Double Door Elevator VES SD

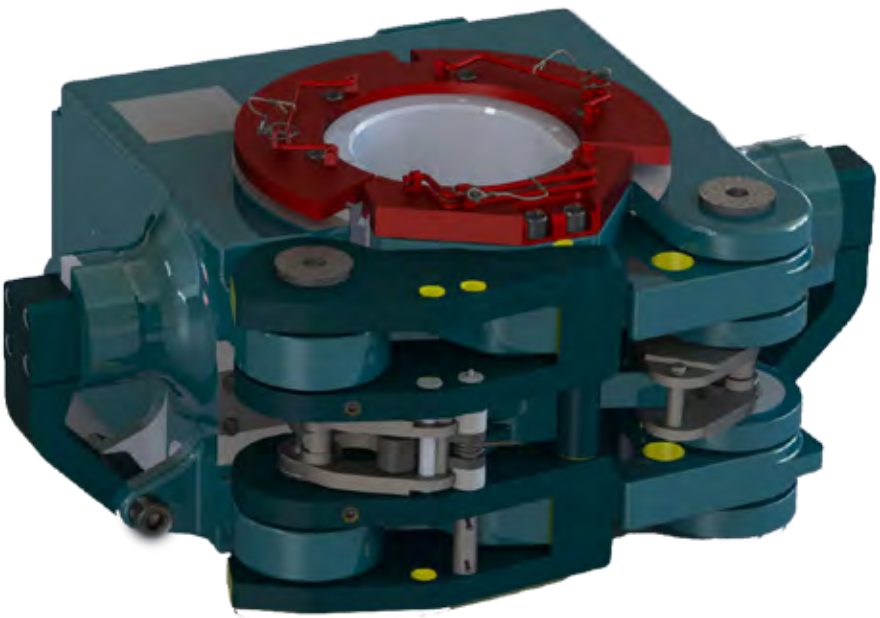
VES SD Type Series

Hydraulic operated elevator [with optional rotators]

VES SD Type Series					
Type	P/N	Load Rate [sh ton]	Type	P/N	Load Rate [sh ton]
VES-SD-350-1	635000 -Y /-VC /-FL	350 tons	VES-SD-500-3	646600 -Y /-VC /-FL	500 tons
VES-SD-500-1	646000 -Y /-VC /-FL	500 tons	VES-SD-750	676000 -Y /-VC /-FL	750 tons
VES-SD-500-2	646200 -Y /-VC /-FL	500 tons			

Operating Instructions

Original Operating Instructions



Manual PN 646200-Y-D Revision: 03, 05-2017

Revision history

Version	Date	Author	Changes
00	2014-09	B+V OT, ROK	Initial Release of Type Series Manual, Update and replacement for VES-SD Manuals
01	2015-04	FORUM Handling Tools OT, ROK	Connection Charts update, added
02	2015-11	FORUM Handling Tools OT, ROK	Layout Company Name update
03	06-2017	FORUM Handling Tools OT, ROK	Document Update, changemgmt.

Document Approval

Version	Author	Eng. Check	Approval Check
02	FORUM Handling Tools MH 06-2017	FORUM Handling Tools as per revision 02 check and change mgmt.	FORUM Handling Tools AV

We are grateful for suggestions and critique regarding this documentation or the product itself.
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Table of contents

A. General

I Basic Information

This operating manual refers to the
Double Door Elevator VES SD (hereinafter called VES SD) from FORUM Handling Tools for use on oil drilling platforms and rigs.

The permissible range of application is specified in the technical data.

This manual covers several different FORUM Handling Tools models from the VES SD Type Series that are all common in use and operation. Most assembly, disassembly, and inspection procedures are the same for all models. If there are differences, they are called out separately within this manual.
When installed in potentially explosive atmospheres, the instructions that follow the Ex symbol must be followed. Personal injury and/or equipment damage may occur if these instructions are not followed.

This operating manual is intended for the operator of the VES SD. It is intended to ensure safe operation and must be read carefully and kept where it is accessible for VES SD users at all times.

This operating manual contains all information on safe and proper operation of the VES SDs. Observance of these instructions is required for safe operation.

In addition, it is necessary to observe all applicable national and local regulations [e.g. accident prevention regulations and environmental regulations] as well as the company's own internal safety regulations.

For installation, maintenance and repair work and proper training of the operating personnel, Forum recommends requesting service from FORUM Handling Tools itself.

II Intended Use

The FORUM Handling Tools VES SD is designed to be used vertical in hanging links. The VES SD conduces as an association between the Top Drive, the Link and the drill tubes. The load capacity of the elevator is designated by the elevator make. The load capacity is limited in vertical direction only.

All Elevator can hold up to a total weight as listed in the specifications (refer to section 1.3 "Technical Data Type series" on page 19).

It is necessary to observe all applicable national and local regulations, e.g. accident prevention regulations and environmental regulations as well as the company's own internal safety regulations.

In addition to observing all instructions in this operating manual, intended use also includes observing all prescribed assembly, disassembly, startup, operating, repair and maintenance work at the specified intervals as well as all safety precautions.
The operation of the VES SD is allowed for the intended use only. All FORUM Handling Tools VES SD are designed in accordance with API 8C.

INFO

In this documentation the abbreviation **t** and the word **tons** are used to describe short tons. If the metric ton is referred it will explicit be named in the text or the abbreviation ton.

