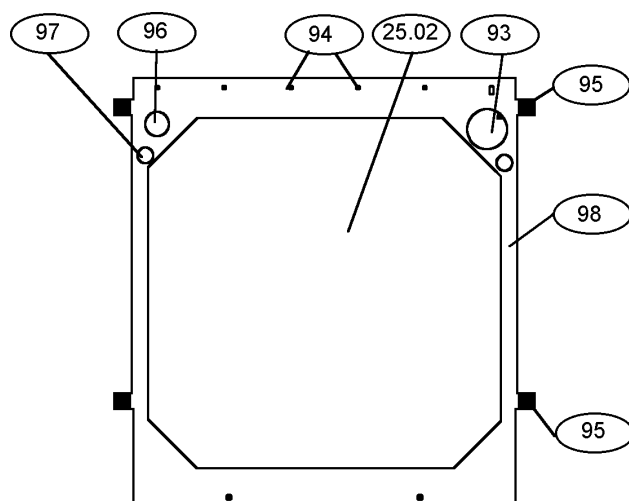


Fig. 16

### 3.1.7.2. Upper Cloths for Pressure Plates

The upper cloths for pressure plates (25.03) have the identifying number 7D 46/54 Q.45 . **They are not to be confused with the upper cloths of the membrane plates.** All edges of the upper cloth are covered on the inside to insure a good seal.

Instructions for dressing and checking refer to section 3.1.7.2.

### 3.1.7.3. Filter Cloth for Head Plate

The head plate filter cloth (25.04) for the head plate (08) has the identifying number 7 K Q.45 .

All edges of the side of the upper-cloth facing the head plate are coated. Then both cloths are firmly sewn together to constitute the head plate filter cloth (25.04).

The head plate filter cloth has openings (101) in the top, which allow it to be attached to the cloth attachment pins (78) on the head plate (08).

On the other three sides, the head plate filter cloth is attached to the head plate by tie wraps and eyes (08.10) in the head plate.

Then the head plate filter cloth is attached to the head plate by means of a metal plate (08.10), which surrounds the opening of the suspension channel (102). (At this stage the filter cloth covers the opening of the suspension channel.)

Finally, a hole is cut in the head plate filter cloth using the hole in the metal fastening plate (08.10) as a template. (The edges of the hole are smoothed off with a soldering iron).

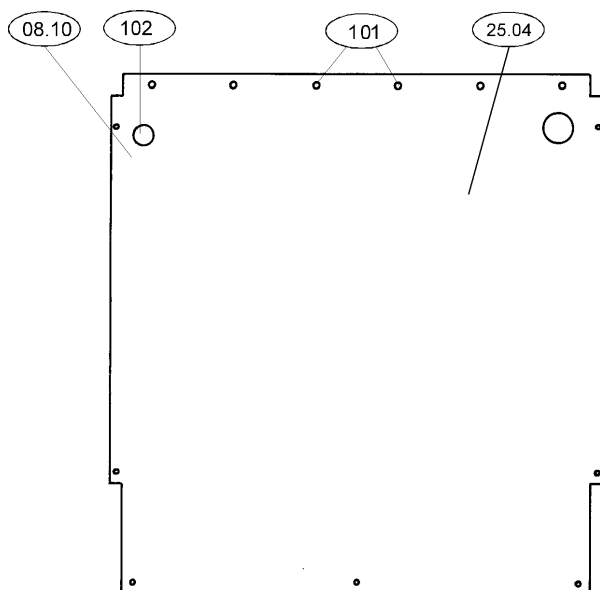


Fig. 17

### 3.1.7.4. Filter Cloth for End Plate

The end plate filter cloth (25.05) for the end plate (09) has identifying numbers 7 EQ 45 .

The end plate filter cloth is installed and attached in exactly the same manner as the head plate filter cloth. The two filter cloths differ from one another only in that their openings and openings for suspension (103) and air for dry blowing (99) for attachment to frames (104) are the exact mirror image of one another.

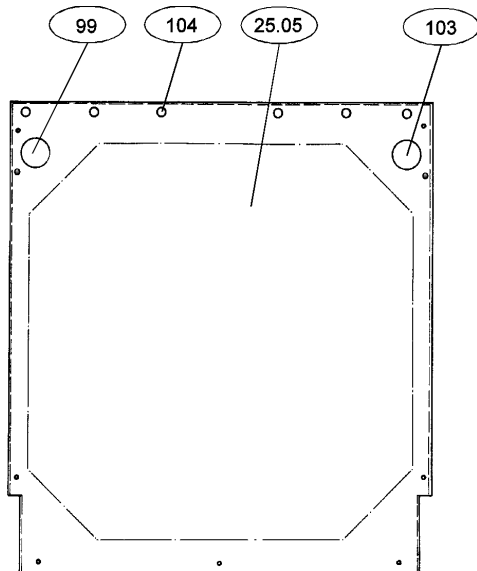


Fig. 18



### 3.1.8. Chute Covers

Two-chute covers (22) are installed on the main frame (23). Two hydraulic cylinders (22.65), one at each end, open the chute covers through which the filter cake falls into the collecting bin.

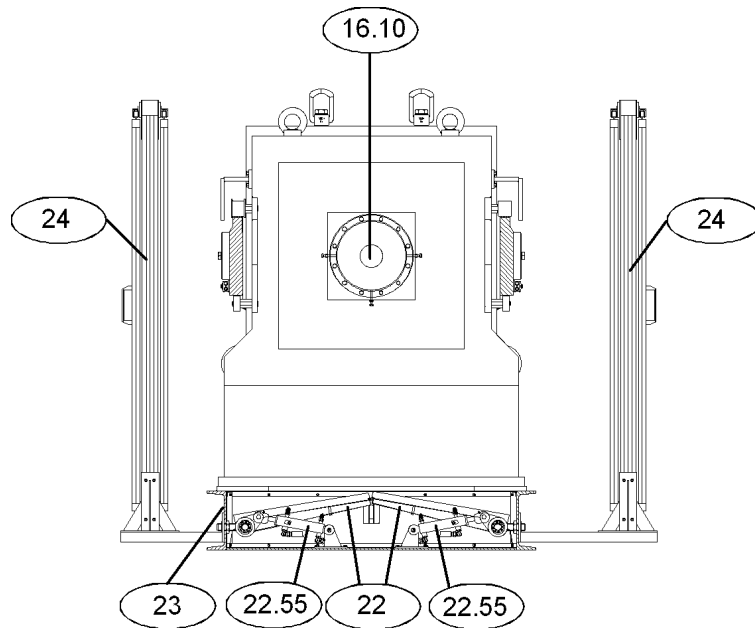


Fig. 22

### 3.1.9. Hydraulic System

Inside the filter press is a hydraulic aggregate (16.19) for the hydraulic drive of the main cylinder (16.10), the hydraulic cylinder for the chute covers (22.65) and the hydraulic cylinder for the plate transport (16.151).

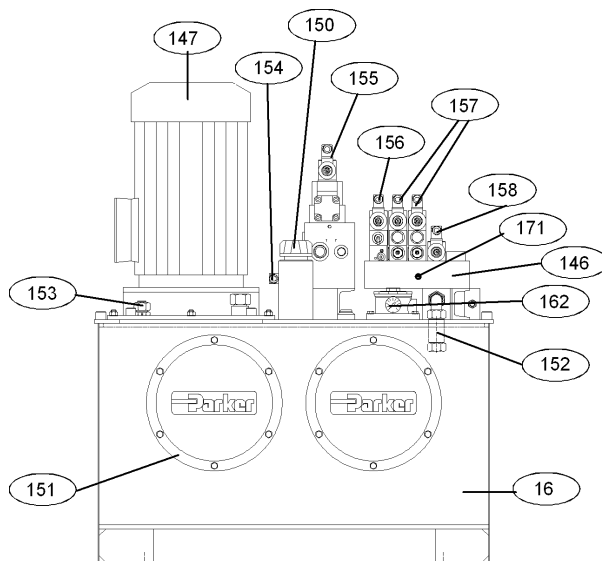


Fig. 23

### 3.1.10. Control Cabinet

The control cabinet (20) is mounted on the main frame (23) of the filter press. It houses the electrical control system. The control for the hydraulic pump is located in the MSR-room.

### 3.1.11. Safety Curtains

On each side of the filter press there is a double rail system from which 2 safety curtains (24) are hung. They are attached to rollers, which move on the rails, so that they can be opened and closed easily.

The safety curtains are equipped with safety switches (24.U2, Abb. 44). These safety switches ensure that the filter press can be started up only when the safety curtains are closed properly and that operation is interrupted when they are opened.

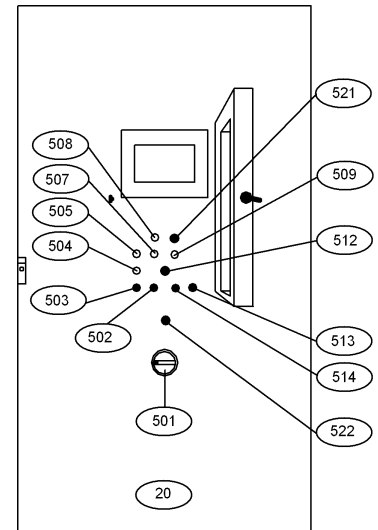


Fig. 24

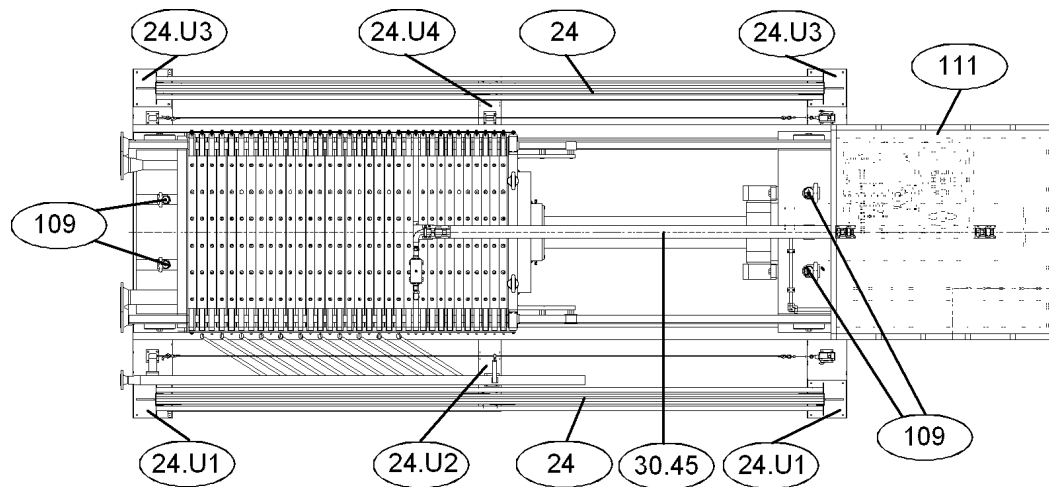


Fig. 26

In addition to providing protection against hot liquid spray, the safety curtains also prevent machine operators from coming into contact with moving parts of the filter press.

### 3.1.12. Squeeze water manifold

In order to exert squeeze pressure, the membrane filter plates (06) are pressurized with water. Each membrane filter plate (06) is connected to the squeeze manifold (112) via hoses with quick connect couplings (110). Each hose connection is provided with a check valve. The check valve is integrated in the quick connect at the squeeze manifold. This allows disconnecting an individual hose (110) from the squeeze manifold without losing squeeze pressure.

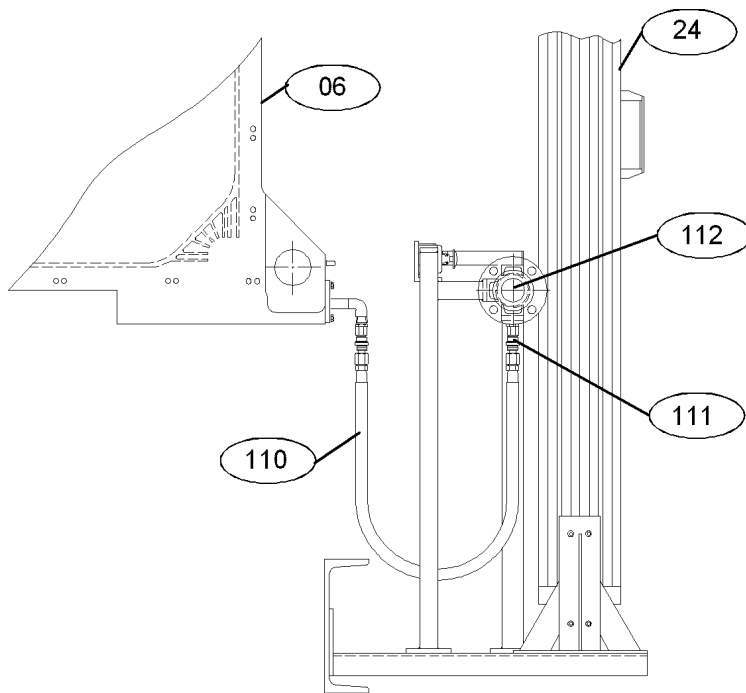


Fig. 27

## 3.2. Technical Data



Type	Model 100 NG-2
Filter Surface Area (m <sup>2</sup> )	538-782
Plate Size (mm)	1,200 x 1,200
Chamber Volume (l)	38-55
Chamber Depth (in)	1.63
Plate Material	PP
Number of Chambers	22-32
Maximum Allowable Membrane pressure bar (psi)	15,5 (225)
<b>Measurements</b>	
Total Length (mm)	7.400
Approximate Total Width with Safety Protectors (mm)	2.740
Approximate Total Height including Main Frame and Washing Machine (mm)	2.445
<b>Weights</b>	
Approximate Empty Weight, with AWM (kg)	18.500
Approximate Operating Weight (kg)	20.000
Approximate Weight of One Filter Plate with Handles (kg)	65
<b>Electrical and Pressure Data</b>	
Electrical connection (VAC/Hz)	120/60
DC Control Voltage (V)	24
Connected power (kVA)	1.5

### 3.3. Operation outline of the process

The filter press operates as a batch type membrane press.

One filter cycle consists of:

- Closing the press (40 bar (580 psi)) hydraulic pressure
- Filling and filtration,
- pressing and coreblowing of the filter cake.
- Emptying and drying of the mud channel,
- Pressure release in the membrane plates,
- Reversing pressure in main cylinder, opening press
- Cake discharge,
- Closing filter press (40 bar / 580 psi) hydraulic pressure

Identification of valves are shown on the attached flow-chart.

#### 3.3.1. Operation of filter press

The closed filter press fills with suspension through line (41). Filtration starts as soon as the set amount of suspension has entered the press. Filtrate exits the membrane plates via line (42) and the pressure plates via line (43). After filtration press water is introduced into the membrane plates to press the filter cake. The press water pressure is increase continuously in a pre-set time span.

After the pre-set time for pressing has elapsed, compressed air for cake drying enters the filter chambers through line (44). When the cake has been dried, valves 02152 HV and 02158 HV open and compressed air displaces the liquid and cleans the mud channel (93).

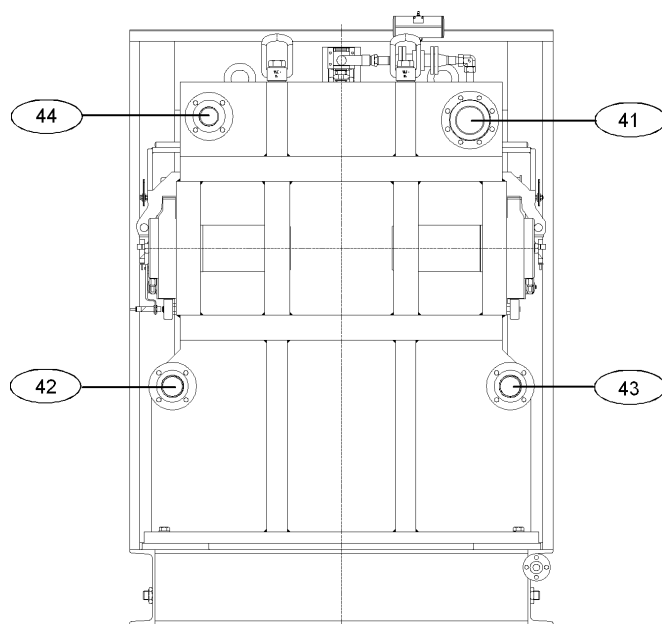


Fig. 30

The membrane plates are then depressurized and the hydraulic pressure in the main cylinder is released. The automatic plate transport opens the filter chambers allowing the cake to be discharged into the cake transport system.

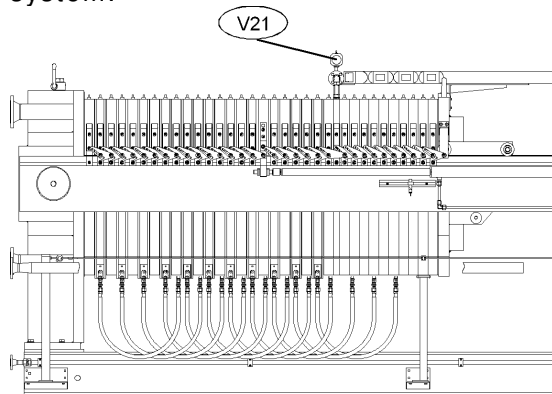


Fig. 31

### 3.3.2. Filling of filter press

Valve 02153 HV (V8) opens allowing suspension to fill the chambers through inlet 41 (Fig. 30). The membranes are depressurized during filling and valve 02160 HV (V24) (44, airtating during filling, Fig. 30) is open. Valves 02155 HV (V6) (43, filtrate pressure plates, Fig. 30) and 01257 HV (V7) (42, filtrate membrane plates, Fig. 30) are closed.

### 3.3.3. Filtration

During filtration the filtrate discharges via valve 02155 HV (V6) (43, filtrate pressure plates, Fig. 30) and 01257 HV (V7) (42, filtrate membrane plates, Fig. 30). Filter cake builds up inside the chambers. Care should be taken that the chambers are filled evenly and sufficiently. The filter cake volume should have at least 70% of the chamber volume.

At the end of filtration valve 02153 HV (V8) (41, inlet suspension, Fig. 30) closes.

### 3.3.4. Cake pressing

The filter cake is dewatered by membrane pressure. Valves 02155 HV (V6), 01257 HV (V7) and 02160 HV (V24) open, to allow liquid to run off. Valve 02215 HV (V13) (pressure release membranes) closes and the pump for press water starts.

Depending on the time span set, the pressure in the space (122) between the membrane plates (06) is slowly increased causing the filter cake in the chamber to be pressed against the pressure plate. At the same time the pressure in the main cylinder is increased to insure proper sealing of the plate package. After the set time has elapsed, cake pressing ends. Valve 01257 HV (V7) and 02160 HV (V24) are closed.