1 sh ton = 2000 lb = 907,19 kg
1 metric ton = 2204,62 lb = 1000 kg

III Improper Use

INFO

Improper use of the VES SD releases FORUM Handling Tools from any liability for personal injury or property damage resulting therefrom.

The VES SD are intended exclusively for lifting and holding the specified pipes. Always observe the specifications (refer to section 1.3 "Technical Data Type series" on page 19).

Additionally the intended use covers the compliance and observance of all procedures and safety notes of this manual as well as performing all necessary maintenance work in the given intervals.

The following is specifically prohibited:

- Use of bushings with pipe sizes for which use is not specified.
- Holding pipe with diameter for which use is not specified.
- Exceeding the load rating/limit of the particular VES SD
- Any use of the Elevator which is not intended.

Moreover operation of the VES SD are prohibited under the following conditions:

- When the Elevator is used for applications other than intended.
- When the hydraulic equipment is not installed properly.
- When the Elevator or parts thereof are damaged or when the additional equipment is not installed properly.
- When protective or safety equipment is damaged, unusable, improperly installed or not present.
- When the Elevator is not operating properly.
- When humans or foreign objects or personnel are located in the hazard area of an Elevator.
- When conversions or modifications have been performed without previous, written approval by FORUM Handling Tools .
- When tools not approved by FORUM Handling Tools are used.
- When the prescribed maintenance intervals have been exceeded.
- When replacement parts not approved by FORUM Handling Tools are used.
- When repair or service work has been performed on the Equipment by companies not authorized by FORUM Handling Tools .

Observe also the section "Warranty and Liability".

IV Potential Misuse

This manual contains information and warnings on procedures that adress hazardous conditions and could cause personal injury but cannot reflect all fashions in which hazardous consequences may occur due to service and/or operation. All personnel using this equipment or service procedures contained within this manual must be completely satisfied that personal and/or equipment safety will not be compromised.

Common methods of MISUSE include but are not limited to:

1. Use without ALL warning and identification labels present. This can cause operating personnel to misunderstand the areas of the equipment that can cause serious injury.
2. Use with insufficient and/or worn assemblies and parts. This can cause failure causing a suspended hazard which can result in serious injury or death. .
3. Use of the Double Door Elevator VES SD in methods not intended. The VES SD should be used ONLY in the methods described in this manual.

V Warranty and Liability

Liability

The technical information, data and instructions for operation contained in this operating manual correspond to the status at the time of print and are provided according to the best of our knowledge in consideration of our previous experience and know-how.

We reserve all rights to make technical modifications within the scope of technical development of the Double Door Elevator VES SD treated in this operating manual. Claims or entitlements cannot be deduced or derived from information, illustrations and /or descriptions in this operating manual.

FORUM Handling Tools is liable for all warranty obligations made within the scope of the contract for any faults or omissions on our part, excluding further claims. Claims for damages suffered are excluded regardless of the legal grounds.

Translations are complete according to best knowledge. We cannot assume any liability for translation errors, even when the translation was performed at our order.
Only the original text is binding. The original text language for FORUM Handling Tools documents and manual is English.

The descriptions and illustrations do not necessarily reflect the scope of delivery or any parts orders. The drawings and illustrations are not to scale.

Warranty

FORUM Handling Tools general terms of purchase and delivery apply. Purchasers recognize these conditions on the day the contract is signed, at the latest.

The terms and duration of FORUM Handling Tools warranty are specified in the sales documents as well as the order confirmation. These will be submitted to the operating company as information at the time the contract is signed, at the latest.

The manufacturer assumes no warranty whatsoever for damage or interruptions in operation resulting from failure to observe the operating instructions.

The operating manual is to be supplemented by the operating company with operating instructions based on existing national regulations on accident and environmental protection, including information on supervisory and reporting obligations taking into consideration operating peculiarities, e.g. in regard to work organization.

Warranty claims/complaints within the scope of the guarantee and liability for personal injury and property damage are excluded, when such result from any of the following causes:

- Any use other than intended;
- Improper installation, operation, maintenance or repair;
- Operation with defective, improperly attached or non-operational safety and/or protective equipment or devices;
- Failure to observe the instructions in the operating manual regarding safe conduct;
- Impermissible structural and/or functional modifications;
- Use of replacement parts not approved by FORUM Handling Tools;
- Normal wear or insufficient inspection of components subject to wear;
- External effects or force majeure;
- Lubricating the Double Door Elevator VES SD with lubricants other than those recommended by FORUM Handling Tools.

Info

Any structural or functional modification to the equipment by the operating company requires previous written approval by FORUM Handling Tools . Failure to obtain such approval voids the warranty as well as the declaration of conformity and releases FORUM Handling Tools from any product liability.

Following modifications or installation of optional equipment, all safety equipment must be reinstalled and checked by the operator for proper function.

VI Obligations of the Operating Company

Planning and Checking Safety Measures

The obligation of the operating company to due diligence includes planning safety measures and supervising their observance.

All personnel performing work on and with the VES SD must be trained by the operating company for the work performed on and with the VES SD.

All personnel must have read and understood the operating manual.

Minimizing Risk of Injury

The following principles apply to minimize the risk of injury:

- Ensure that work on the VES SD is performed only by qualified personnel.
- The personnel must be authorized for such work by the operating company.
- The personnel must wear the prescribed protective equipment.
- Procedures, competencies and responsibilities must be clearly defined and established in the area of the VES SD. Proper behavior in the event of a malfunction must be clear for everyone. The personnel must be given regular training.
- All WARNING signs and information on the VES SD must be complete and easily legible. For this purpose WARNING signs and information are to be cleaned regularly and replaced as required.

Trouble-free Operation

The following principles apply for trouble-free operation:

- Keep the complete operating manual at the location where the VES SD is in operation where it is easily accessible for everyone and in an easily legible condition.
- Use the VES SD exclusively for its intended purpose.
- Use the VES SD only when it is in a perfect operating state.
- Before starting work, check to ensure that it is in a safe operating state and functioning properly.

Requirements for Operator

Basic knowledge of safe handling and use of the VES SD includes knowledge of the general safety precautions.

Ensure that the VES SD is operated only in compliance with the general safety precautions and other instructions in this manual.

Training

The operating company is obligated to organize and hold regular training to ensure that all personnel involved with transporting, installing, operating and/or servicing the VES SD is familiar with the required procedures and safety precautions.

Minimum Qualifications

All work on the equipment requires special knowledge and qualifications on the part of the operating personnel.

All personnel working on VES SD must have the following qualifications:

- Personal suitability for the work performed.
- Suitable qualifications for the work performed.
- Familiarity with the safety equipment and its function.
- Familiarity with this operating manual – particularly the safety precautions – and all sections relevant for the work to be performed.
- Familiarity with the elementary instructions on operating safety and accident prevention.

In general, all employees must have one of the following minimum qualifications:

- Technical training for independent work on the VES SD.
- Sufficient qualifications for working on the VES SD under supervision and at the instructions of a trained specialist.

VII User Groups

This operating manual is subdivided into the following user groups:

Personnel	Qualifications
Operating personnel	Sufficiently trained in: • Functional procedures on the equipment • Operating procedures Knowledge: • Competency and responsibility in regard to the work to be performed • Behavior in emergencies
Service personnel	Basic knowledge of Mechanics Hydraulic Authorizations (according to standards of safety engineering): • Starting up equipment • Grounding equipment • Marking of equipment • Basic knowledge of installation and operation of the VES SD.

Special Technical Knowledge

The following work should be performed only by specially trained personnel:

Work Performed	Qualifications
Work on hydraulic system	Special knowledge and experience with work on hydraulic systems.
Work on mechanical parts	Personnel qualified or trained in industrial mechanics; work is to be performed only under supervision and on instructions of a person qualified in accordance with generally accepted codes of practice in industrial mechanics.

VIII Safety Symbols

The safety precautions in this document contain standardized depictions and symbols. Four hazard classes are distinguished depending on the probability of occurrence and severity of the consequences.

Selection of the WARNING category depends on the probability of occurrence and the possible extent of damage.

NOTE

Situations which could result in damage to the machine or its surroundings or to tools are distinguished in this manner, supplemented, where applicable, by a pictograph.

⚠ CAUTION

Indication of recognizable hazard for humans or possible property damage.

Failure to observe can lead to reversible injuries or property damage!

The symbol as specified in ANSI Z535.6 emphasizes the cause.

Measures for avoiding are listed.

⚠ WARNING

Indication of recognizable hazard for humans.

Failure to observe can lead to irreversible injuries!

The symbol as specified in ANSI Z535.6 emphasizes the cause.

Measures for avoiding are listed.

⚠ DANGER

Indication of imminent hazard for humans.

Failure to observe can lead to irreversible or lethal injuries!

The symbol as specified in ANSI Z535.6 emphasizes the cause.

Measures for avoiding are listed.

Preliminary Safety Precautions

Safety precautions are given in the preceding form at the beginning of complete chapters or sections. They apply for the entire chapter or the entire subsequent section.

Safety Precautions Relevant for Action

If a safety precaution applies only for one single action or a short series of actions, it is integrated into the text preceding the possible hazard point.

For example:

1. Attach hoisting gear to eye bolts in cover.

⚠ CAUTION Danger of pinching/crushing hands! The cover can fall shut when the retainer is not engaged. Never open the cover by hand.

2. Open the cover with a crane and suitable hoisting gear.
3. Unscrew the M10 bolts on the hydraulic assembly with a 17 mm box wrench.
4. .

Instructions for Safe Procedure

Special work steps to ensure Safe Procedure are depicted as follows (example):

Safe Procedure

5. Shut off machine.
6. Disconnect supply lines.
7. Attach machine to crane.
8. .

Linguistic Conventions

This documentation uses terms and symbols intended to help you find information more easily, perform work steps more effectively and recognize dangerous situations more quickly. These symbols and terms are explained below:

All important text sections are printed in bold face.

- Lists without any necessary sequence are marked with a dash (-) at the left side of the column.
- Individual activities to be performed are indicated by a dot (•) to the left of the column.

Relevant consequences of an action or work step are marked with an arrow >) in the left margin.

Enumerations in a certain sequence (e.g. a series of work steps) are indicated by sequential numbers (1, 2, 3,.) in the left margin.

For example:

1. Unscrew nuts on machine feet.
2. Lift machine.

For greater clarity the illustrations are located in the right column with the text opposite or directly below the associated text section. Larger illustrations extending over the entire width of the page are located before the explanatory text. The illustrations are provided with captions in telegraph style.