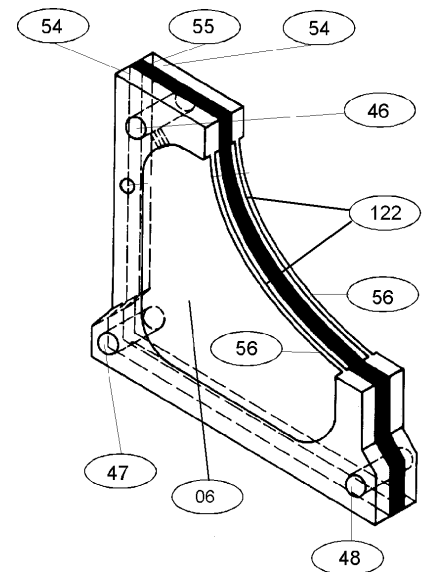


Fig.. 52

### 3.3.5. Filter cake drying

This step describes cake drying with compressed air. Valve 02159 HV (V12) opens. The air enters through hole (52) on top of the filter chamber and flows evenly through the filter cake. The air escapes through hole (65) in the pressure plate and the opened valve 02155 HV (V6). During drying the pressure on the membrane plates must be higher than the pressure used for cake drying. After the set time has elapsed, valve 02159 HV (V12) and 02155 HV (V6) are closed and cake drying ends.

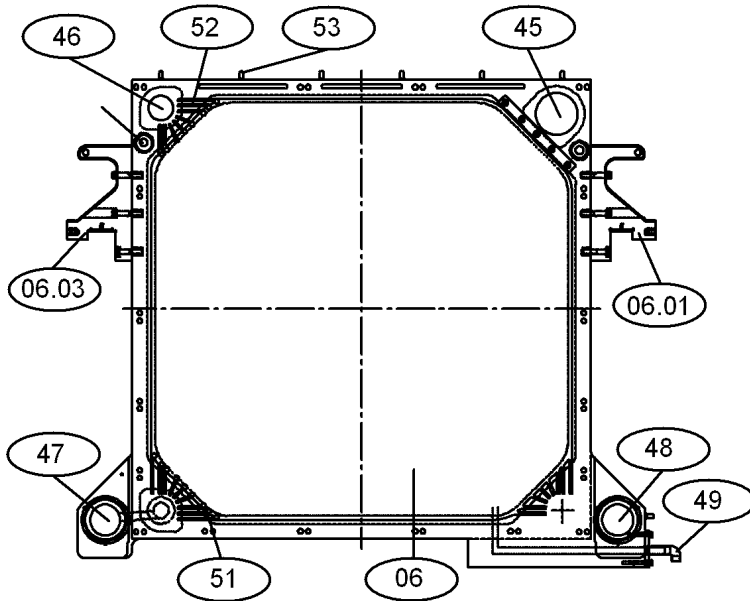


Fig. 9

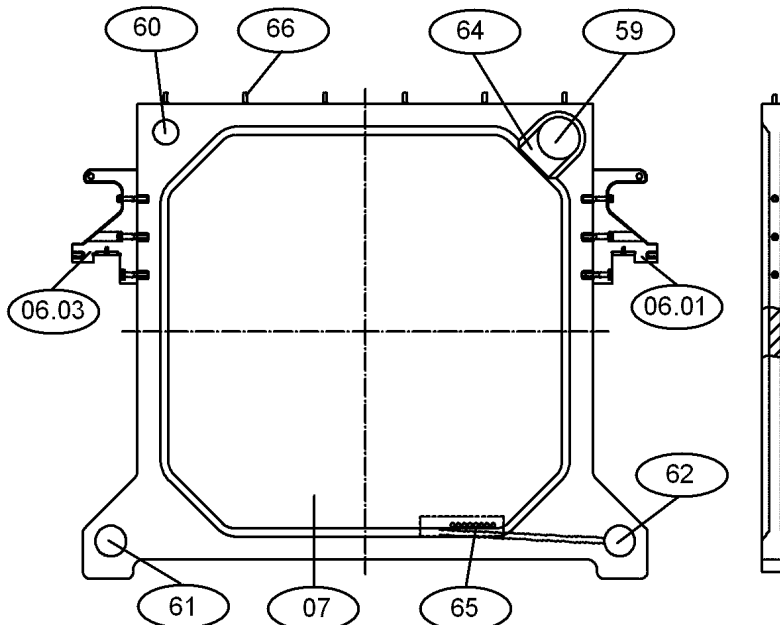


Fig. 11

### 3.3.6. Emptying and drying of mud channel

Left over suspension in the mud channel is removed and at the same time the mud channel is dried.

Ventile 02158 HV (V19) (outlet channel cleaning) and 02152 HV (V21) (mud channel emptying) are opened. Compressed air flows through the mud channel in the opposite direction, i.e. in the same direction as used during filling of the chambers.

Air enters the mud channel via valve 02152 HV (V21) and exits through valve 02158 HV (V19).

After the set time elapses valve 02152 HV (V21) closes and valves 02155 HV (V6), 01257 HV (V7) and 02160 HV (V24) open to aerate the plate package.

The press water pump stops and the used press water is drained of from the membrane spaces. With the membrane pump a vacuum is created in the intermediate space. The membranes are retracted back to the membrane frame which opens the chamber completely. The hydraulic pressure on the main cylinder is slowly released.

### 3.3.7. Emptying filter press

The automatic plate transport opens the filter chambers allowing the cake to be discharged into the cake transport system.

After the main cylinder pressure (16.10) returns to 40 bar (580 psi) the end piece is pulled from the plate package. This opens the filter chambers in the first block one by one and discharges the filter cake into the cake transport system.

The two transport cylinder (16.151.Fig.2) hold the second block (107, Fig. 55, center) securely against the head piece.

When the transport cylinders (Fig. 55, bottom) retract, the second block opens and the filter cake is discharged into the cake transport system. At the same time the first block closes.

After the press is completely empty, the entire plate package closes with a pressure of 40 bar (580 psi) (Fig. 55, top).

When all starting requirements are met, the next filter cycle starts.

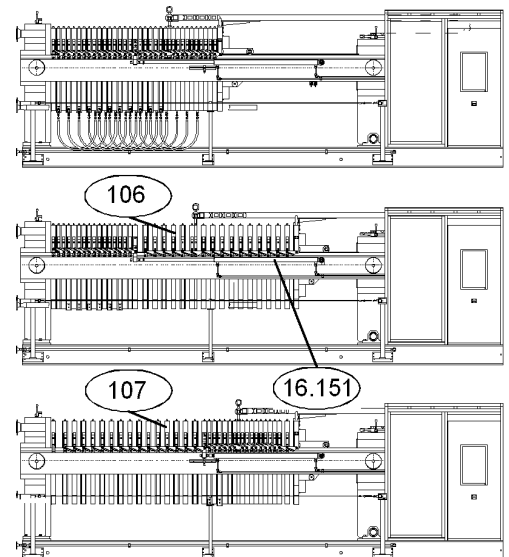


Fig. 55



## 4. Shipping and Installation of the Filter Press

### 4.1. Shipping

Proper transport, weights and lifting points (109) are shown in transport drawing Sk 5-15319B.

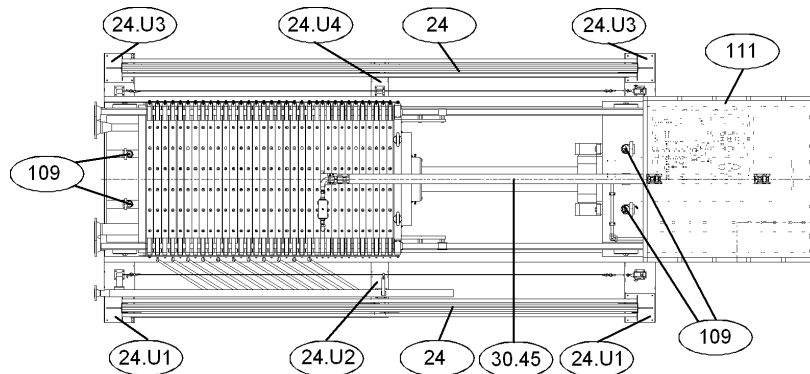


Fig. 32

### 4.2. Installation

An installation plan is delivered with the filter press. The press is mounted on a frame, which corresponds to the dimensions of the press frame (See drawing "Support for PKF Main Frame" in the Appendix). The filter press must be aligned horizontally to the filter cake-collecting bin. A hose-leveling instrument should be used to level the filter press. The instrument should be placed on the glide-surfaces of the cross beams. Diagonal and parallel measurements are to be taken. The tolerance for all measurements is 0 +/- 1 mm. The installation of the filter press and the parts that are delivered with it should be carried out, whenever possible, under the supervision of PUTSCH personnel.

### 4.3. Connecting Pipes and Valves

A flow chart showing the routes of pipes and tubes is delivered with the filter press. It shows how to connect the pipes and identifies the size of automatic valves as well as the dimensions of the pipes.

Care should be taken that the valves are properly installed.

Welding should not be performed when valves are installed.

Valves must open and close slowly to prevent hammering in the pipe system.

**Before working on pipe systems and valves, the pipes must be emptied and free of pressure. Piping supervisor must give premission for work to commence.**

## 4.4. Connections on the Head Piece and on Blind Plate

### 4.4.1. Connections on the Head Piece

The following connections are located on the head piece: DN 150 for suspension (41), DN 125 for filtrate from the pressure plates (43), DN 125 for filtrate from the membrane plates, (42) and DN 100 compressed air for blow drying (44).

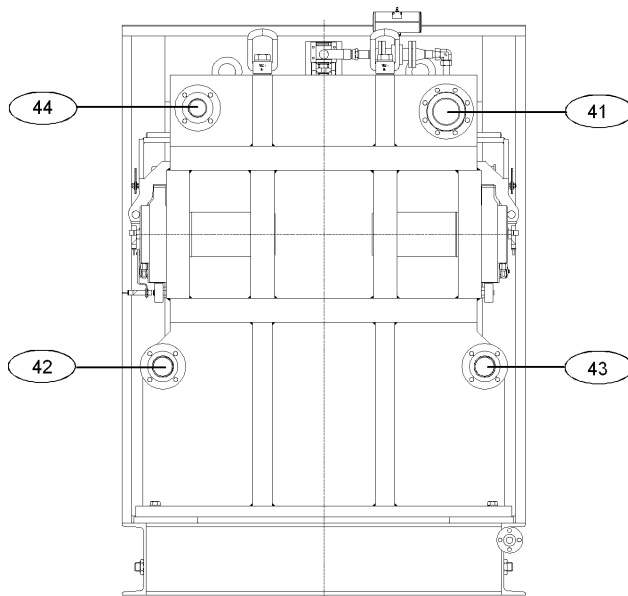


Fig. 35

### 4.4.2. Connections on blind plate

On top of the blind plate is the connection for valve 02152 HV (V21). When this valve opens compressed air flows into the mud channel to empty and dry it.

## 4.5. Removal and Installation of Filter Plates

### 4.5.1. Removal of Filter Plates

In order to be able to open the filter press, one has to press the "Stop at the end of the cycle" button (502) while the machine is in operation. The filter press empties closes again, opens the first block (end piece side), (106) and then stops in the open position. The filter press is to be shut down by the main switch (501), and a warning sign is to be hung on the machine or set up in front of it. With the first block (106) open, self-tightening nuts and washers are unscrewed from the filter plate to be removed and from several other plates both in front of and behind it. Then the linking pieces are removed from the handles (06.01, 06.03) on both sides of the filter press.

Finally the disconnected plates are pushed together, so that a sufficiently large working space is created in front of and behind the plate to be exchanged. The filter plate can now be lifted diagonally out of the opening between the crossbeams (04) by a lifting device.

Lifting device cables may only be attached to the handles (06.01, 06.03) of the plates.

The filter plate can also be manually removed from below. When installing and removing filter plates, boards are to be placed over the chute covers in order to protect them from being stepped on.

If several filter plates are to be removed, it is recommended that all of the nuts, washers and linking pieces of a block be removed.

The second block (107) (head piece side) can be opened as described in Section 6.2, "Control in Semi-Automatic Operation". The filter plates are removed in the same manner as those of the first block.

### 4.5.2. Installation of Filter Plates

Filter plates are installed according to the steps described in section 4.5.1., but in reverse order.

After the filter plates have been installed and fastened in place by the linking pieces (17), nuts and washers, the filter press can resume operation (The linking pieces are installed in an alternating over/under pattern. One end is under its neighboring piece, while the other end is over its neighboring piece).

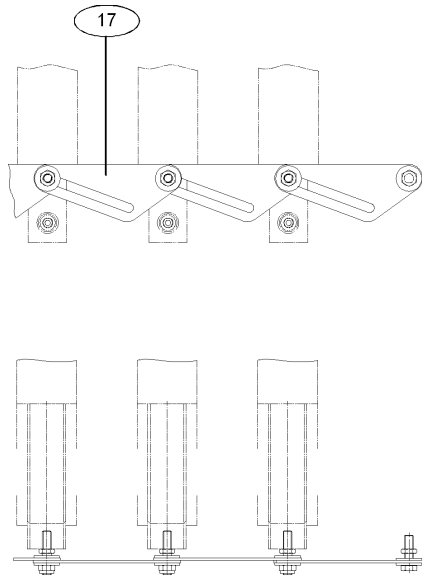


Fig. 38

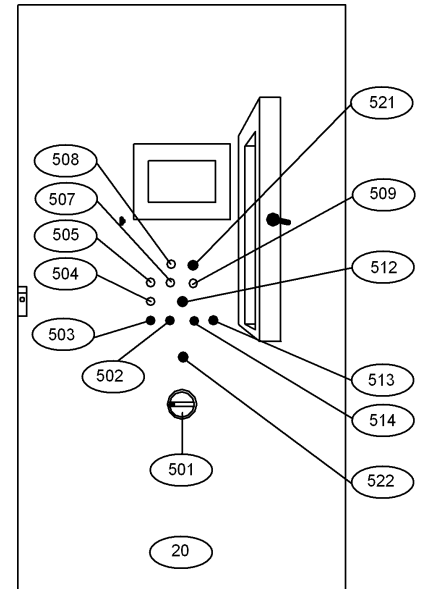


Fig. 37

## 4.6. Installation and Removal of Filter Cloths

Filter cloths are not installed on the filter plates until the installation of the entire filter press, including pipelines, valves, is complete.

### 4.6.1. Installation of Filter Cloths

The first block of filter plates (at the end piece end) (106) is opened manually. Following the description given in Section 4.5.1., the linking pieces (17) are removed from the handles of the filter plates. Now the filter plates can be pushed aside on the two crossbeams (04) to create enough working room for the installation of the filter cloths.

#### 4.6.1.1. Cloth for End Plate

The end cloth (25.05) has the identification number 7E Q45 . It is attached to the end plate by lining up openings (104) in its top edge with the cloth holding pins (86) of the plate. The under-cloth, which is installed first, must be smooth and wrinkle-free. By means of a metal plate (08.10), the end cloth (25.05) is bolted to the end plate where the suspension intake pipe (79) is located. A hole is cut in the end cloth (103) to the size of the hole in the metal plate (08.10) (The edges of the hole can be smoothed off with a soldering iron). Thereafter the end cloth is fastened by ties for filter cloth to the eyes (08.08) on both sides and on the bottom of the end plate, so that it lies smoothly in place.

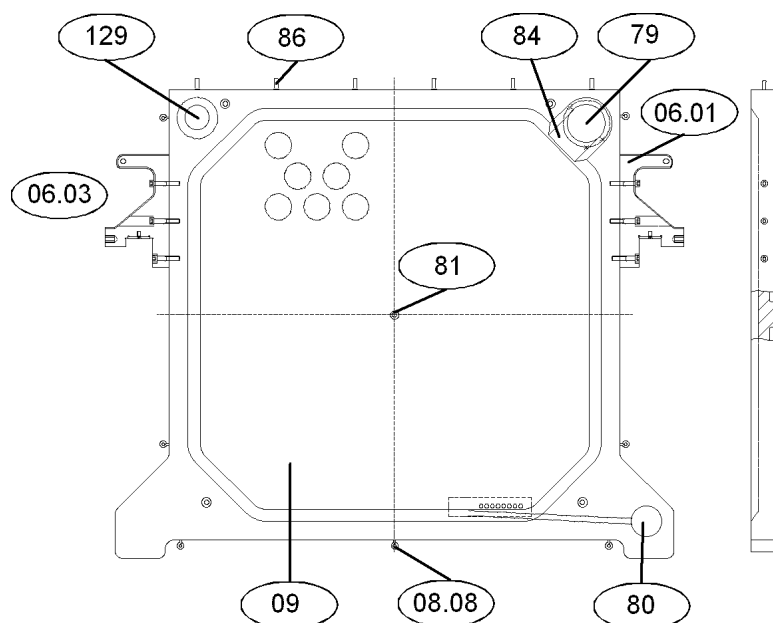


Fig. 39

### 4.6.1.2. Cloth for Membrane Plate

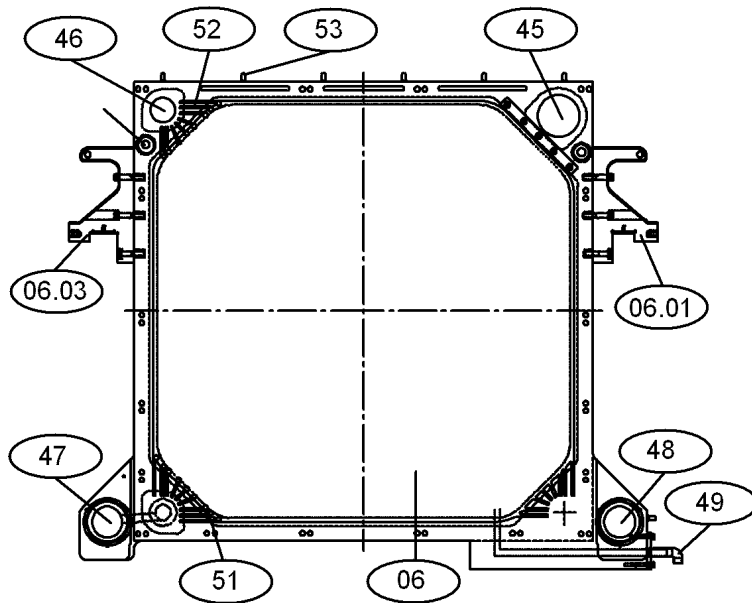


Fig. 40

The membrane filter cloth has the identifying number 7D 52/66 Q45 (Fig. 16).

One side of the filter cloth is folded back and rolled up. The rolled up side is pushed through the hole of the mud channel (45) and is unrolled on the other side of the membrane plate. Then the upper edge with holes (94) is placed over the cloth holding pins (53) and after smoothing down the cloth on the filter area, the sides are tightened to the membrane plate with the velco closures (95).

Below the cloths are fastened with tie wraps.

To keep the filter cloth from sliding off the cloth holding pins, rubber washers are pushed over the pins.

After dressing the filter plate it must be checked to make sure that the opening for compressed air (96) is even with the hole in the filter plate (06).

Sealing rings (06.29) (06.30) must be aligned properly in the holes for filtrate in the membrane plate (47) and filtrate in the pressure plate (48).

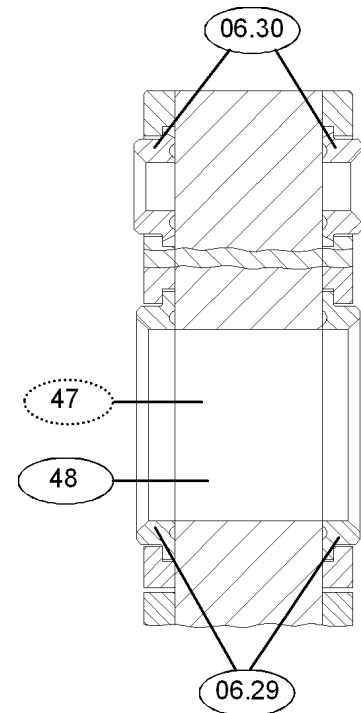


Fig. 41

### 4.6.1.3. Cloth for Pressure Plate

The pressure plate cloth (25.04) has the identifying number 7D 46/52 Q45 (Abb. 42).

The cloths are installed on the pressure plates in the manner described in section 4.5.1.2.

However, in contrast to the installation procedure for the membrane plates, sealing rings are not installed in the openings for filtrate from the membrane plate (61) and filtrate from the pressure plate (62).

After filter cloths have been installed on all filter plates in block 1 (106), the linking pieces (17) are attached to the handles (06.01) (06.03) of the filter plates as described in section 4.4.2. The first block is then closed manually and the second block is opened (See Section 4.4.1.).

Filter cloths are installed on all filter plates in the second block (107) in the same manner as previously described.

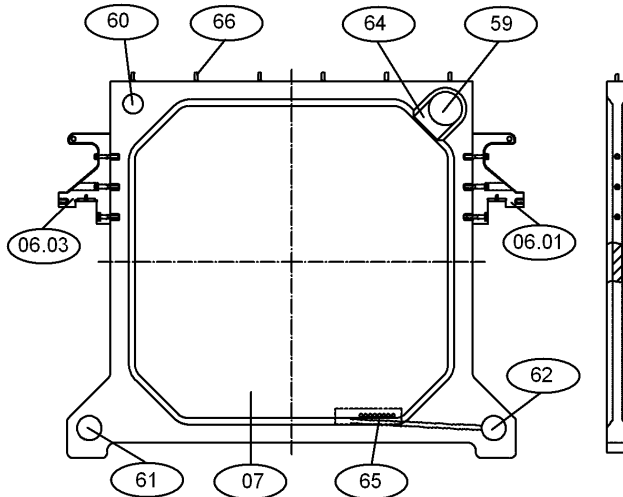


Fig. 42

#### 4.6.1.4. Cloth for Head Plate

The head cloth (25.04) has the identifying number 7K Q45 . It is installed exactly like the end cloth (25.05) (See Section 4.5.1.1.). The head cloth differs from the end cloth only in the fact that its openings are the mirror image of openings in the end cloth.

#### 4.6.2. Removal of Filter Cloths

In order to remove filter cloths, the filter plate must be partially disassembled according to instructions given in Section 4.5.1.

Next, the ties for filter cloth and Velcro fasteners are released and the grommets are removed from the cloth holding pins.

One side of the filter cloth is folded and rolled up. It can then be pulled through the opening for the suspension channel (45) (59).

#### 4.7. Installing the Safety Curtains

The safety curtains (24) are delivered with the filter press as loose parts.

Please assemble safety curtains according enclosed assembly drawing.

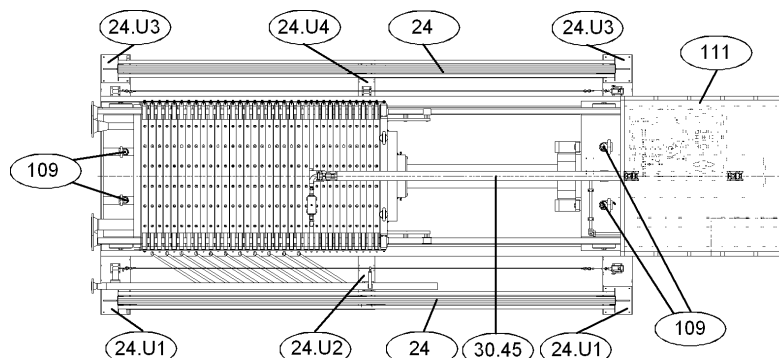


Fig. 44

## 4.8. Connecting the Valves

Control air is required for the operation of the automatic valves.

A distributing device to control the action of the valves is mounted on the head piece of the filter press.

In "manual mode" the valves can be activated by a manual lever.

## 4.9. Electrical Connections

The electrical control cabinet is mounted on the main frame (23) of the filter press. It accommodates standard connections for 1,5 kVA, 60 Hz, 120 V and is operated by 24 V DC control voltage.

## 4.10. Trial Run of the Filter Press

The trial run is to be conducted without interruption. Automatic program commands are to be simulated or electrically overridden.

During the trial run, all switching procedures, the plate-transport system and the hydraulic system are to be carefully monitored to make sure that they are functioning properly.

When starting up the filter press, the following conditions must be in effect:

### General Preconditions

- Control air for relay valves on the filter press,
- Pump for suspension ready for operation,
- Compressor for compressed in operation,
- Screw-drive and/or conveyor belt ready for operation,
- Minimum level of suspension present in the tank,
- Membrane water pump ready for operation.

### Electrical/Mechanical Preconditions

- Switch on main switch (501),
- Emergency Off (522) must be unlocked,
- Spray curtains closed,
- Filter press is open,
- all valves in basic position,
- Switch key (512) "Automatic/Manual" to "Automatic",
- Hydraulic pump ready for operation,
- Press "Control Power On" key (504),
- Press "Reset" button (521).

If the required prerequisites are met, "Wait for Start" appears on the control panel.

The illuminated key „Start" (503) lights up and the filter press can now be started.

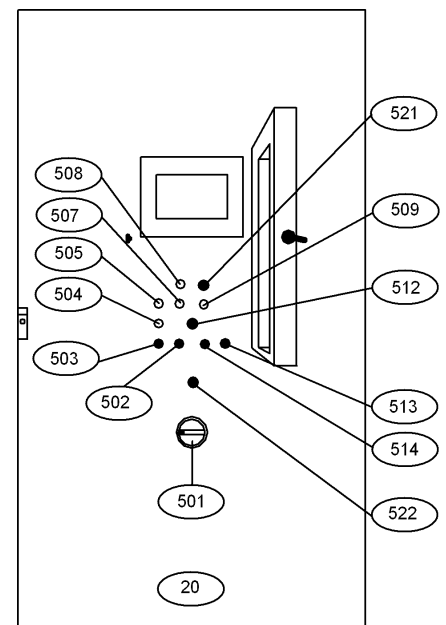


Fig. 48

## 4.11. Adjusting the Filter Press before Initial Start-Up

Before the filter press is started all auxiliary equipment in front of or after the filter press must be started and checked.

- The hydraulic unit is switched on.



The hydraulic unit (16.19) must have been adjusted previously and made operational according to Section 8.2.

- Pump for suspension is switched on.
- Compressed air for blow-drying is present.
- Control air for relay valves is present.
- The filter cake transport system is in operation.

When the specified preconditions have been met and the control values have been entered, the filter press can be started up.

### Generating the clamping (closing) force

The clamping force is generated by the amount of hydraulic pressure the main press hydraulic cylinder is charged with.

The plate set is burdened with significant pressure changes during the course of a press cycle. The clamping force is adjusted to these pressure changes during the press cycle in order to obtain the longest possible life span of the filter press components. The clamping force is adjusted automatically in order to achieve a tight (sealed) plate stack during each cycle step.

In the case that the operating conditions (pressures) need to be changed in the future, the pressure values can be adjusted in the filter press control system.

The following maximum pressure values are valid for an operating temperature of **65°C**.

These maximum values must not be exceeded because they have a direct impact on the life span of the filter press and its components.

- 40 bar (580 psi) during (at) press closing („Set Point LP“).
- 90 bar (1305 psi) during press filling („Low Pressure“).
- 180 bar (2610.5 psi) at end of filtration („High Pressure“).
- 260 bar (3771 psi) at end of squeeze („Max. Pressure During Squeeze“).
- 280 bar (4061 psi) is maximum hydraulic pressure („Max. Pressure System“).

It is recommended to „set“ the necessary pressures only, rather than setting the maximum values.



For your system and the operating conditions during start-up we recommend the following settings:

- **30** bar (435 psi) during (at) press closing („Set Point LP“).
- **80** bar (1160 psi) during press filling („Low Pressure“).
- **160** bar (2320.5 psi) at end of filtration („High Pressure“).
- **240** bar (3481 psi) at end of squeeze („Max. Pressure During Squeeze“).
- **280** bar (4061 psi) is the maximum hydraulic pressure („Max. Pressure System“).

The automatic control effect (response) of the clamping force is influenced by the pressure value of the „Pressure Differential“. The recommended set point is between 5 and 10 bar (72.5 and 145 psi). The hydraulic pressure and consequently the clamping force are increased more rapidly when setting a lower value; consequently the hydraulic pump will operate at a higher frequency rate. Alternatively, the response time of the control loop will be “slower” when setting a higher value. The hydraulic pump will operate less frequently.

## 5. Operation Filter Press

### 5.1. Start-Up of the Filter Press

The filter press must be carefully inspected prior to every start-up. Pay particular attention to the following questions:

- Are the filter plates arranged in proper sequence? (Membrane Plate - Pressure Plate - Membrane plate)
- Are the filter plates installed properly with reference to their sides?
- Have all gaskets for the filtrate channels in the membrane plates (47) (48) been properly installed?

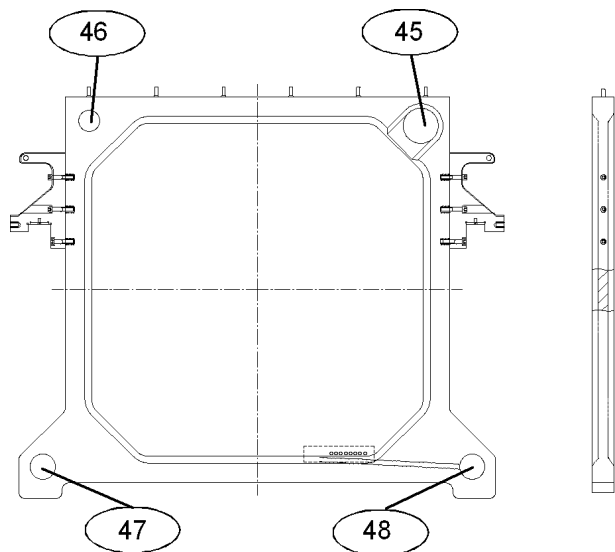


Fig. 56

- Have the filter cloths been installed properly? Have they been stretched tightly enough over the filter plates? The openings for air for dry blowing (46) must not be obstructed.
- Has closing pressure been properly set?
- Set the variables on the control panel for all the pressures and times for running the program

When the inspection has been finished, the following systems are put into operation and/or inspected:

- Agitators in the suspensions tank,
- Hydraulic system in the filter press.



**Prior to completing the check-list described above, the hydraulic system must be prepared for operation in accordance with section 8.2.2.**

- Pump for suspension is switched on.
- Compressed air for blow-drying is present.
- Control air for relay valves is present.
- The filter cake transport system is in operation.

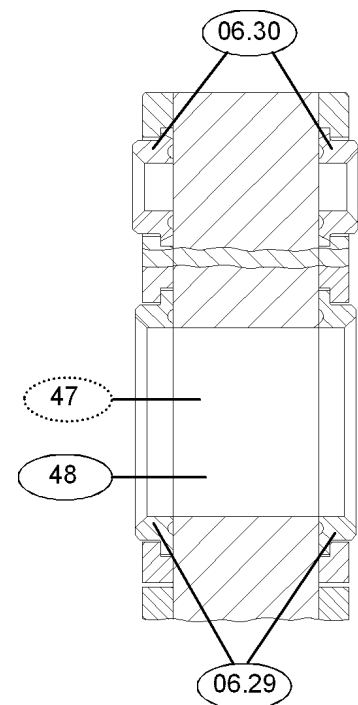


Fig. 57

## 5.2. Continuous Operation of the Filter Press

The filter press is operated fully automatically..  
The filtration of suspension can only be carried out in the automatic mode (key switch "Automatic", 512).

## 5.3. Shutting Down the Filter Press

If the filter press is to be shut down for several hours or longer, it is taken out of automatic operation by pressing illuminated button "Stop at the End of the Cycle", (502).  
As a safety measure, manual valves in the lines for suspension and compressed air are closed.

## 5.4. Manual Operation of the Filter Press

In the manual mode (key switch "Manual", 512) the filter press can only be opened and closed hydraulically for maintenance and repair work.

The filter press is taken out of the automatic mode by pressing the illuminated button "Stop at the End of the Cycle", (502).

During emergencies the filter press can be taken off the automatic cycle immediately.



ATTENTION

By switching key switch (512) from „Automatic“ to „Manual“ and subsequently activating switch (514) „open press“, the automatic cycle is interrupted.



DANGER

This function should only be applied in extreme situations/danger, since it is impossible to return to the cycle step which was interrupted.

After the above step the press must be emptied manually!  
This should only be done by qualified personnel!

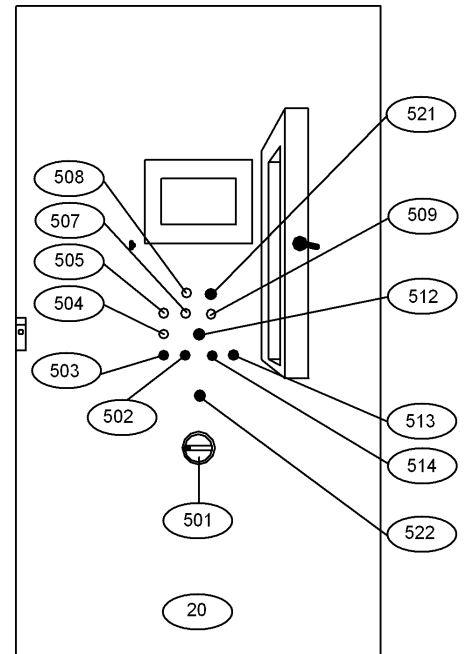


Abb 59

## 6. Control of the Filter Press

Every filter press is equipped with a programmable control system (SPS).

If several filter presses are installed in a sugar factory, they must be connected to one another by an automatic sequence control system.

The automatic sequence control system is programmed in such a way that filling a filter press and drying filter cake cannot take place simultaneously in the filter presses in that particular station.

The control program causes production to progress in sequential steps, which are numbered consecutively from step 1 to the end of the filtration cycle.

If the filtration process does not require some of the program steps in the sequence, the control system simply omits them and automatically proceeds to the next required steps.

### 6.1. Control of the Filter Press in Automatic Operation

#### 6.1.1. Preconditions for Start-Up of the Filter Press in the Automatic Mode

The description given here applies only to filter presses that are equipped with OP 170B Controllers (500).

##### General Preconditions for Start-Up:

- Pump for suspension is switched on.
- Compressed air for blow-drying is present.
- Control air for relay valves is present.
- The filter cake transport system is in operation.

##### Electrical/Mechanical Preconditions

- Switch on main switch (501),
- Emergency-Off device (522) must be unlocked
- Press "Control Power On" button (504)
- Press "Confirm Repairs" button (521)
- Safety curtains must be closed,
- Filter press is open,
- All butterfly valves are in position "IDLE".
- Turn key switch "Automatic/Manual" (512) to "Automatic",
- Hydraulic pumps are running and functioning properly.

When these pre-conditions are met, the machine is ready to start.

- Illuminated button "Start" (503) blinks.
- Press illuminated button (503) to start the filter press.

Atmospheric air behind the membranes can escape during filling through valve 02215 HV.

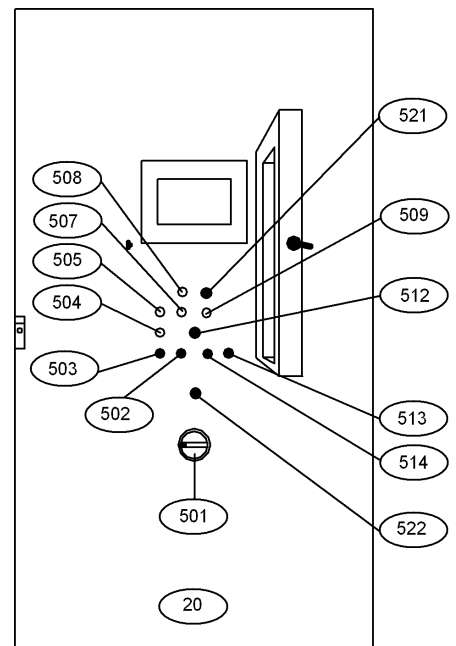


Fig. 61

## 6.1.2. Step Display in Automatic Mode

When the preconditions identified in section 6.1.1. have been met, the filter press can be started up. Pressing illuminated button "Start", (503) initiates the following actions:

Message on the controller (500)

Step	Step_DDCE	Aktion
1	1	Start
2	2	Close Filterpress (LP)
3	2	Close Drip Trays
4	3	Close Filterpress (HP)
5	4	Fill Chambers
6	5	Fill I
7	6	Compression I
8	7	Drain Membrane (optional on DCS input)
9	8	Retrac Membrane (optional on DCS input)
10	9	Feed II (optional on DCS input)
11	10	Compression II (optional on DCS input)
12	11	Air Blow
13	12	Core Blow
14	13	Drain Membrane
15	14	Retrac Membrane
16	15	Blow Down
17	16	Open Press (Drip)
18	17	Open Drip Trays
19	18	Cake discharge I
20	18	Cake discharge II
21	18	Cake discharge III
22	19	Go To Step 1 nicht STOP nach Zyklus
23	19	Close Filterpress (LP)
24	19	Close Drip Trays
	0	Idle

\* If the illuminated key "Filter Press Stops at End of Cycle" (502) is activated prior to the end of program Step 18, the machine stops at the end of the cycle.

Additional information about the program sequence can be called-up by the controller.

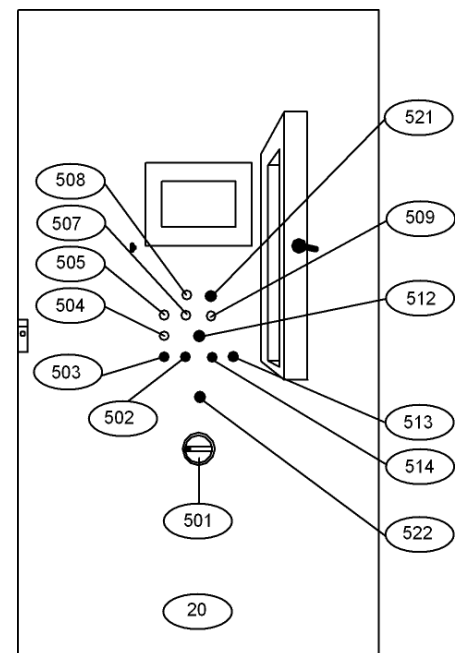


Abb. 62

## 6.2. Operation of the PKF after Emergency-Off or Power Outage

General information about an "Emergency-Off" situation:

A dangerous situation exists if it becomes necessary to activate the "Emergency-Off" button (121 + 522). A thorough inquiry and careful investigation must be made to determine why the emergency action was necessary. Operating personnel must be instructed that they are to employ the emergency shut-down devices only in cases of real danger.

When an emergency shut-down device is activated, the control system is shut down. The initial settings for controlling valves, message lights, motors, etc. are discontinued. Internally, while in the automatic mode, the control system "remembers" the last program step in operation at the time of shut-down.