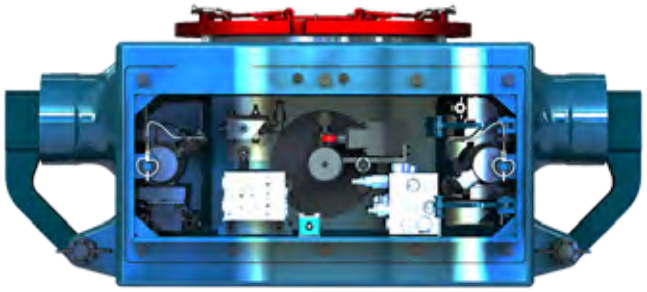

Fig. 1: Illustration Example Machine

INFO

Additional information and relationships requiring special attention are distinguished in this manner.

IX Personal Protective Equipment (PPE)

The following symbols located at appropriate points in the operating manual indicate that it is mandatory to wear personal protective equipment:

WEAR PROTECTIVE GLOVES!

WEAR EYE PROTECTION!

WEAR SAFETY SHOES!

WEAR PROTECTIVE HELMET!

WEAR EAR PROTECTION!

X Conformity

The VES SD satisfies all requirements in applicable directives and standards. A sample of the EC Declaration of Conformity is given in the appendix.

INFO

This operating manual is a part of the technical documentation for the VES SD. The EC Declaration of Conformity is delivered together with the VES SD. Keep these instructions and the associated documents for later use.

XI Contact FORUM Handling Tools worldwide

In the event of problems that cannot be solved with the aid of this manual, please contact one of the following addresses.

Forum B + V Oil Tools GmbH
Hermann-Blohm-Strasse 2
20457 Hamburg
Germany
tel: +49.40.37022.6855
fax: +49.40.37022.6899
Email: oiltools@f-e-t.com
web: www.f-e-t.com
www.blohmvoss-oiltools.com

FORUM Handling Tools
1023 Forum Drive
Broussard, LA 70518 USA
tel: +1.337.373.1800
fax: +1.337.369.6893

FORUM ENERGY TECHNOLOGIES Drilling Service Locations
Email:ForumDP.Sales@f-e-t.com

Canada
#106, 3903 - 75 Ave
Leduc, Alberta T9E 0K3
tel: +1 780.980.0345
fax: +1 780.986.3278

Mexico
Avenida Avante Monterrey N 300
Parqu Industrialxico
tel:+ 52.81.8245.6800

Scotland
Peregrine Road, Westhill
Aberdeenshire, AB32 6JL
tel: +44.1224.744000

United Arabic Emirates
Oilfields Supply Center
Building B-45
Jebel Ali Free Zone Dubai UAE
tel:+971.4.883.5266

Singapore
No 51 Benoi Road #06-00
Liang Huat Industrial Complex, Singapore
629908
tel: +65.6465.4850
fax: +65.6465.4851
Out of hours +65.913.898.12

XII Online Technical Document access

a. Information via homepage

INFO

For further and actual information you can also visit our homepage in the Internet.

A digital version of the operation instructions for this product as well as the operation instructions, safety- and update notes for other FORUM Handling Tools products can be reached via the blohmvoss-oiltools homepage.

To join our Internet Technical Documentation service with the latest updates on new technical documentation in a free and easy way, you must register to our service with your email-address and name in the customer-login area ❶ on www.blohmvoss-oiltools.com.