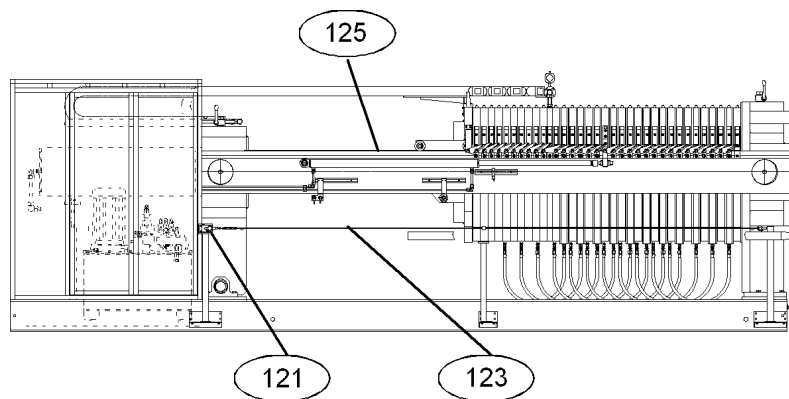


Figure 66

### Restarting the Filter Press

- Correct the problem that was the cause of the dangerous situation and unlock the Emergency-Off device.
- Press key "Reset" (508).
- Turn on control power by pressing key (504) "Control Power On".
- After emergency shut-down, program is continued where it stopped before.
- The automatic cycle can be restarted at „point of interruption“.

### 6.3. Operating the Filter Press with the Controller

An OP 170B (Siemens) controller is standard equipment on the PKF 140-A3-O. If the customer desires, the PKF can be equipped with another controller instead.

The controller is built into the door of the control cabinet (20).

In addition to the controller (500) the following control elements are also located on the door of the control cabinet:

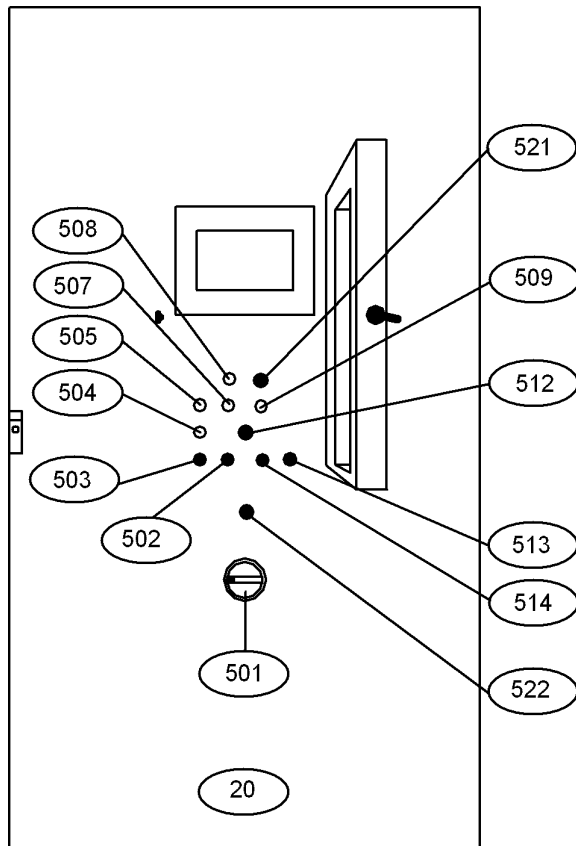


Figure 97

#### Key to Figure 97:

- 500 - OP 170B Controller
- 501 - Main Switch
- 508 - Signal Light Fault
- 505 - Signal Light: Control System On
- 507 - Signal Light: Manual Operation On
- 509 - Signal Light: Automatic Operation On
- 504 - Switch On Control Power
- 512 - Key Selector Switch: Automatic/Manual
- 503 - Illuminated button: Start
- 502 - Illuminated button: Stop the Press at the End of the Cycle
- 514 - Selector Switch: Open/Close Press
- 513 - Selector Switch: Open/Close Chute Covers
- 521 - Reset "Fault"
- 522 - Emergency / Off switch

### 6.3.1. Operating the Filter Press with the OP 170B Controller

The control unit display (136) of the OP 170B (500) shows pictures of the operating process. Information and malfunction are flashed into the appropriate pictures. Malfunctions are shown in the upper area, operating information in the lower area.

The operating information includes information about the current program step, i.e. the current status of the filter press.

### 6.3.2. Explanation for the OP 170B Keyboard

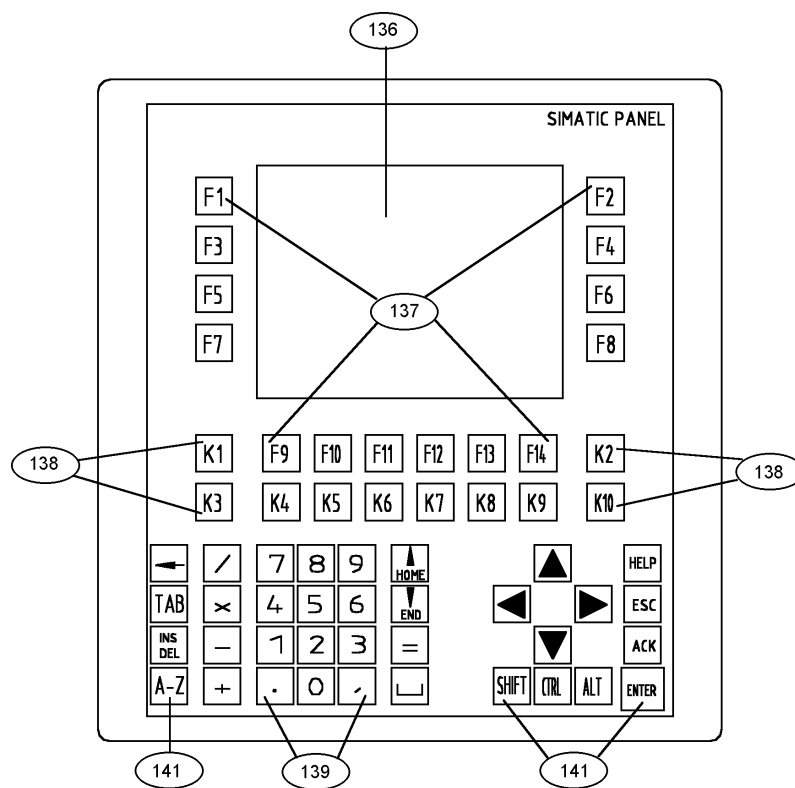


Figure 98

#### 6.3.2.1. Function keys F1 – F14 (137)

These keys are partially activated on different screens. Each function of the function key is shown on the open screen.













### 6.3.2.2. Lower Keyboard (138) (K- function keys)

K1	Indication	Opening and closing of each current operating information on each screen.
K2	Faults	Calling up the error register.
K3	Basic Screen	Opening start up screen with the option to access additional screens.
K4	Timer Process	Change to the process screen, where all processing times belonging to a specific process (such as cake drying) can be changed.
K5	Other Values	Process screen for adjusting all other parameters necessary for operation.
K6	System Datas	Process screen showing operating data (such as charge duration or filtration time).
K7	Process PKF	This process screen shows the PKF operating sequence. Additional screens show current process information, such as running time, pressure, speed.
K10	Manual	Opening start up screen to manually adjust all valves (only works when in "manual" operating mode).

### 6.3.2.3. Number Block (139)

Values such as quantity, pressure, and times can be changed with the 10-key pad. For selection of variables to be changed, use the ▽ key or the Δ key.

### 6.3.2.4. Right Key Pad Area (141)

-  - key has no function
-  - cursor up
-  - cursor down
-  - cursor right
-  - cursor left
-  - acknowledge malfunction
-  - help text (only when LED is lit)
-  - Enter-acknowledge changed values in variables
-  - switch window – main screen
-  - escape key

### 6.3.3. Operation and Observation with the OP 170B

#### 6.3.3.1. Settings

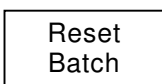
After the filter press is started, the OP 170B shows the start up screen.



Key to test the lights on the control panel



Key to change language setting (if existing)



Pushing the key below this symbol resets operating data.



USER: ADMIN  
Protected use **Password: 100**



For opening the safety door



Time control: Screen were all control times can be set (for example: opening and closing of various operations).



Unauthorized changes in the following screens void any guarantees and require consultation with the manufacturer. The key below the symbol pictured enters a protected area.



USER: ADMIN  
Protected screens **Password: 100**

### 6.3.3.2. Service

Settings of the necessary parameters for the filter press occur in two areas. The keys K4 and K5 are for the appropriate settings area. The arrow keys move the cursor to the value to be changed, allowing change of the variable. The new value can now be entered as a whole number or as a fraction. Pressing the ENTER key enters the value into the control system.

Timer Process K4 Settings of all times necessary for the process.

Other Values K5 Setting of all other parameters necessary for the process.

### 6.3.3.3. Observation

Observation of the process also occurs in two areas. It is **not** possible to make adjustments.

Systems data K6 Opening this screen shows all current operating data.

Process PFK K7 This screen shows the filter press with the shut-off valves. The “open” and “closed” position of each valve is shown. (open-light / closed-dark). This screen also shows the most important information for the operating process.

K8 Trend Hydraulic

K9 AWM Operate

## 7. Response to Interruptions

The automatic control system constantly monitors the filter press station including its shut-off valves, mud pump, compressed air station and the transport system for filter cake.

In addition to its monitoring and operating functions, the display of the control panel also reports all problems that arise during the operation of the filter press. Whenever a problem occurs, the current message is replaced by an alarm streamer.

**The malfunction must be identified and corrections must be made before production can resume!**

After corrections have been made, it is necessary to push the "Reset" key (508). This recalls the image that was on the screen at the time when the "Interruption" message first appeared.

The alarm banner can be faded out by pushing key „K2“. This does not eliminate the interruption.

Only 2 problems can be displayed simultaneously on the display screen. If more than 2 problems occur simultaneously, one of the two problems on the screen must be corrected and verified before the next problem in line can be displayed on the screen.

If the operating program is interrupted by the activation of either the "Emergency/Off" button (121 + 522), a dangerous situation exists. Operating personnel must be instructed not to activate emergency devices unless there is genuine danger. A conscientious investigation must be carried out to determine what the reasons were for the activation of emergency devices. Only then can the press be restarted in accordance with Section 6.6.

## **8. Inspection and Maintenance of the Filter Press**

A conscientious service and maintenance program can substantially increase the reliability and the working life of the filter press and its assemblies under the existing operating conditions.

The oil in the hydraulic system is to be changed after 3,000 hours of operation. When the filter cloths no longer give the desired results, they must be changed.

### **8.1. Inspection and Maintenance during the Campaign**

#### **8.1.1. Inspection of the Filter Station**

A daily inspection of the filter press and the auxiliary systems should be carried out. The following items should be included in the inspection:

- Proper installation of filter cloths.
- Cleanliness of the filter cloths and the gaskets.
- Are there visible signs of damage to the filter cloths (especially in the "Neck" region?)
- Proper seating of sealing rings in the filter plates.
- Are all screws on the handles of the filter plates, on the linking pieces and on all other moving parts tight?
- All pipes, including those on the hydraulic system and all gauges are to be tested to make certain that no leaks exist.
- Check tension of emergency switch's wire below the stouts. These switches work on tension and sag.
- Inspect the gaskets of compressed air connections on the automatic valves.
- Inspect the filter cake transport system for cleanliness, especially at the transfer and discharge points. Heavy encrustations at the transfer points must not be allowed to form.

## 8.1.2. Maintenance and Lubrication of the Filter Station

The following parts are to be lubricated according to the lubrication sheet:

- Clean the wear-surfaces of the crossbeams (125) daily and if necessary spray with a light weight oil.

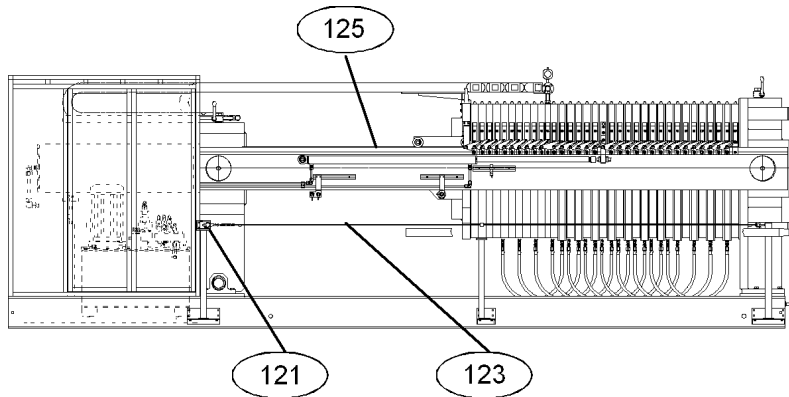


Fig. 70

## 8.2. Inspection and Maintenance of the Hydraulic System

### 8.2.1. Introduction

The Hydraulic System is delivered completely assembled and filled with oil. All necessary adjustments and valve work was completed at the manufacturer during a test run. The most important building types are shown in figures.

The most important building types are shown in figures 74 and 75.

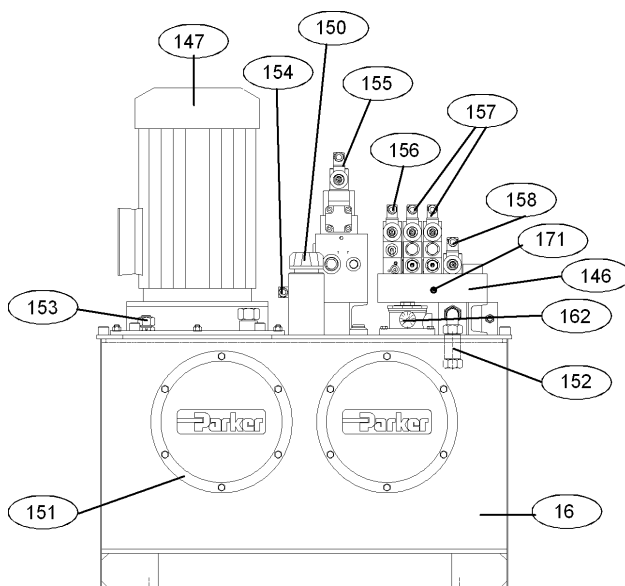


Fig. 74 Hydraulic Aggregate (Front View)

### Explanations for figures 74 and 75

16	Hydraulic Aggregate	154	Valve Block – Decompression
146	Control Block	155	Valve Block – Lock Cylinder
147	Motor	156	Valve Block – Pressure switch Low pressure High pressure
148	Fill Level Indicator	157	Valve Block Cover Plates
149	Drain Valve	158	Valve Block Plate Transport
150	Fill and Venting Filter	160	Control Valve – Pump pressure
151	Maintenance Lid	162	Manometer
152	Return Filter with Dirt indicator	171	Measuring point 6.2.
153	Connection for filling the pump		

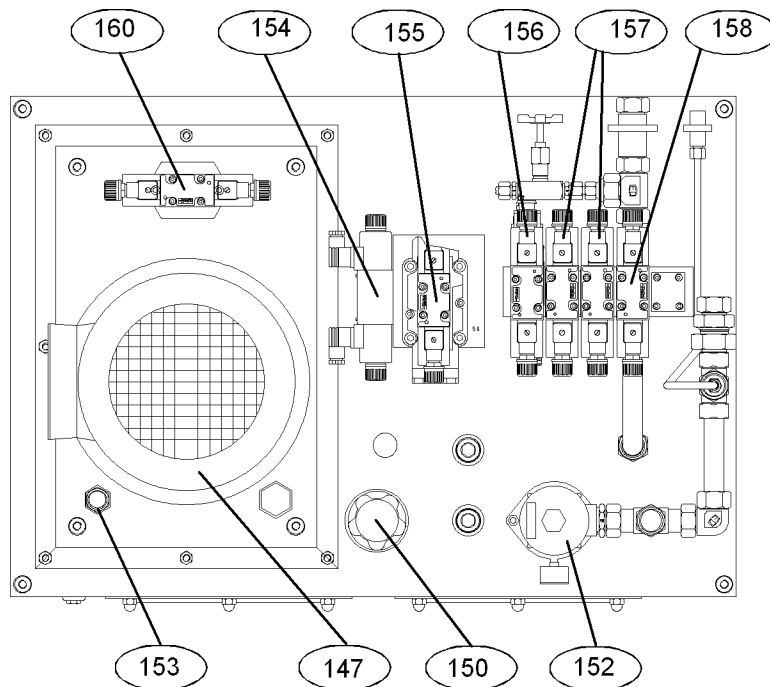


Fig. 75 Hydraulic Aggregate (View from above)

### 8.2.2. Directions for Working on the Hydraulic System

The customer needs only to visually inspect the system after assembly at their location to insure no damage occurred during delivery and assembly.

To avoid any damage, the pressure values set by the manufacturer must not be changed.

Following the directions and recommendations in the Operating Manual is a prerequisite for smooth and trouble free operation of the hydraulic system and its components.

For safety reasons, no screwed and/or bolted lines, pipes, connections and devices may be loosened while the system is under pressure.



**ATTENTION**

**All work performed on the hydraulic system must only be done by properly trained and qualified personnel.**

- No work on the system with oily hands.
- Observe extreme cleanliness during all work on the system.
- All openings are to be equipped with protective flaps so that no dirt can penetrate the system.
- Do not use steel wool to clean the oil container.
- Fill the system only with a filter (150) (25 µm or finer).
- Cover or tape all elastic seals and bearings of movable parts when painting.
- Mount control and adjustment devices tension free to avoid jamming of the control piston.
- Lay pipes tension free. No vibrations may be conducted.
- Use only Teflon seals, cu-seals etc. for sealing.
- All hydraulic screw and/or bolt connections are to be checked for leakage and tightened if necessary after 200 hours of operation.

### **8.2.3. Preparation and Start-Up at the Manufacturer**

- All directional control valves are equipped with a manual emergency control (161, Fig. 77), offering manual switching without control tension. The valves are equipped with a countersunk pin in the center of the magnet face. If necessary, this pin can be pushed down with a suitable object. Do not use pointed or sharp edged objects, so that the valve does not get damaged. All emergency controls are manufactured with a return spring. When not in use, the switches shown in the switch schematic should be in a neutral position.
- Check the oil level of the aggregate (148, Fig. 74) in regular intervals. Please note that the "maximum" oil level may only be set when the lock cylinder has been positioned. Ignoring these instructions can lead to an overflow of the container when positioning the lock cylinder.
- A safety block (163, Fig. 76) is located on the bottom of the cylinder. This keeps the press closed, even if a hose rupture should occur. There is also a manometer (67) for pressure control and both pressure switches control the lock cylinder.



- Pressure sensor (60, Fig. 76) controls the closing pressure of the press. If the closing pressure falls below the set value during operation, the hydraulic pump automatically starts up again until the set value is reached. The pump then shuts off time delayed.. The pressure sensor also controls the decompression of the main cylinder while the press opens.