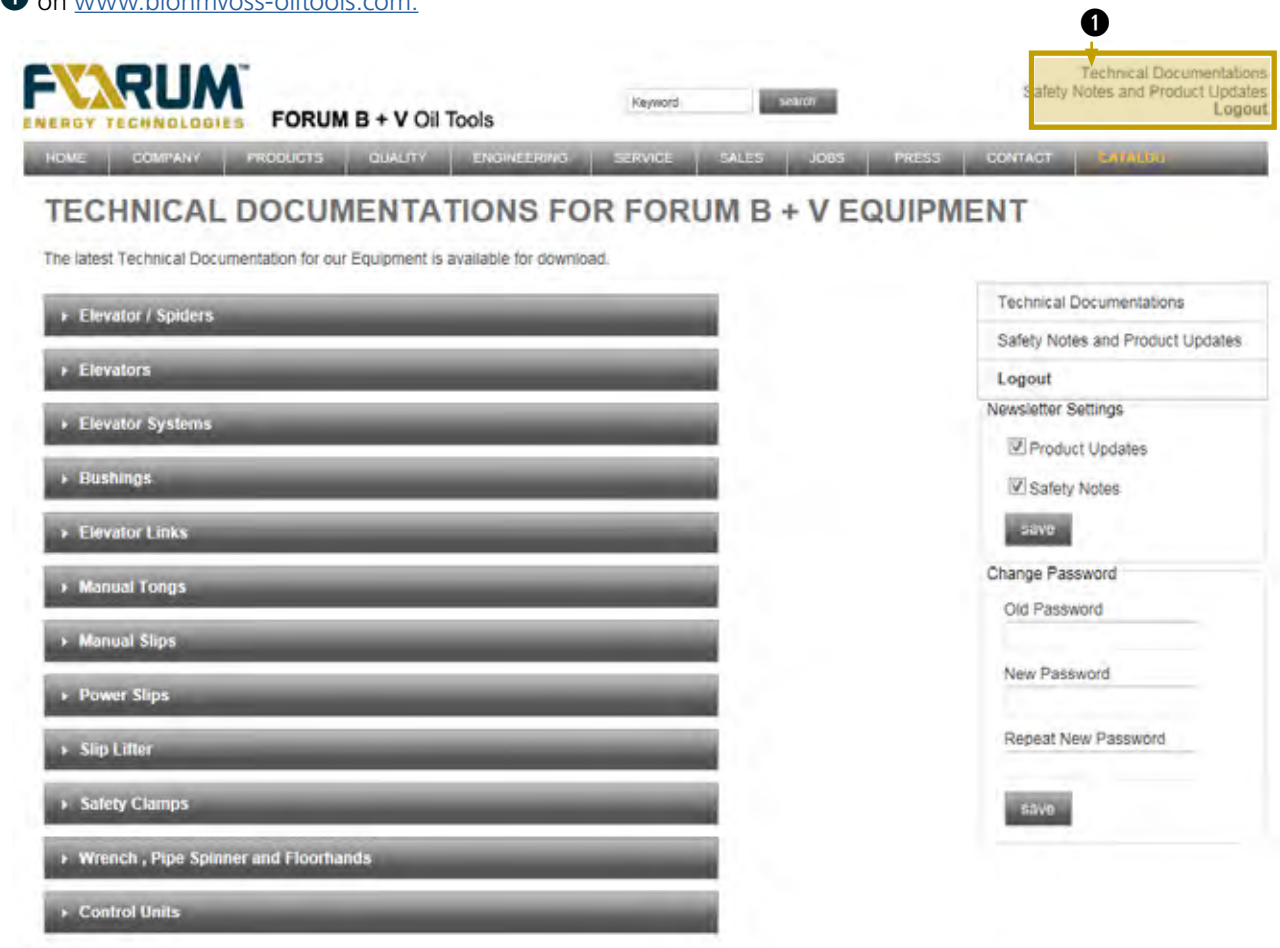

Fig. 2: Illustration Service–Homepage

b. Information via Extranet

INFO

For further and actual information you can also visit our Extranet homepage .

A digital version of the operation instructions for this product as well as the operation instructions, safety – and update notes for other FORUM Handling Tools products can be reached via the Extranet.

To join our Internet Technical Documentation service with the latest updates on new technical documentation in a free and easy way, you must register to our service with your email-address and name in the customer-login area on https://www.accessoiltools.com/fx/ .

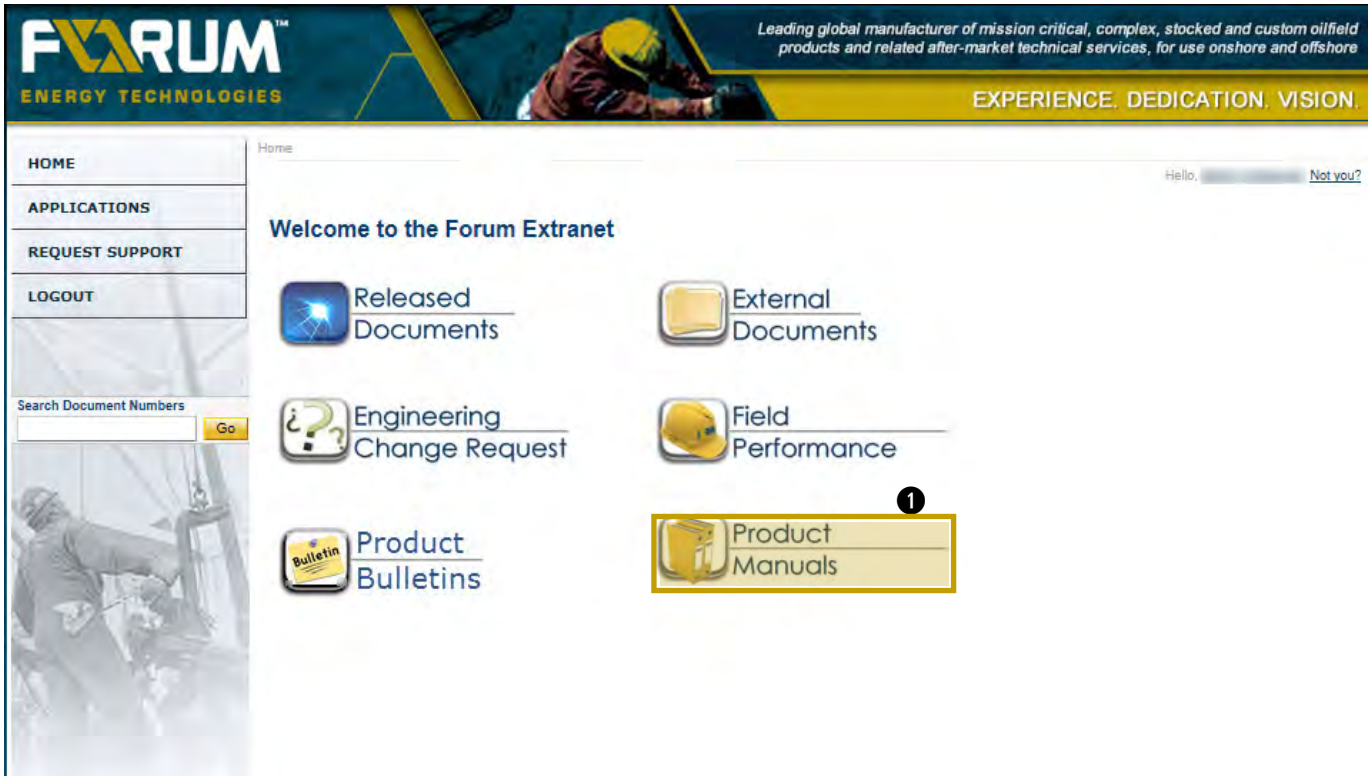

Fig. 3: Illustration Service–Extranet

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DESCRIPTION

1 Description

The FORUM Handling Tools VES SD Elevators are designed with strength and safety factors in accordance with API Regulations Section 8C - and are to be used for handling long, heavy strings of casings.