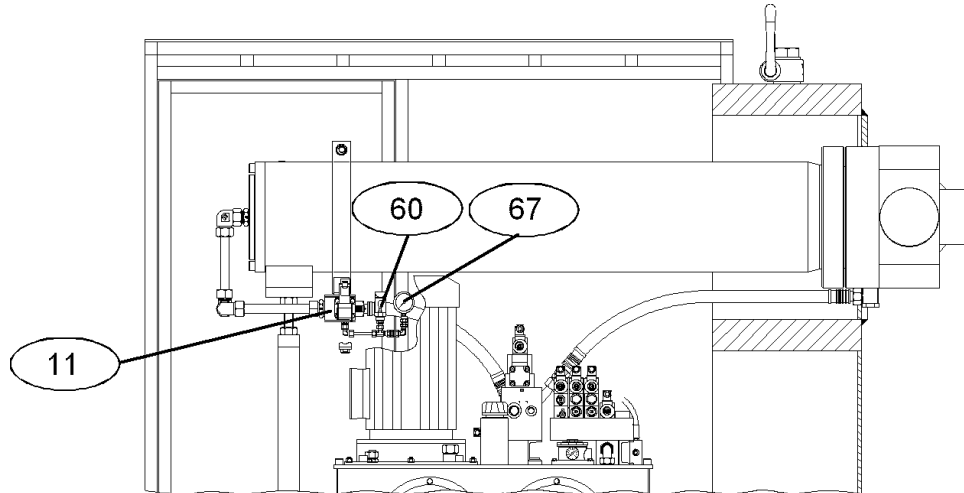


Fig. 76

- The plate transport and cover plate cylinders are operated with a lower pressure in contrast to the lock cylinder.
- Both transport cylinders (16.151, Fig. 2) are controlled by a circuit switch with exacting accuracy to achieve synchronized operation of the transport cylinders. Each of the two component currents is also protected by a pressure relief valve (set at 80 bar 1160 psi). This adjusted pressure value must not be changed.
- The cover plate cylinders (22.65, Fig. 22) are controlled via two directional control valves (157, Fig. 74) with an integrated choke/air regulator. The optimum speed for opening and closing the cover plates is set at the manufacturer. Faster opening or closing can - for opening or closing independently - easily adjusted if desired.
- Each of the two directional control valves (157, 164) has an intermediate plate with two integrated choke/air regulator non-return valves (180 + 181, Abb. 77). Unscrewing the choke/air regulator increases the rotation speed. Screwing in the choke/air regulator decreases the rotation speed. Depending on the design, the screwing or turning of the choke/air regulator is done with either a knurling nut or a hexagon pin spanner (monkey wrench) Tighten the choke/air regulator with a counter nut after adjustments are made.



If the choke/air regulators are screwed in to a dead stop, the oil delivery is shut down completely and the cover plates can no longer be operated.

The return filter (152, Fig. 75) mounted on the tank is equipped with an optical (162) and electronic dirt indicator. The indicator should be checked regularly to ensure a timely change of the filter element.

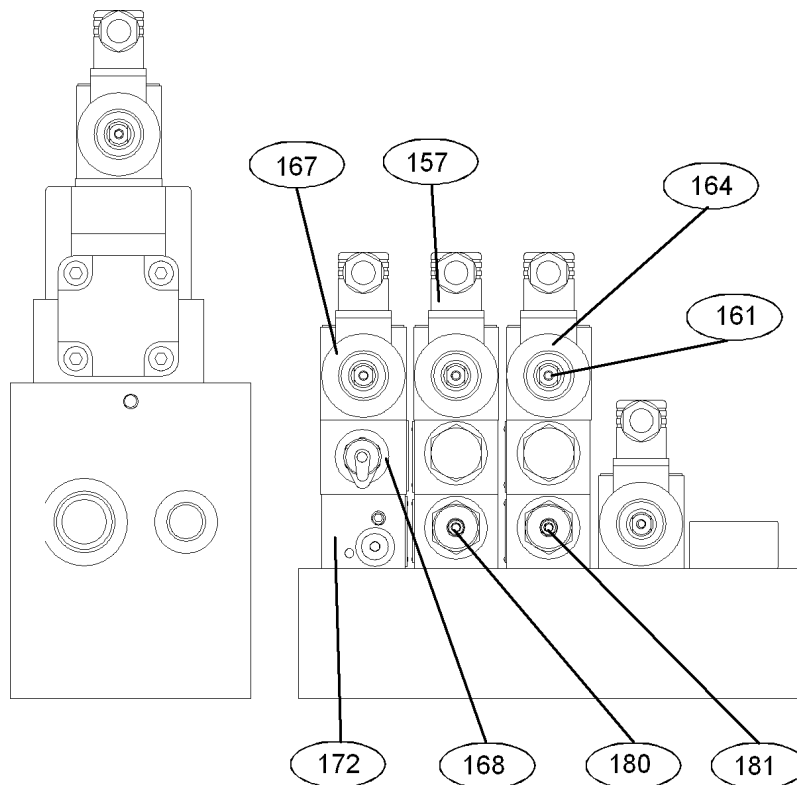


Fig. 77

### 8.3. Hydraulic Oil Change

The pressure fluid is an important component of a good operating hydraulic system. It fulfills the following important functions:

- Power transfer
- Wear and tear protection and less wear and tear
- Heat dissipation.

Statistical data indicate that over 80 % of all hydraulic component failure is traced back to deficient hydraulic fluids. Selection and monitoring of the pressure fluids is of the utmost importance.

The total amount of oil in the hydraulic system is **350 l** (volume in the oil tank is about 300 l).

The hydraulic system is filled with hydraulic oil Shell Tellus 46 at the manufacturer. This oil is suitable for normal conditions in closed rooms. The optimum surrounding temperature is between 10 and 30 °C. The following oil brands and types may also be used:

<b>Manufacturer</b>	<b>Hydraulic oil-type</b>
Aral	Aral-Vitem DE 46
Chevron	Chevron EL Hydrauliköl 46
ESSO	ESSTIC 46
Mobil	Mobil DTE Oil
BP	BP Energol HL 46
FINA	FINA Cirkan 46
TEXACO	Rando Oil 46
VALVOLINE	Valvoline ETC-10

Other hydraulic oils **must** be used with higher or lower temperatures in the surrounding area. If necessary, suitable hydraulic oils may be used, if the operating parameters are explained to the hydraulic oil manufacturer.



**ATTENTION**

All of the hydraulic system must be made pressure free before an oil change.

#### **Draining the Hydraulic Oil**

- Open the drain valve (149, Fig. 74) at the bottom of the oil tank. Remove closing plug.
- Collect the oil in a suitable container and dispose of it lawfully and responsibly.
- Close the drain valve (149, Fig. 74) and replace closing plug.

## Filling the Hydraulic Oil

- Unscrew the cap of the fill and ventilation filter (150, Fig. 74).
- Fill with about 300 l of hydraulic oil.
- While filling, observe the oil level indicator (148) on the tank.
- The hydraulic oil **must** be filled through a fill filter (filter grade 25 µm or finer).  
Oil from a barrel usually does not offer the required purity.  
A specially designed filling pump should be used.
- Fill the lock cylinder by moving it back and forth and bleeding and ventilating the rod and floor.
- When the lock cylinder is retracted, set the maximum oil level.
- Screw on the cap of the fill and ventilation filters.

## Oil Change Intervals

Duration of an oil fill depends on the operating pressure, operating temperature, number of revolutions and fluid type. Generalities about duration of an oil fill are therefore not possible. Analyses of the oil can be helpful.

The following oil change intervals are recommended:

The first oil change takes place immediately after start-up at the manufacturer. Subsequent oil changes are required after 2000 to 3000 operating hours.

For a trouble free operation change the hydraulic oil and the filter insert of the return filter before each campaign.

## Operating Temperature

The oil temperature may not exceed 60 °C. Higher temperatures lower the lubricating power of the oil, possibly damaging the hydraulic pump.

## 8.4. Adjusting the Hydraulic System

Since the hydraulic system is delivered completely assembled and adjusted, further adjustments are normally unnecessary. Should, however, components of the hydraulic system be disassembled for repairs, or if parts of the hydraulic were exchanged, adjustments and/or ventilation work may be necessary.

These adjustments are described below and should be done only by experienced and qualified personnel. The work sequence described is the same as the first start-up of the hydraulic system by the manufacturer. Prerequisite for all work is that the hydraulic tank was filled with suitable hydraulic oil as required.

### 8.4.1. Start-up of the Pump

For the first start-up, the pump should be filled through a connection to the pump (153, Fig. 74, 75). Only build up pressure when ventilation is completed.



**Check rotation direction of the motor!  
Rotation direction "right" – clockwise!**

Close the connection (153) on top of the tank lid again after ventilating the pump.

Only after operating for a short time without pressure (no magnet valve has been started or has been manually operated) may pressure be built up.

### 8.4.2. Adjusting the Operating Pressure

The required operating pressures for each function are set and monitored automatically from the PLC via proportional pressure valves. In addition there are two pressure limiting valves in the control stack. These valves are set for the maximum operating pressure. The pressure settings must not be altered at this location.

### 8.4.3. Adjustment of the Pressure-Limiting Valve (175) at the Cylinder Safety Block (Alternate Pressure)

The pressure regulating valve is set by the manufacturer. The set values cannot be changed.

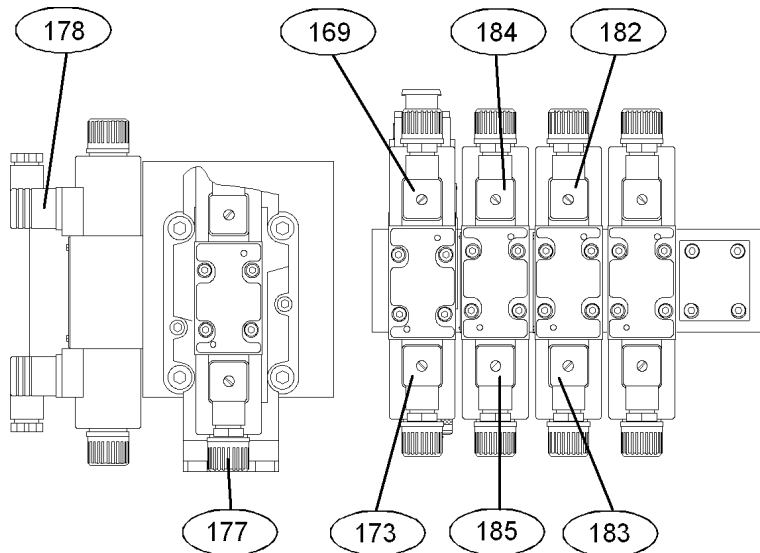


Fig. 79

#### 8.4.4. Adjusting the Speed of the Cover Plates

- Manual operation: Close the return valve chokes (180 + 181, Fig. 77), (screw in the set spindles on the front and back of the valves all the way).
- Open the chute covers of the filter press:  
Selector switch chute cover open Y 42 (184, Fig. 79) and unscrew the return valve choke across from the spool until the required speed is reached.
- Open the chute covers on operating side of the filter press  
Selector switch chute cover open Y 41 (182, Fig. 79) and unscrew the return valve choke across from the spool until the required speed is reached.
- Close the front chute covers of the filter press:  
Activate selector switch chute cover closing Y 40 (183, Fig. 79) and unscrew the return valve choke across from the spool until the required speed is reached.
- Close the back chute covers of the filter press: After front chute covers are closed Y 39 (185, Fig. 79) activate selector switch chute covers closing and unscrew the return valve choke across from the spool until the required speed is reached.

Secure the spindles with the lock nut after completing the adjustments.

**Representation of the Control Block with Valve Magnet Legends**

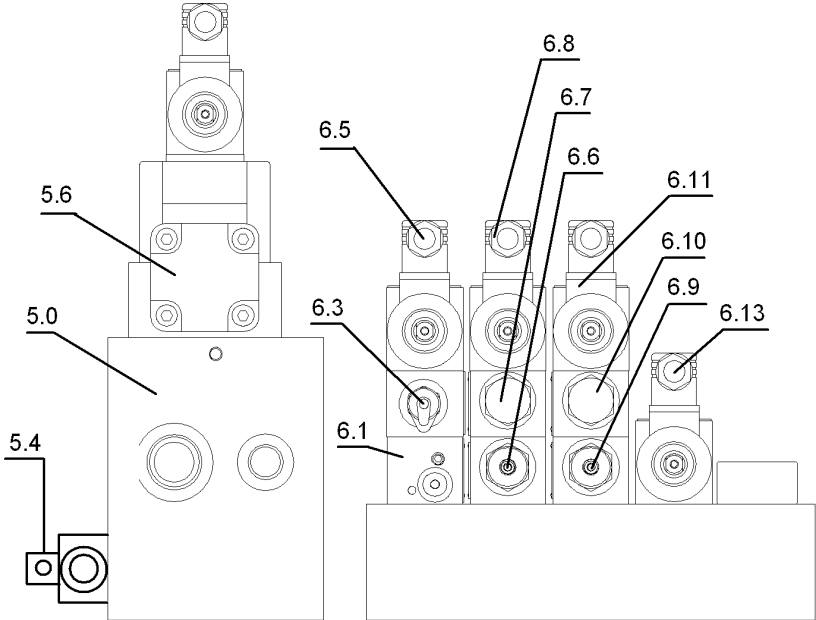


Fig. 80 Valves

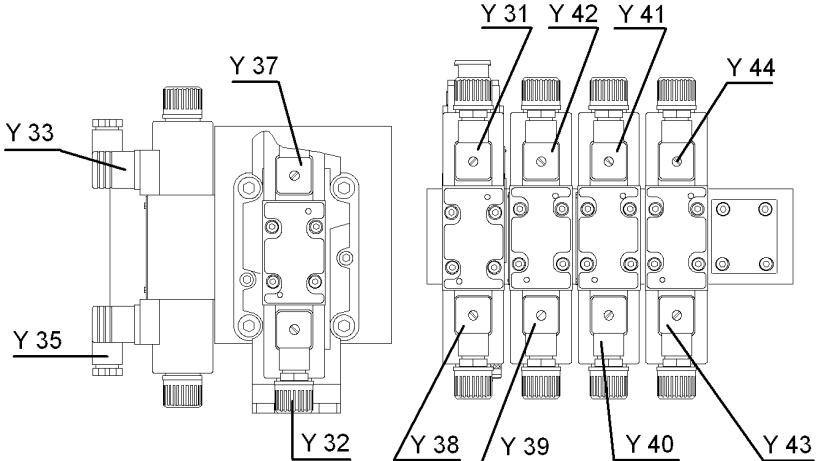


Fig. 81 Magnets

## 8.5. Conditions Required for the Operation of Electrical and Control Devices

In order to protect and preserve the built in electrical and control instruments, the following environmental conditions must be maintained both during and especially after the campaign.

- Control Cabinet: Protection Code IP55, NEMA 12  
Approval - UL, CSA, VDE
  
- SPS: Protection Code IP65  
Insulation Class C, according to DE 0110  
Surrounding Temperature 0...+55 °C  
(At lowest air intake)  
Storage Temperature -20...+70 °C  
Humidity Class F according to DIN 40040  
(15% to 95% without condensation)
  
- Operating Panel, OP 170 B: Protection Code, outer surfaces IP65, NEMA 4  
Protection Code, interior IP20  
Surrounding Temperature 0...+50 °C  
Storage Temperature -20...+60 °C  
Relative humidity 85%
  
- Peripheral Electrical Equipment: Initiators IP66, NEMA 4  
Pressure Gauge IP54, NEMA 3R  
Pressure Absorber IP65, NEMA 12  
Valves IP65, NEMA 12  
Terminal Boxes IP65, NEMA 12  
Safety Switches IP65, NEMA 12
  
- Cables and Cords: All electrical devices are to be protected against mechanical stress and are to be used in accordance with the valid Operating Manual.



## **8.6. Service and Maintenance Prior to Long Shut-Down Periods**

Filter cloths have to be cleaned directly after shut-down.

The glide pieces on the handles of the filter plates are to be inspected for wear.

All shut-off valves and pressure reducers are dismantled, cleaned and inspected.

Following the inspection and service steps outlined above, the exterior surfaces of the press are thoroughly cleaned and all points identified in the lubrication sheet are greased or oiled to protect them against corrosion (See also section 8.1.2.).

Finally the press is closed with its complete filter package inside. The filter plates remain covered by their (cleaned) filter cloths.

The press is not pressurized and remains closed until shortly before the beginning of the next production cycle. At that time new filter cloths are attached to the filter plates and the oil in the hydraulic system is changed.

Following completion of an operating cycle, one must make certain that the filter plates are not exposed to temperatures under -10 °C. In countries with extremely low temperatures in winter, the plate package must be heated.

Reserve filter plates are to be stored in an upright position in a storage room and are to be covered by black foil in order to protect them against ultra-violet light.

Reserve filter cloths must be stored in their sealed shipping packages in a storage room. They must be protected against ultra-violet light.

## **8.7. Teleadapter / Data Port Connection**

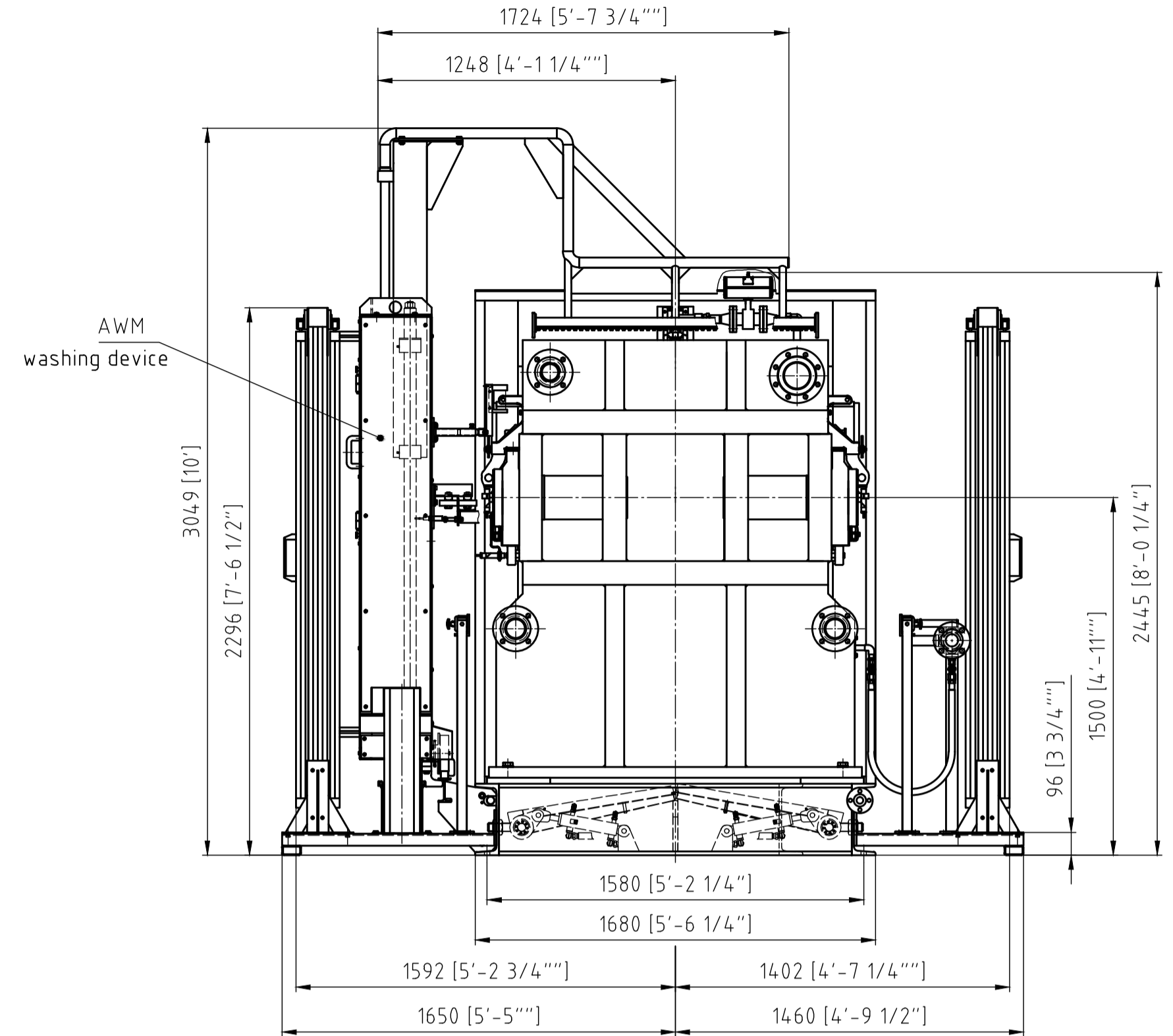
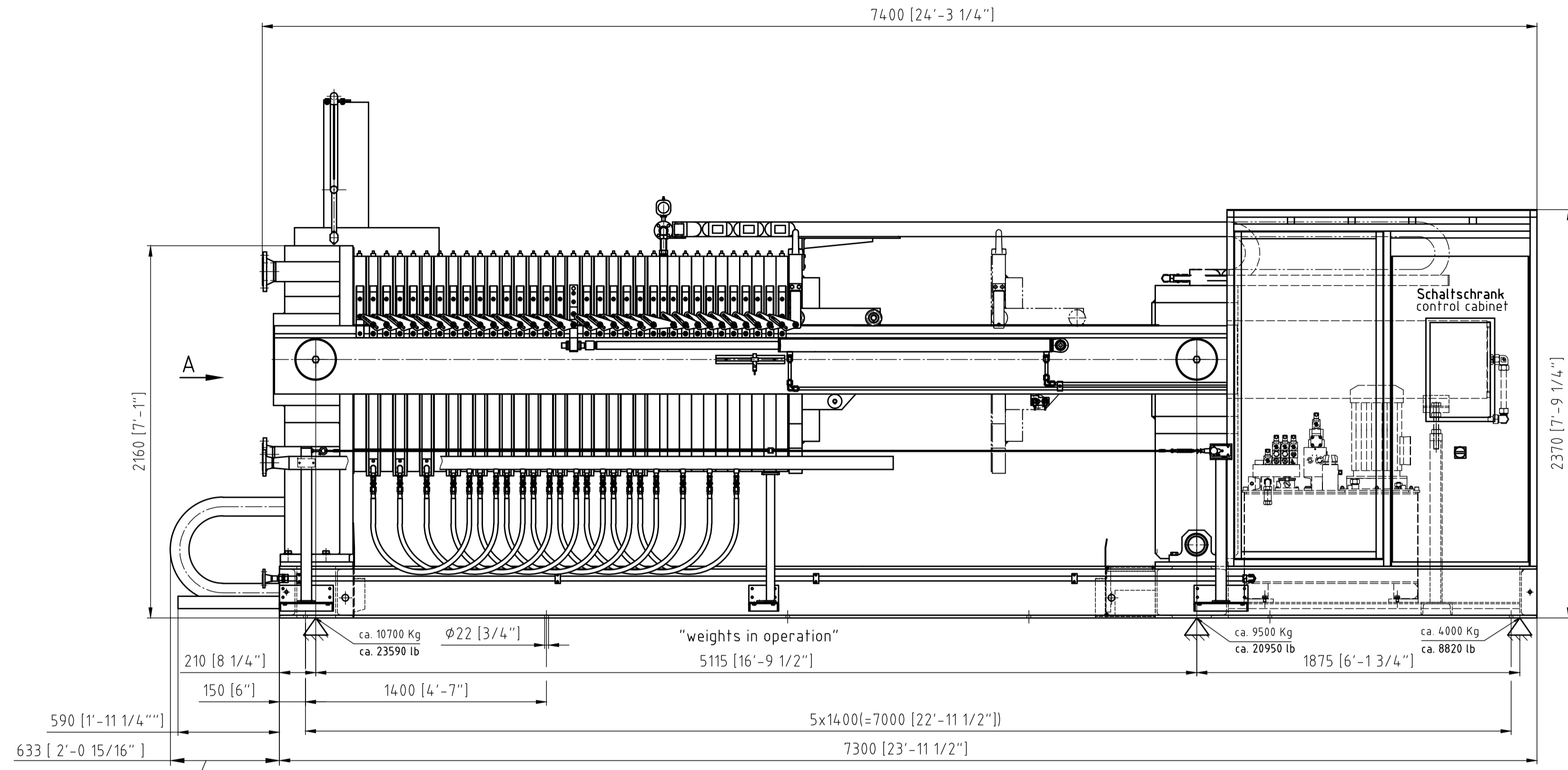
Our S-7 control systems (Siemens) are equipped with a "Teleadapter" / Data Port to service our customers anywhere in the world.

The customer has the option for a long distance diagnostic of his machine. Data from the machine can be transferred to the manufacturer who in turn can deliver programming changes and updates to the customer.

The Teleadapter / Data Port is located in the control cabinet. If several machines are delivered to one customer, the adapters are connected with a MPT-bus. Only one machine has to be equipped with a Teleadapter / Data Port.

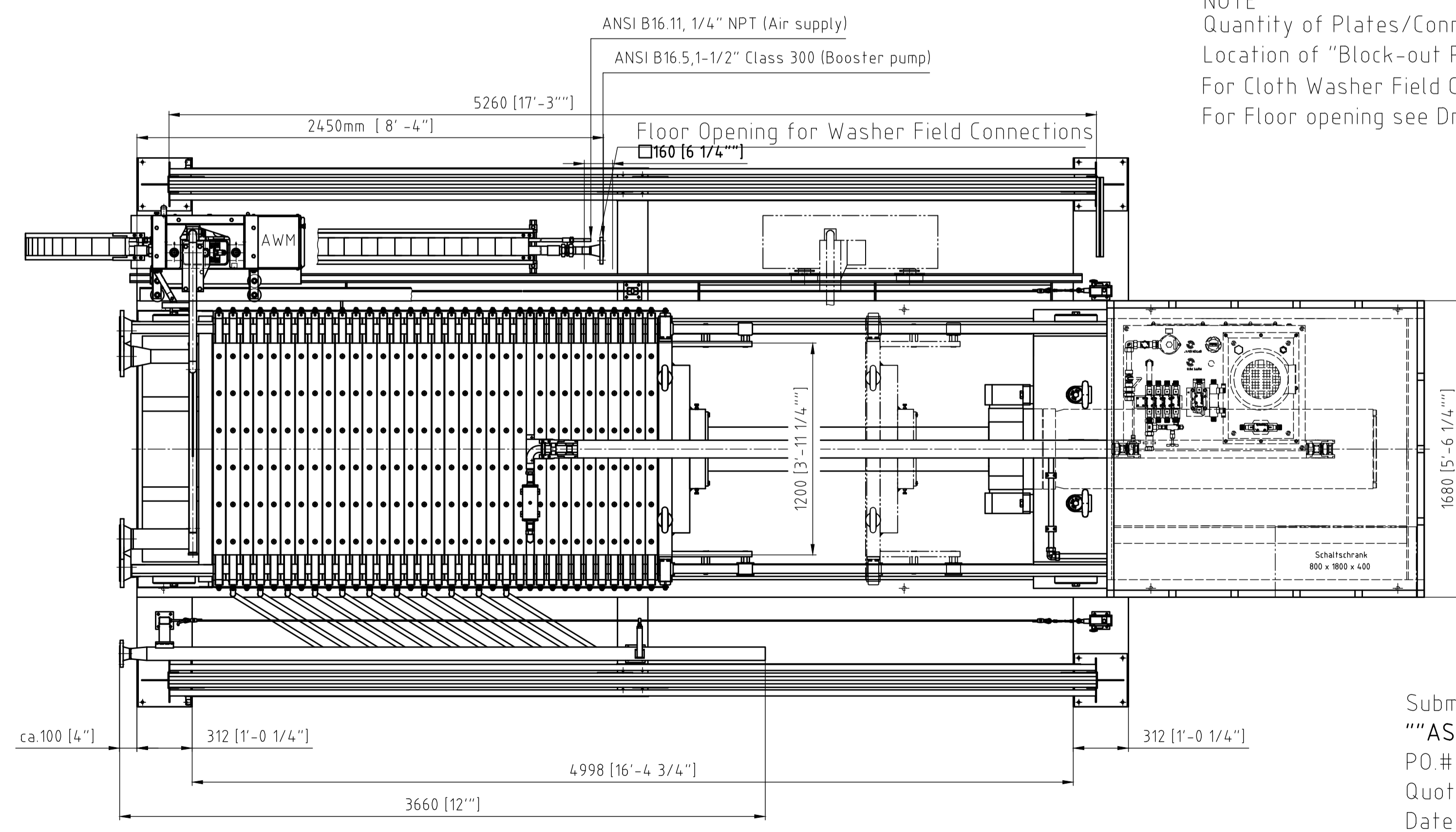
The customer has to install a telephone modem, connected to his telephone provider, if he would like the opportunity for long distance diagnostics.

12 11 10 9 8 7 6 5 4 3 2 1

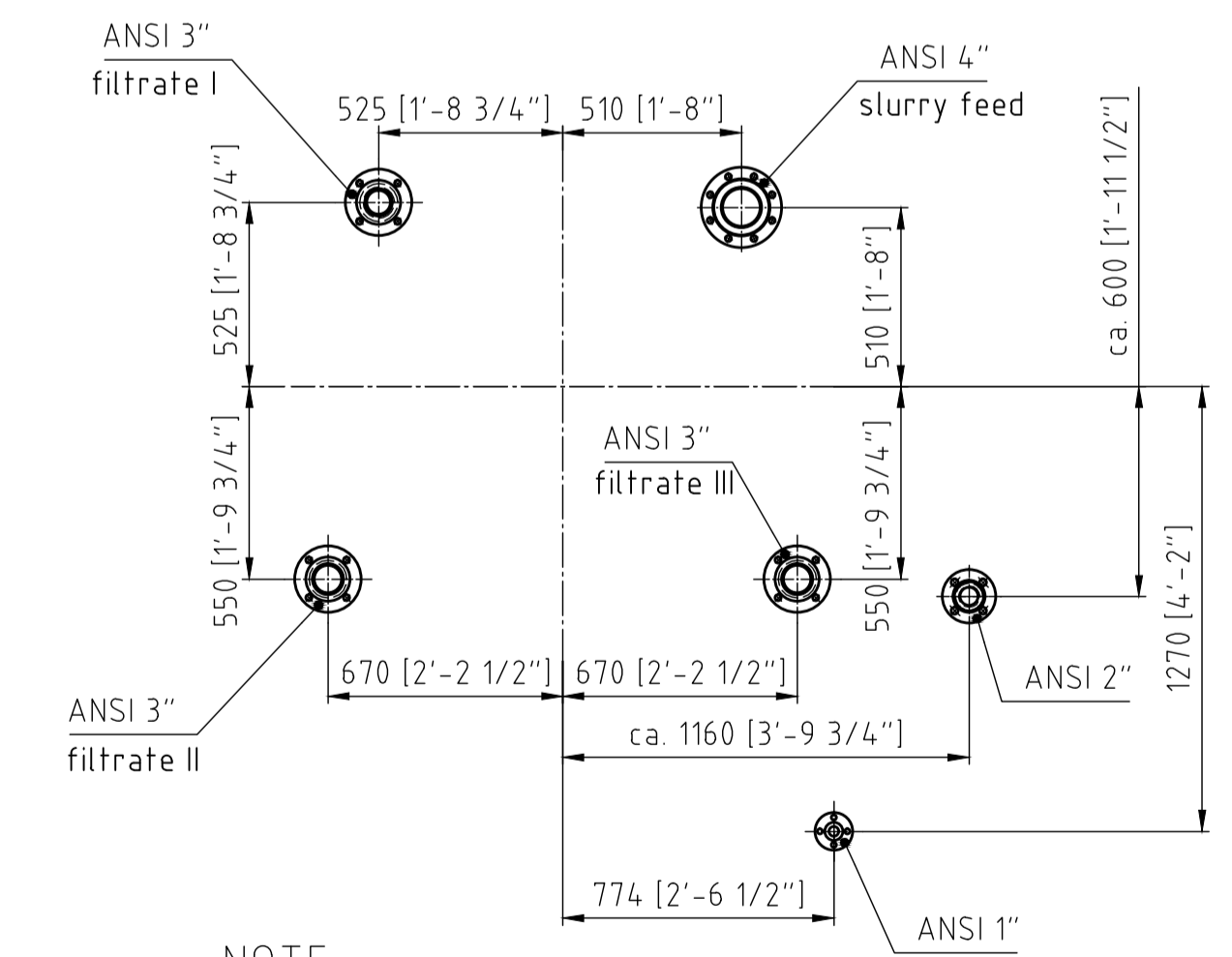


genaues Maß bei Montage  
correct dimension during mounting

NOTE  
Quantity of Plates/Connections supplied is for 42 Chambers  
Location of "Block-out Plate" for reference only!  
For Cloth Washer Field Connections see pdf:5-12727\_1Gb-DDCE11-0027  
For Floor opening see Drwng. SK5-16274-Floor-Opening



Ansicht A  
view A  
Flanschbild  
flange arrangement



NOTE  
All Flanges are ANSI 150#-B16.3

Submittal Drawing!  
"AS BUILT"  
PO #: DDCE11-0027  
Quote No.FST- 02-25-2165-09/ R1  
Date:05/28/09