The VES SD can be operated easily by one man due to replaceable bushing segments and a positive locking mechanism.

The design of the bushing segments allows the tool to grip casing with uniform radial pressure, ensuring a safe hold while minimizing the possibility of damage to the pipe. The elevator is available for hydraulic power and bushing operation only.

All Elevators from each Type Series are manufactured with a Latch and a Lock to secure the lock mechanism against accidental opening, ensuring a safe hold while minimizing the possibility of damage to the pipe.

Features and Benefits

- Available in 350 sh ton up to 750 sh ton models.
- Replaceable bushings made of hardened material.
- Allows for a sustainable higher load rating thanconventional elevators.
- Utilizes the same body for multiple pipe sizes.
- Hydraulic operated automated devices available.

1.1 VES SD Main Assemblies

The VES SD consists of the assemblies described below.

Info

Please note that this illustration does not reflect the scope of delivery (see also Chapter „Warranty and Liability“). FORUM Handling Tools offers bushing assemblies as accessories to match the specific pipe diameters.

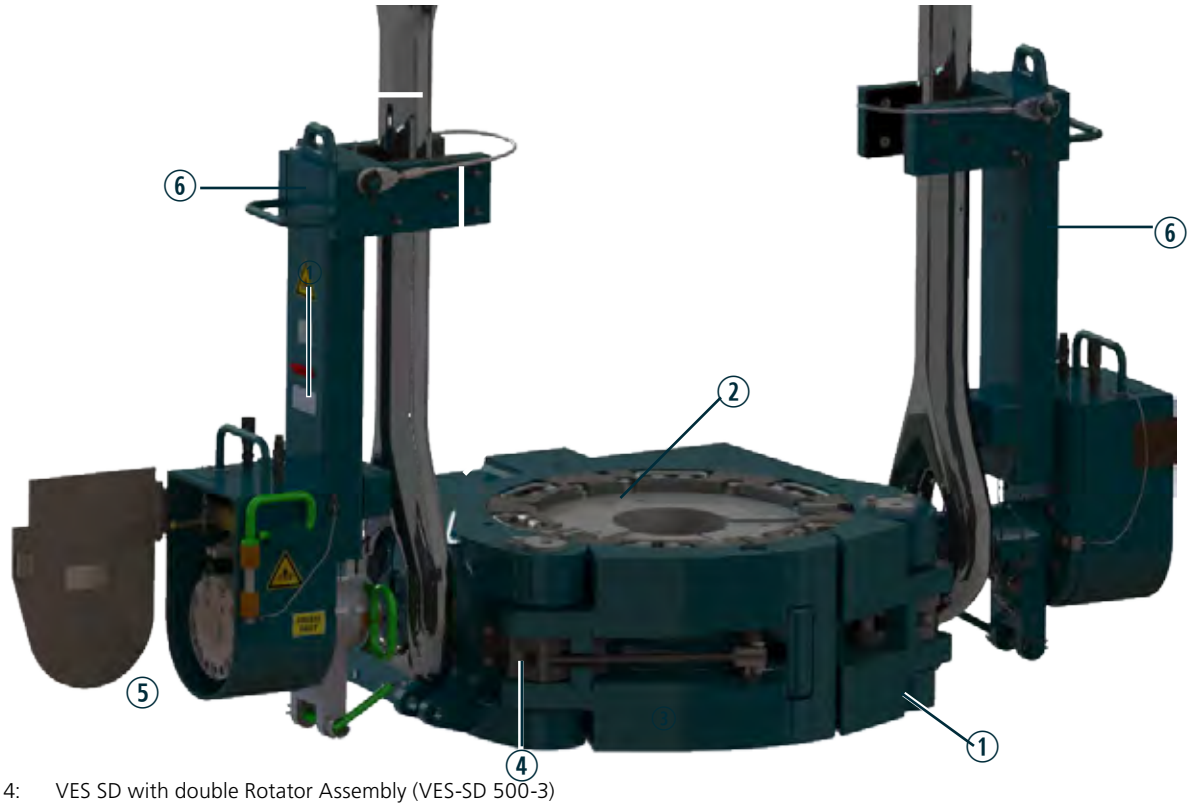


Fig. 4: VES SD with double Rotator Assembly (VES-SD 500-3)

Item	Name	Item	Name
①	Elevator Frame	②	Bushing system
③	Elevator Door right	④	Latch Lock
⑤	Elevator Door left	-	Single Elevator Rotator (optional)
⑥	Double Elevator Rotator (optional)		

A catalog with complete general drawings and parts lists for the assemblies of the VES SD can be found in chapter 5 in this manual.

1.2 Assemblies and Components

Elevator Frame

The FORUM Handling Tools VES SD Elevators are made of high-quality, heat treated and tested steel castings. For a proper balance during the opening and closing procedure the body and doors are constructed to meet the center of gravity.

All elevators are made with a Latch Lock to secure the lock mechanism against accidental opening.