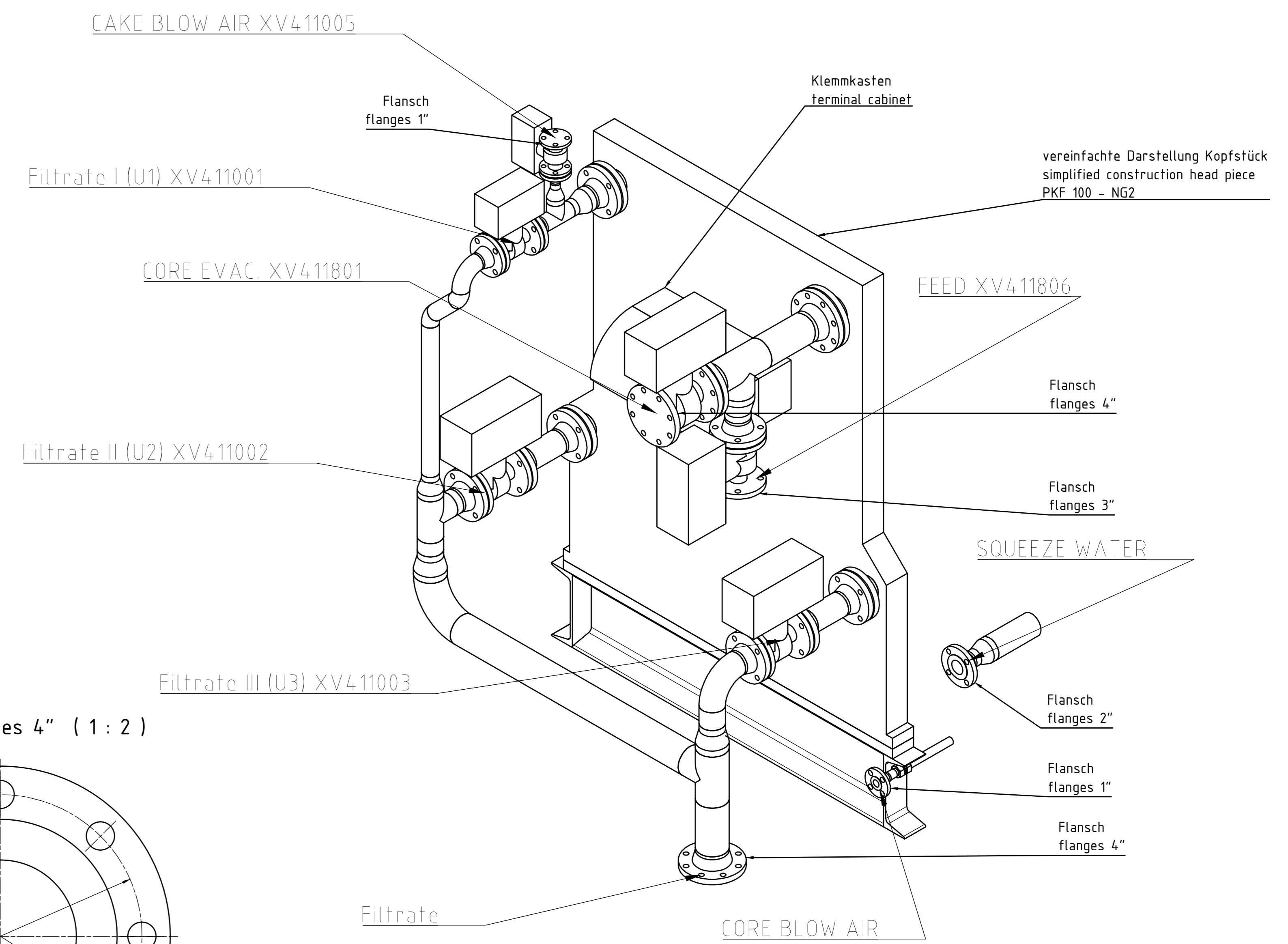
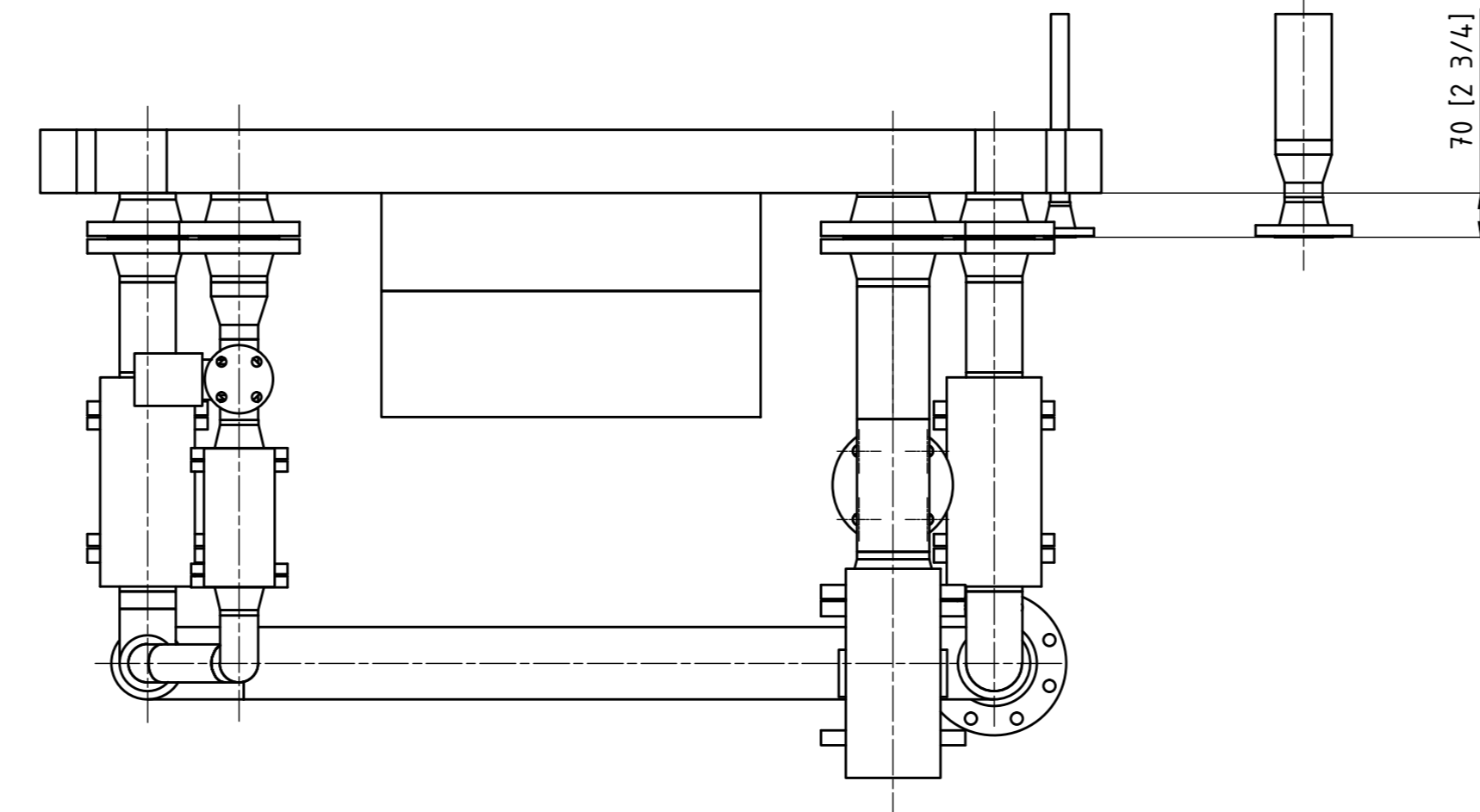
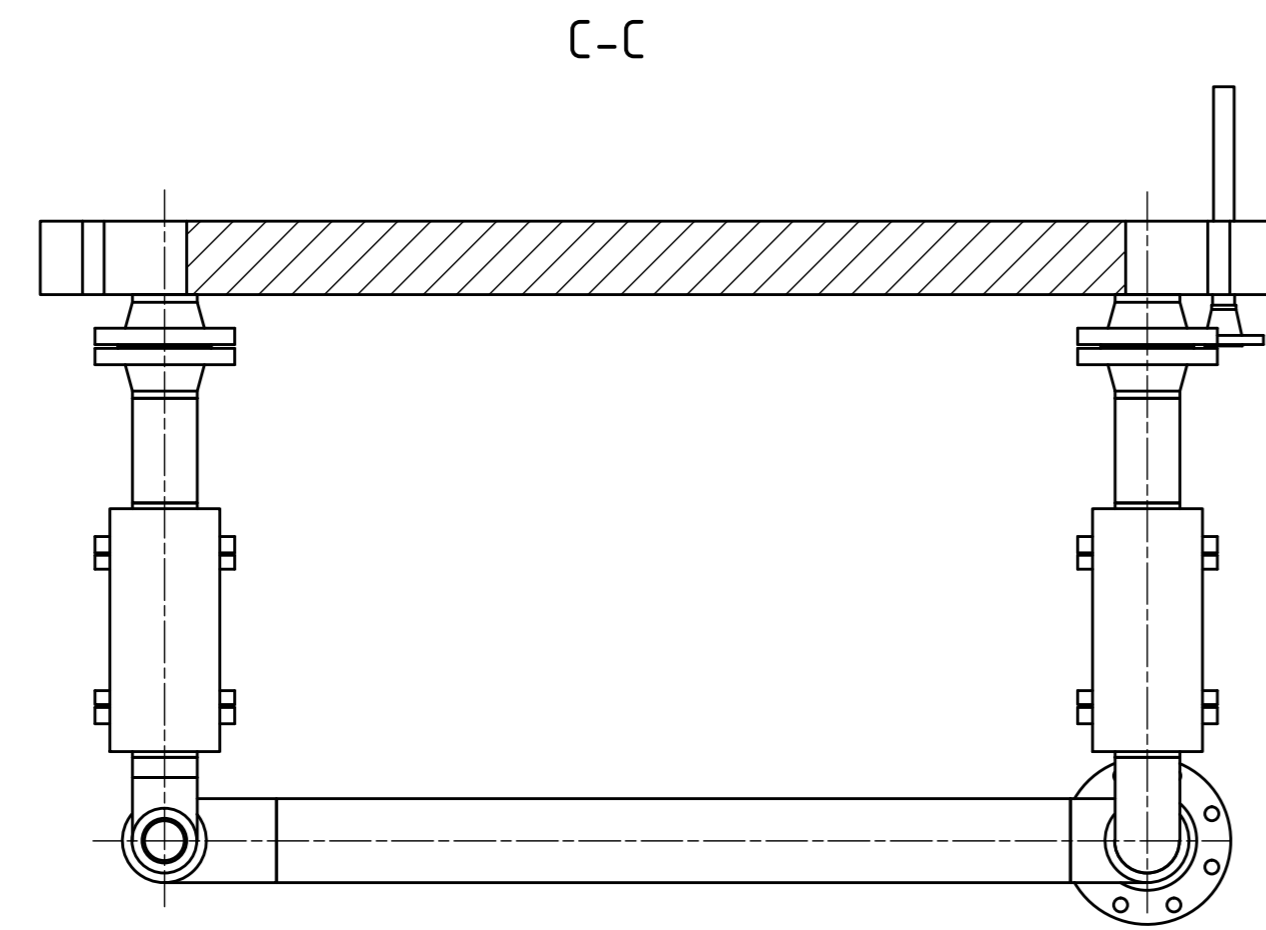
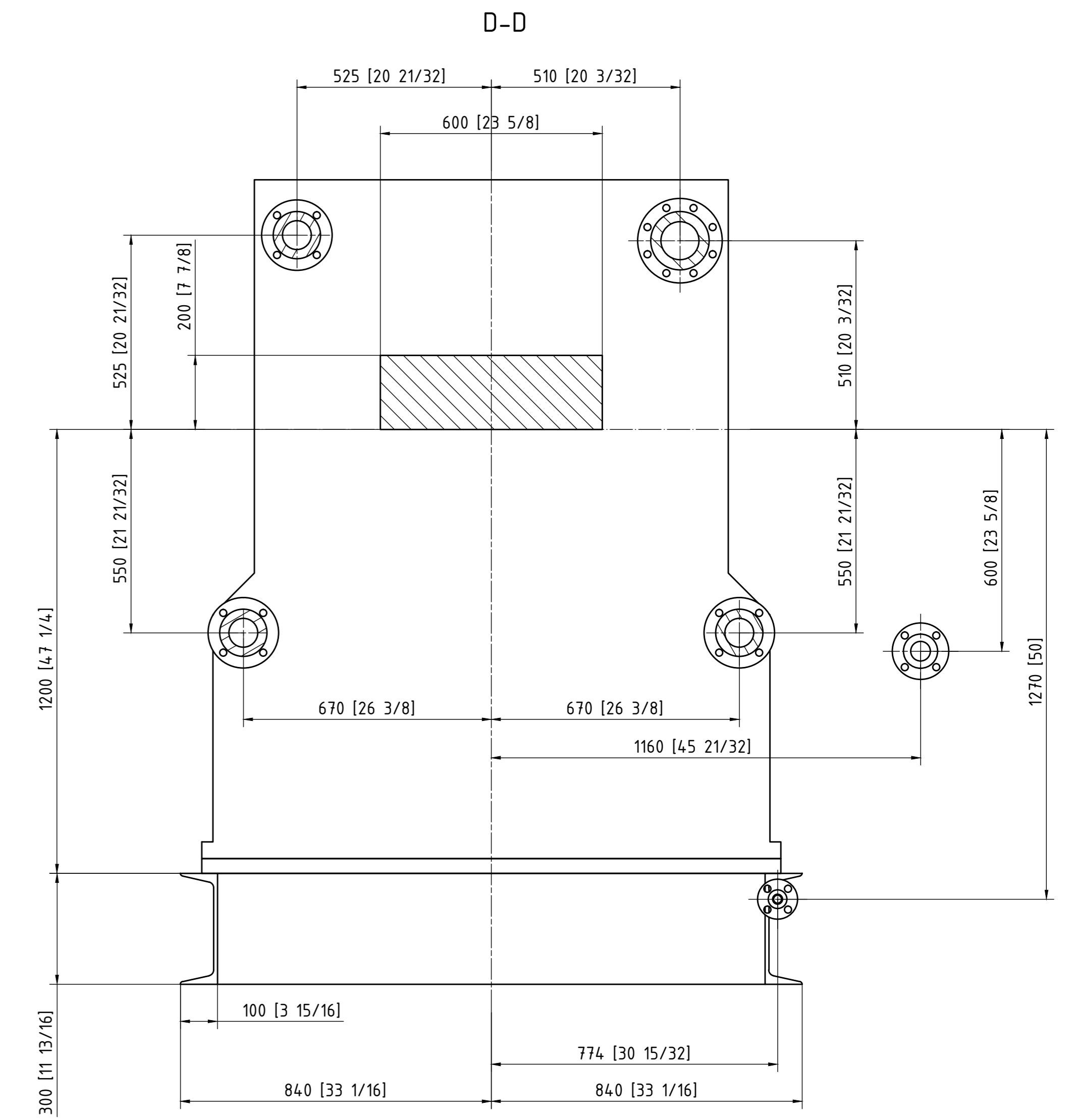
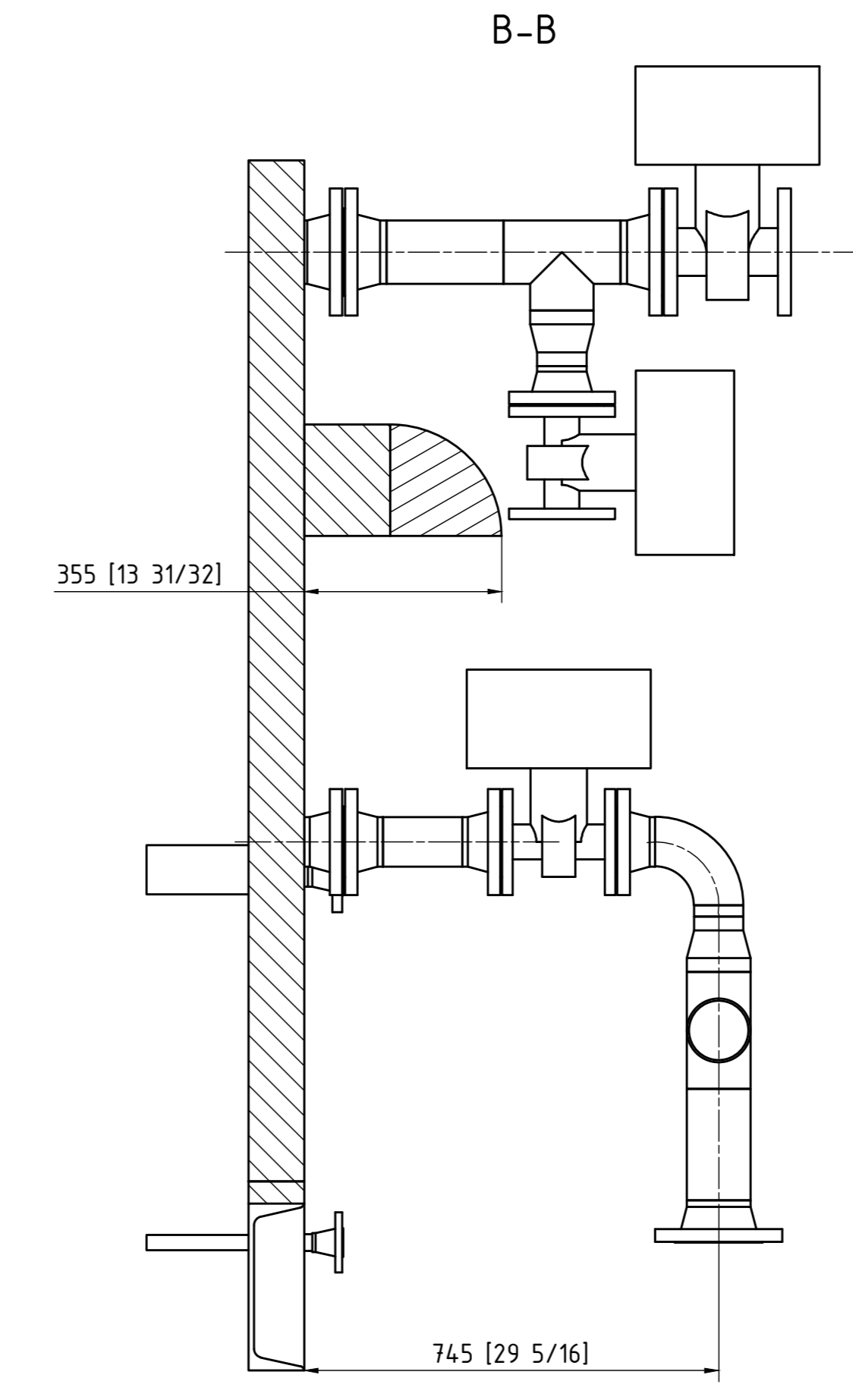
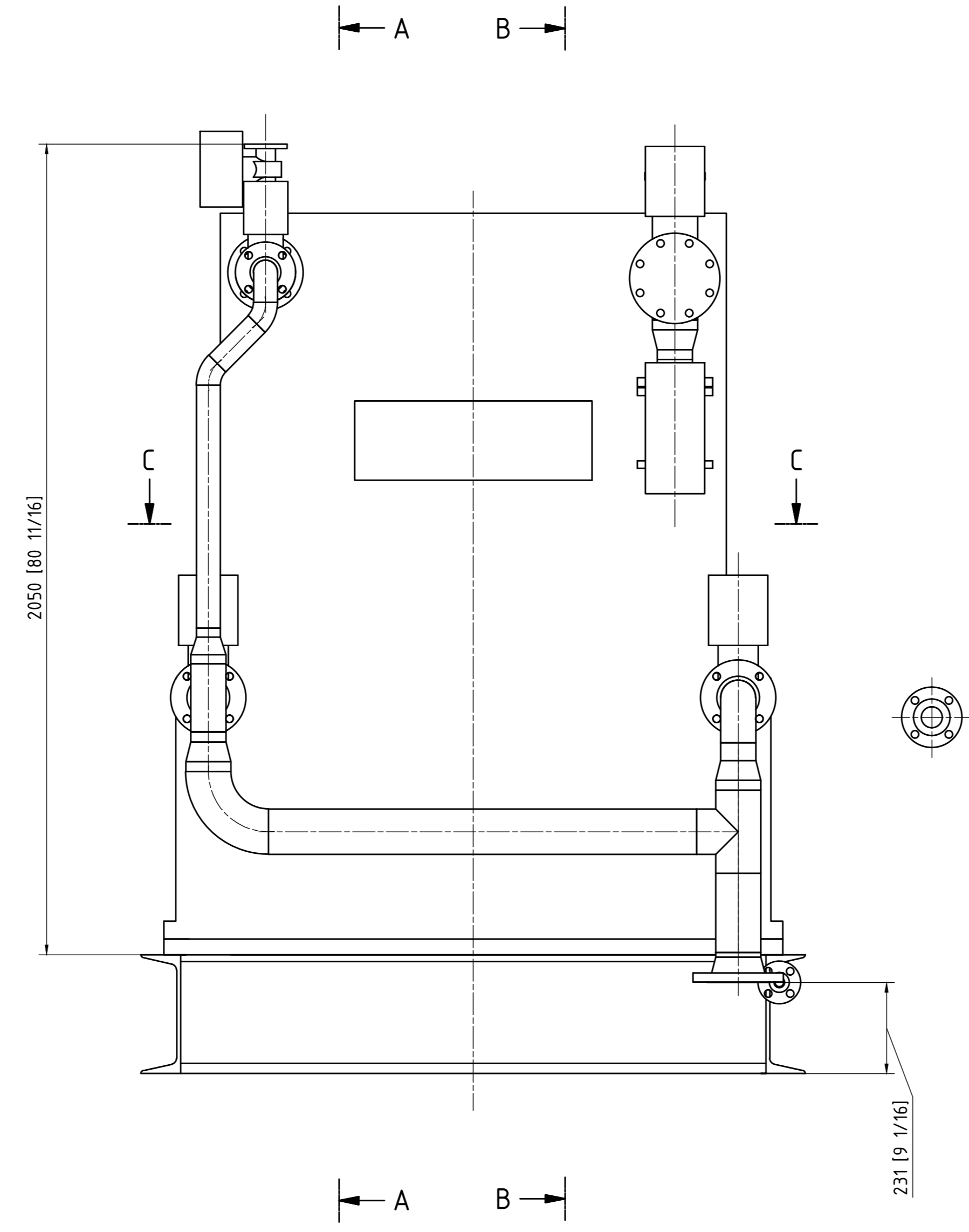
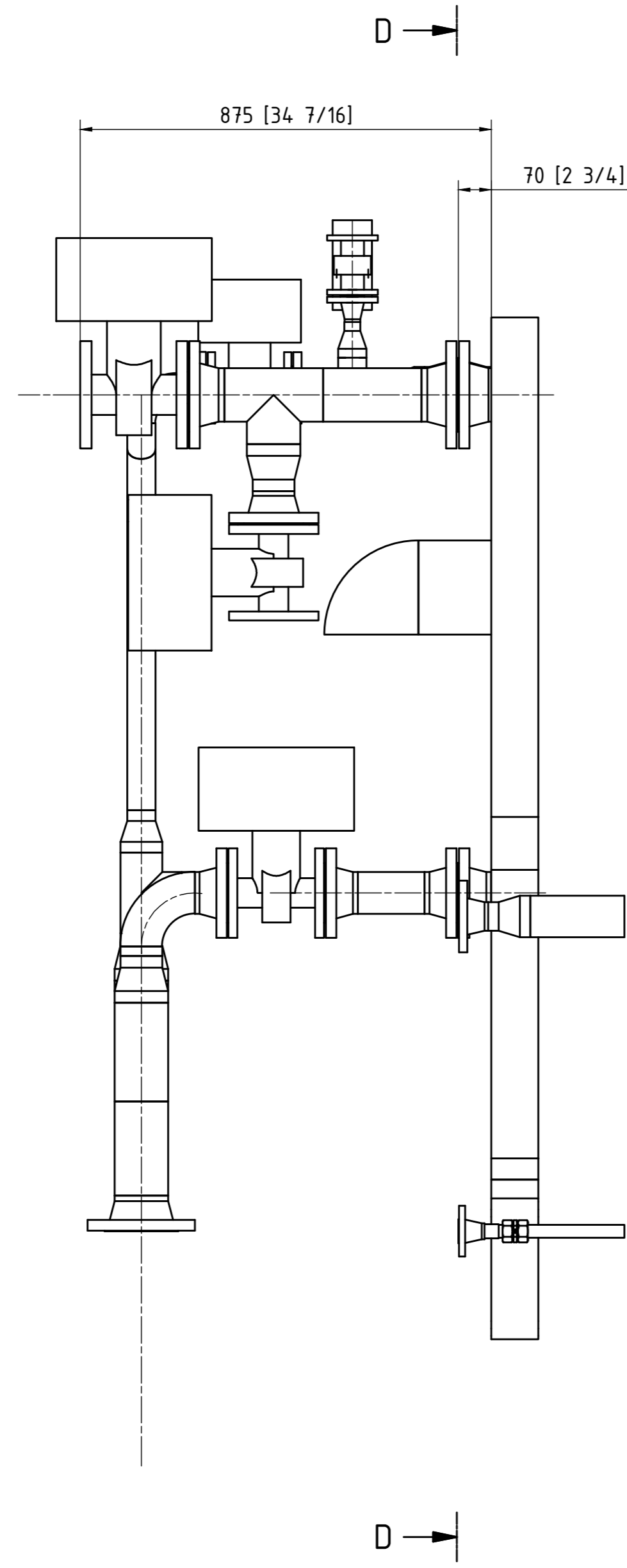
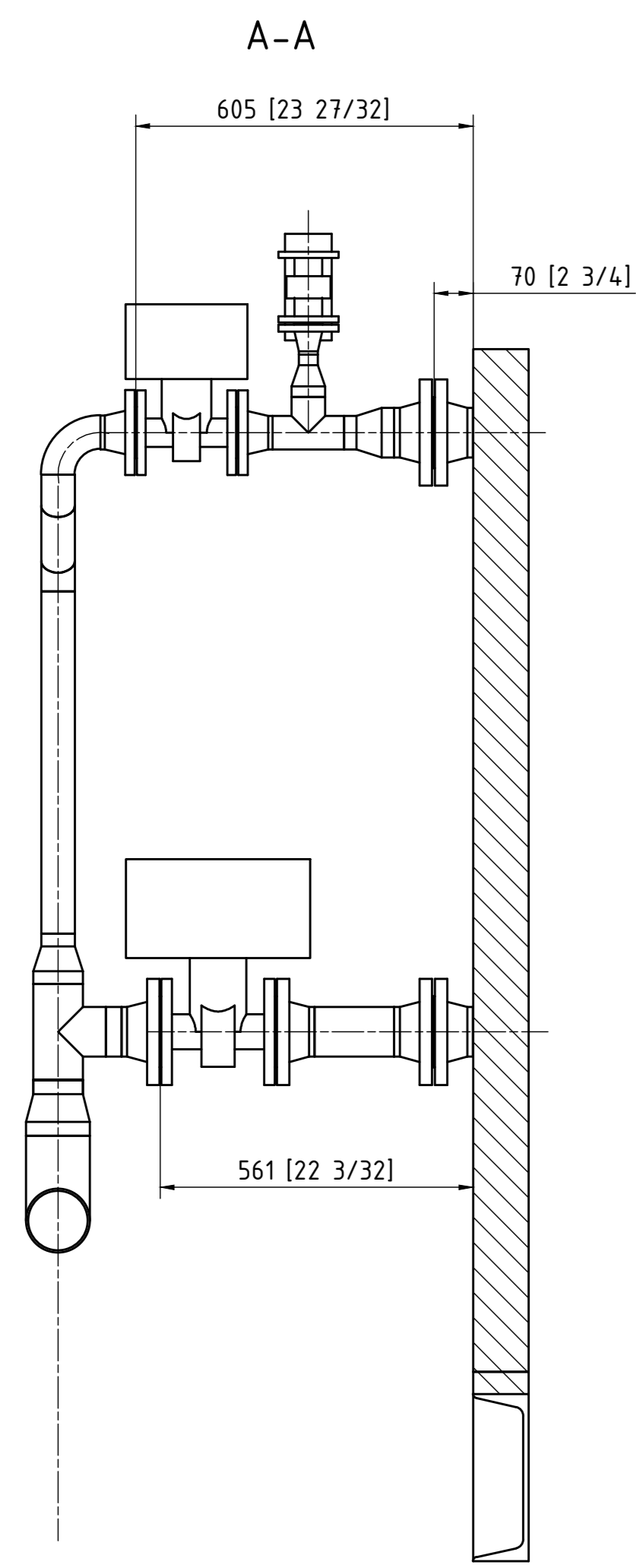
Project: DDCE (MARATHON)  
Location: VONORE, TN  
Tag #: 4101 - F01  
FILTER PRESS SYSTEM