When the doors are open, the pipe is placed in the elevator. When the automatic closing trigger is activated by the pipe, the elevator automatically closes.

Not before the elevator is properly closed and latched, the feedback signal „elevator closed and latched“ is given to the operator. The frame takes the load transferred through the bushing system and transfers it to the elevator links.

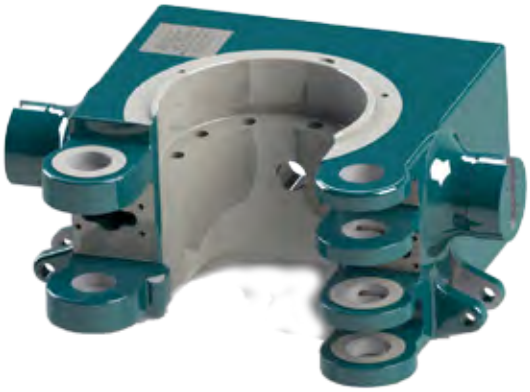


Fig. 5: VES SD Elevator frame (VES-SD750 / 1)

Bushing System

The design of the bushing segments allows the VES SD to grip casing with uniform radial pressure, ensuring a safe hold while minimizing the possibility of damage to the pipes. The elevator is available for hydraulic power bushing operation only. The machine is approved for operation in explosion hazard areas.

The VES SD elevator can be converted for use as casing, drill pipe, drill collar or tubing elevator, and can be operated easily by one man due to replaceable bushing segments and a positive locking mechanism.

Fig. 6: VES SD Bushing system (VES-SD 750 / 1)

Programming of software

It is recommended to program the software according to this description.

- Driller opens the elevator.
- The doors open.
  To open the doors, the software needs a min opening signal of approx 8 seconds. If this is short, the still activated trigger will close the doors with pipe inside again.
- After 5 seconds there is an automatic signal to arm the elevator.
- When the pipe hits the trigger, the elevator closes immediately.

Hydraulic Assembly

Double acting hydraulic cylinders open and close the door. For this purpose it is necessary to supply pressure alternately to hydraulic connections.

The elevator has three connections on the rear
(A, B and C for BV type series
P, T and XP for VC type series).

A - used to close the elevator.
(P: Constant hydraulic pressure)

B - used to open the elevator.
(T: Tank Line)

C - used as a feedback line.
(XP: Pilot Signal (Feedback)).

All hydraulic connections have a coupling bushing and a plug coupling with quick connection couplings, 3/8 and 1/4. The used coupling by FORUM Handling Tools fulfill the ISO 16028 standard and are ideal for interchangeability with other manufacturers.
This features include the ability to connect with virtually no air inclusion or disconnect with little or no spillage.

- 5075 psi maximum operating pressure for all sizes (connected and disconnected)
- Push - to - connect
- Standard sleeve - locking device prevents accidental disconnection

1 Male Coupling

2 Female Coupling

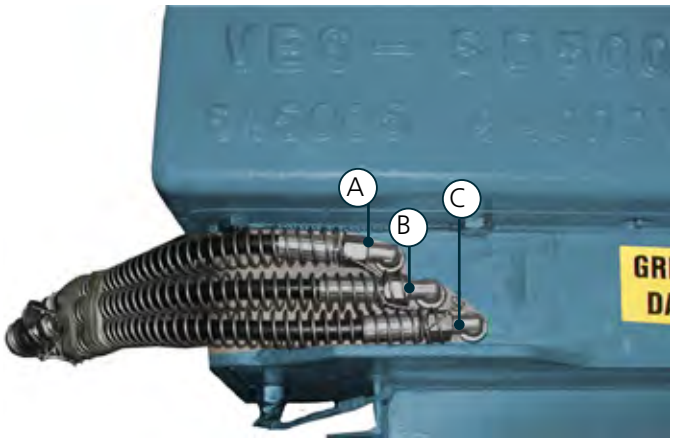


Fig. 7: VES SD Hydraulic connections (BV Type - VES-SD 500)

Fig. 8: VES SD Hydraulic connections

Additional Features:

Features:

- Closing trigger
  An integrated trigger system for automatic door closing.
- Elevator Load Sensor
  The load sensor prevents unintended opening under load for weights higher than approximately 300 kg (depending which bushing sizes are installed).
- Hydraulic feedback signal "Elevator closed":
  When the elevator is fully closed and latched the driller receives a hydraulic closing signal (feedback signal).

1.3 Technical Data VES SD Type series

Name	VES SD 350	VES SD 500 / 1	VES SD 500 / 2	VES SD 500 / 3	VES SD 750
Size	2.3/8" - 9.7/8"	2.3/8" - 9.7/8"	10.3/4" - 20"	20" - 30"	2.3/8" - 9.7/8"
Capacity	350 sh ton	500 sh ton	500 sh ton	500 sh ton	750 sh ton - 18° 1000 sh ton - 90°
Partnumber[2]	635000-Y/-VC/-FL	646000-Y/-VC/-FL	646200-Y-/VC/-FL	646600-Y-/VC/-FL	676000-Y-/VC/-FL
Rotation System [5]	see table in chapter refer to section 1.4.5 "FORUM Handling Tools Elevator Rotator Systems for VES SD Elevator" on page 25				
Control Switch [5]	see table in chapterrefer to section 1.10 "Controls and Component Sizes" on page 29				
Bushing Assembly	645031-BC	645031-BC	645230-BC	645600-BC	675030-BC
Hook Up Kit [3]	675000-HUK	675000-HUK	675000-HUK	675000-HUK	675000-HUK
Length	874 mm	874 mm	1300 mm	1550 mm	1065 mm
Width	1100 mm	1180 mm	1496 mm	2016 mm	1280 mm
Height	456 mm	456 mm	4453 mm	490 mm	674 mm
Ear to ear	1100 mm	1100 mm	1369 mm	1840 mm	1200 mm
Weight [4]	952 kg	1102 kg	1980 kg	3800 kg	1980 kg