Leergewicht: 19400 Kg  
weight empty: 42770 lb

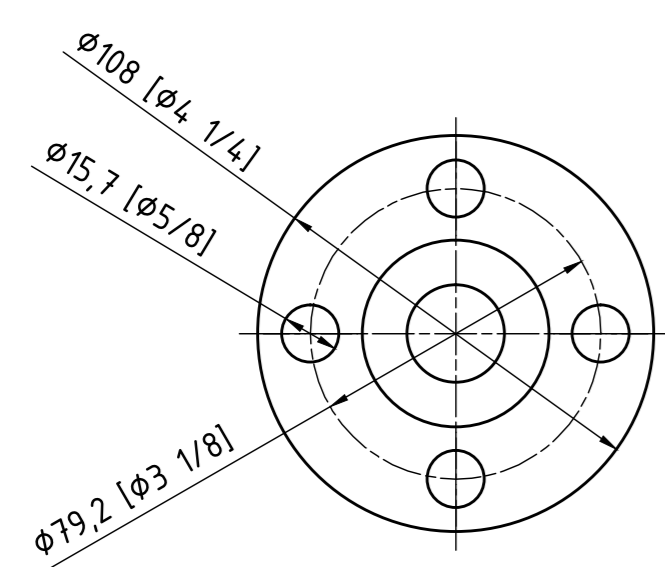
Betriebsgewicht: 20900 Kg  
operating weight: 46080 lb

1250 [4'-1 1/32"]	inch	Foot	millimeter
Freigegeben - Layer	Layer	Freigegeben - Layer	Layer
English	English	English	English
EW	EW	EW	EW

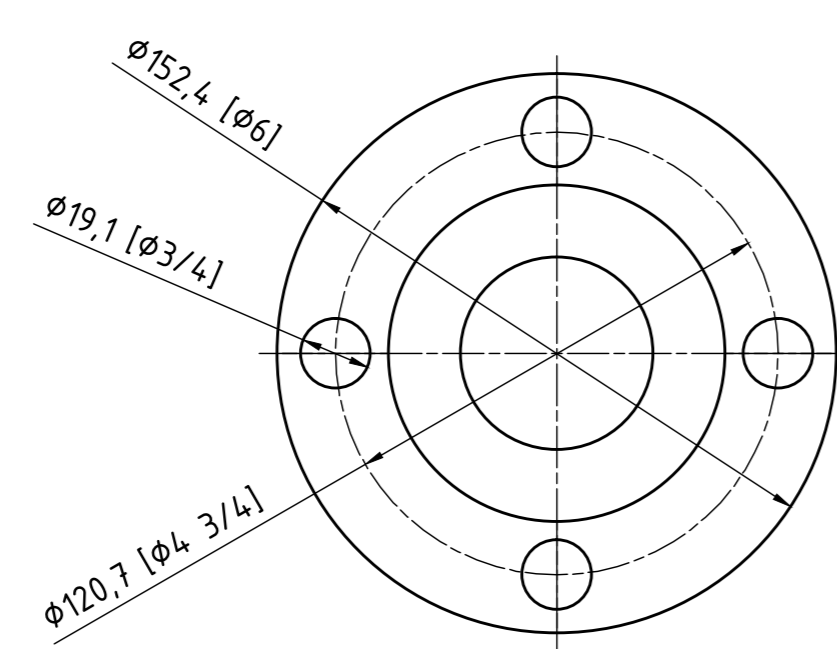
Erstellt durch:		Erstellt für:		Gewicht:	
Z/4		Maßstab 1:20		Allgemeintoleranz	
/3		ISO 2768 - mK			
Zust:		Datum		Name	
Änderung		Datum		Name	
Bearb. 23.08.2006		Ch. Becker		Maßblatt PKF 100 NG-2 mit AWM	
Gepr. Norm				main dimensions with Cloth Washer	
Ce dessin et ses feuilles ci-jointes restent notre propriété exclusive et ne peuvent être ni copiés ni communiqués à de tierces personnes sans notre autorisation écrite.		Putsch		SK5-16278/4 "FINAL" Press Dim.	
				Blatt A1	



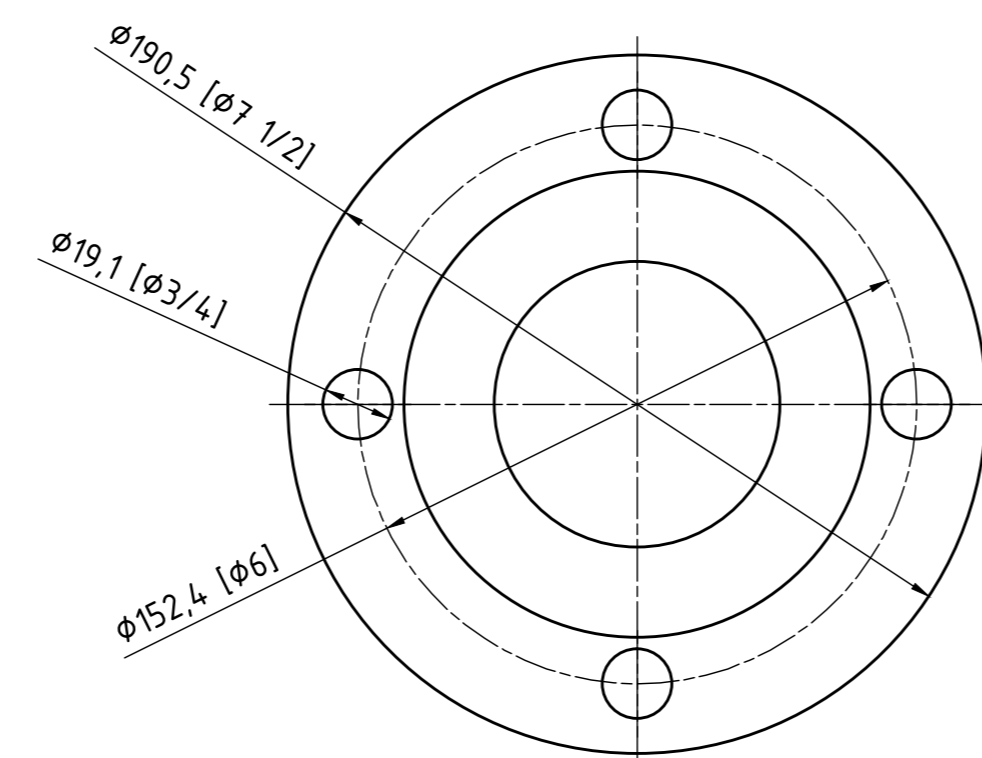
Flansch / flanges 1" ( 1 : 2 )



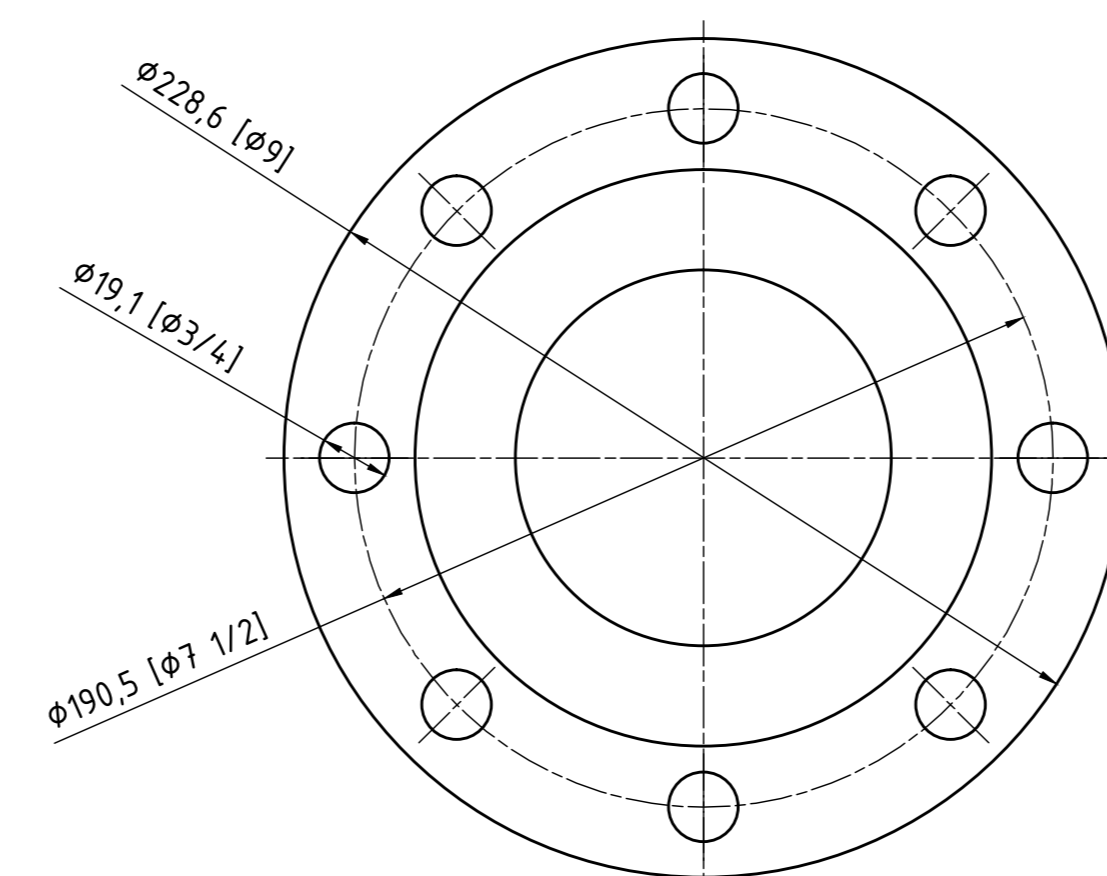
Flansch / flanges 2" ( 1 : 2 )



Flansch / flanges 3" ( 1 : 2 )



Flansch / flanges 4" ( 1 : 2 )



NOTE:  
All flanges are Class150 #, ANSI

Rev. 02: remove PT connection, move Filtrate header 10-09-09

Plant site: VONORE, TN  
Project: MARATHON  
PO.No.: DDCE11-0027  
EN No.: 4101-F01

Erstellt durch		gezeichnet	
Erstellt für		gezeichnet für	
Methode		ISO 2368 - mk	
Verhältnis		1 : 10	
Werkstoff		ISO 2368 - mk	
Zust.	Änderung	Datum	Name
<small>           Dieser Zeichnung sind alle Anlagen zugeordnet, die unter dieser Nummer gefertigt wurden. Die Zeichnung ist nur zur Darstellung der Anlage zu verwenden. Änderungen sind durch eine neue Ausgabe zu ersetzen. Die Zeichnung ist zu verwenden, wenn keine andere Angabe vorliegt.         </small>		Datum	Name
<small>           This drawing is to be used for the construction of the plant only. It is not to be used for any other purpose without the approval of the drawing office.         </small>		Datum	Name
<small>           Ce dessin est à utiliser uniquement pour la construction de l'usine. Il ne doit pas être utilisé à d'autres fins sans l'autorisation de l'atelier de dessin.         </small>		Datum	Name
<small>           Ca disegno è da usare solo per la costruzione dell'impianto. Non deve essere usato per altri scopi senza l'autorizzazione dell'ufficio disegni.         </small>		Datum	Name
<small>           This drawing is to be used for the construction of the plant only. It is not to be used for any other purpose without the approval of the drawing office.         </small>		Rohrleitungsplan PKF100NG-2 pipe arrangement plan	
<small>           Ca disegno è da usare solo per la costruzione dell'impianto. Non deve essere usato per altri scopi senza l'autorizzazione dell'ufficio disegni.         </small>		M5-16250A R02-FINAL ( as built) 1/23	

simplified adjusting instructions:

take upper pressure control valve out .  
take lower pressure control valve ca. 50% out.  
(below valve Y-31 and Y-38).

piloting Y-34 and Y-38.

screw upper pressure control valve to 70 bar (low pressure).  
(below Y-38).

piloting Y-34 and Y-31.

screw lower pressure control valve (below Y-31) on block.  
connect messure tube to 6.4.

adjust pressure control valve (below Y-30) to ca. 300 bar.  
adjust lower pressure control valve (below Y-31)  
to 270 - 275 bar (securit valve).

unscrew pressure control valve (below Y-30) 2 revolutions.  
adjust up to 260 bar (high pressure).  
(dekompression above Y-36)  
first activate Y-35, then Y-36.

**Attention !!**

The pressure control valve below Y-31 must always  
adjusting higher as the pressure control valve below Y-30.

screw pressure control valve (below Y-36) on block.  
(at the cylinder safety block under the key cylinder)  
piloting Y-31, Y-32, Y-33 and Y-34.  
close press to 260 bar.

unscrew pressure control valve (blow Y-36)  
up to pressure decrease is haerable,  
then screw ca. one revolution.  
(pressure decrease must not hearable)

**cylinder - safety block**

PADZ1112.420

**connections**

A / B= G1 1/4"  
AD/AM= G1 1/4"  
Y = G3/8"

**key cylinder**

Ø350/250-1600 .MM  
V=22mm/sec VOR  
V=23mm/sec ZURÜCK

**cylinder for chute cover**

**back side** Ø40/28-125MM  
**front side** Ø40/28-125MM

Ø63/45-.....MM  
V = 50mm/sec

**current divider for transport cylinder**

limit of hydraulic unit  
PADZ2203.500  
ALL DISPOSALS  
STRAIGHT FROM BLOCK

Attention:  
circuit points  
A2 : GE30ZSREDA3C 100MM  
PIPE EW30ZSA3C  
B2 : GE25ZSREDA3C 150MM  
PIPE EW25ZSA3C

reservoir capacity 300 litres  
Recommended hydraulic fluid :  
HL or HLP46 according DIN 51524  
range of viscosity at 40°C  
40 to 50 x 10<sup>-6</sup> m<sup>2</sup>/s (40 - 50 cSt)

- Y-30 pressure regulator
- Y-31 controlblock high pressure
- Y-32 press close
- Y-33 differentialcontrol off
- Y-35 dekompression keycylinder
- Y-36 dekompression keycylinder safetyblock
- Y-37 press open (1. package open)
- Y-38 controlblock low pressure
- Y-39 chutecovers close
- Y-40 chutecovers close
- Y-41 chutecovers open
- Y-42 chutecovers open
- Y-43 movement of plates, locking
- Y-44 movement of plates, open (2. package open)
- Y-45 transport cylinder (30 bar)
- Y-46 transport cylinder (6 bar)

Fremdsprachen - Layer	
Layer	Sprachen - ID
Deutsch	D
English	EN

Erstellt durch:		Ersatz für: PADZ2529A00/A		Gewicht: kg	
Mafstab: 1:1		Allgemeintoleranz: ISO 2768 - mK			
Zust.	Anderung	Datum	Name	Hydraulikplan PKF 100 NG-2 (16 bar)	
		31.05.2010	H. Schneider	hydraulic circuit diagram	
<small>Diese Zeichnung und ihre Beilagen sind unser geistiges Eigentum. Sie dürfen ohne unsere vorherige schriftliche Zustimmung nicht kopiert, vervielfältigt oder anderen Personen zugänglich gemacht werden. This drawing and its enclosures are our intellectual property. They must not be copied, duplicated or made accessible to other persons without our previous written permission.</small>					
				5-17117.16-10	
				Blatt A1	

all returns into the tank to be installed  
up to 100 mm above the ground