1 not covered by this manual 2VC = with NOV Control FL= Feedback level 4 weight without bushing 5 Optional

Environmental conditions	
Hydraulic Working Pressure	Min 130 bar (1,885 Psi), Max 210 bar (3,040 Psi)
Temperature Working Range	- 20° C to + 60° C - 4° F to 140° F
Maximum allowed pressure	210 bar (3046 Psi)
Required Flow rate	Min 6 Gpm (22 l/m) Max 10 Gpm (37 l/m)

INFO

The term Bore Code and „BC" is a placeholder for various pipe-types with different diameters.

A list of bore codes can be found in the FORUM Handling Tools General Catalog.

With the sale request the complete part number of desired Bore Code (BC) is specified for example as 645600-109

(Instead of 645600-BC).

1.4 Main Dimensions

1.4.1 VES SD 350 Main Dimensions

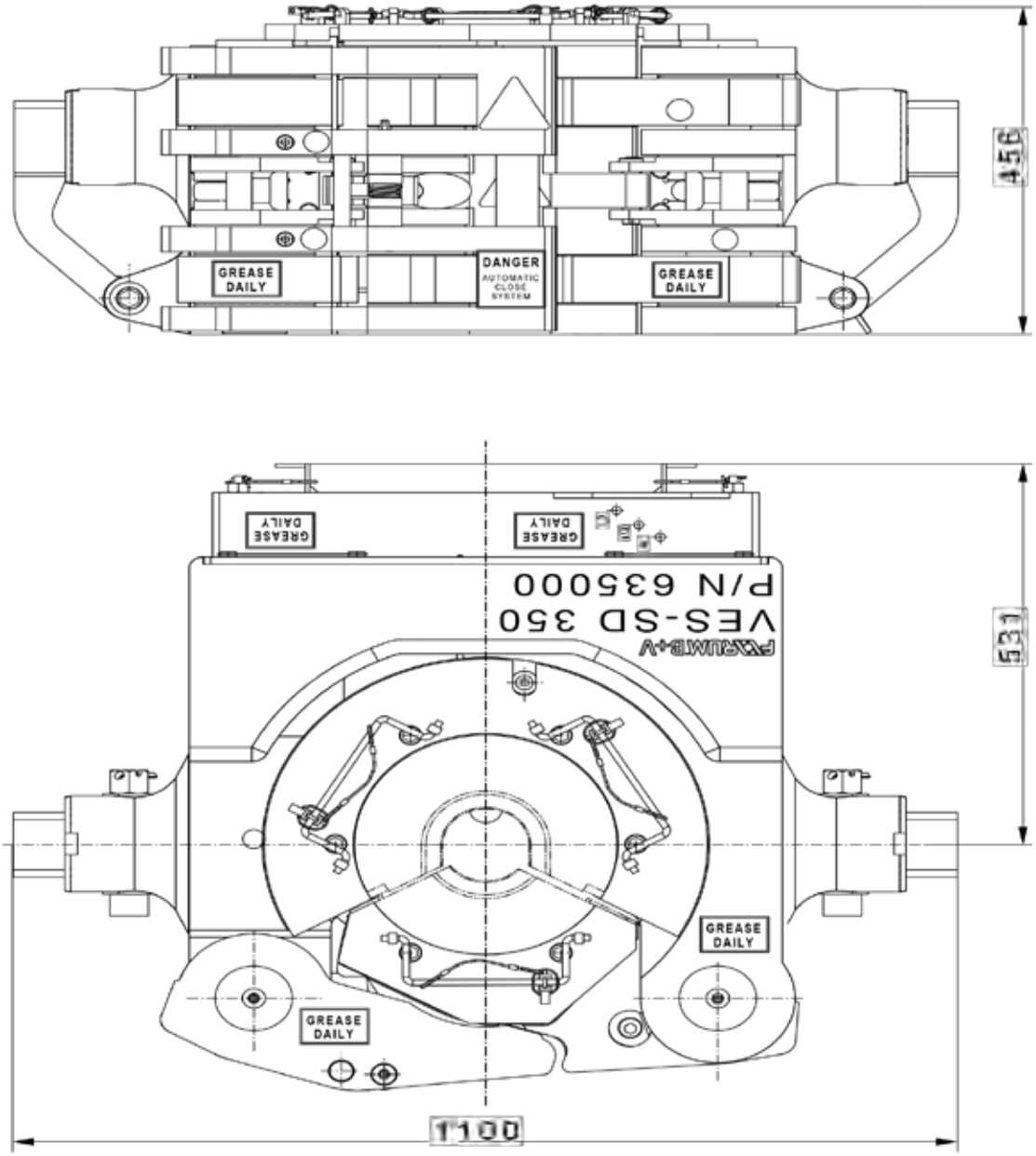


Fig. 9: VES SD350 Dimensions

1.4.2 VES SD 500 / 1 Main Dimensions

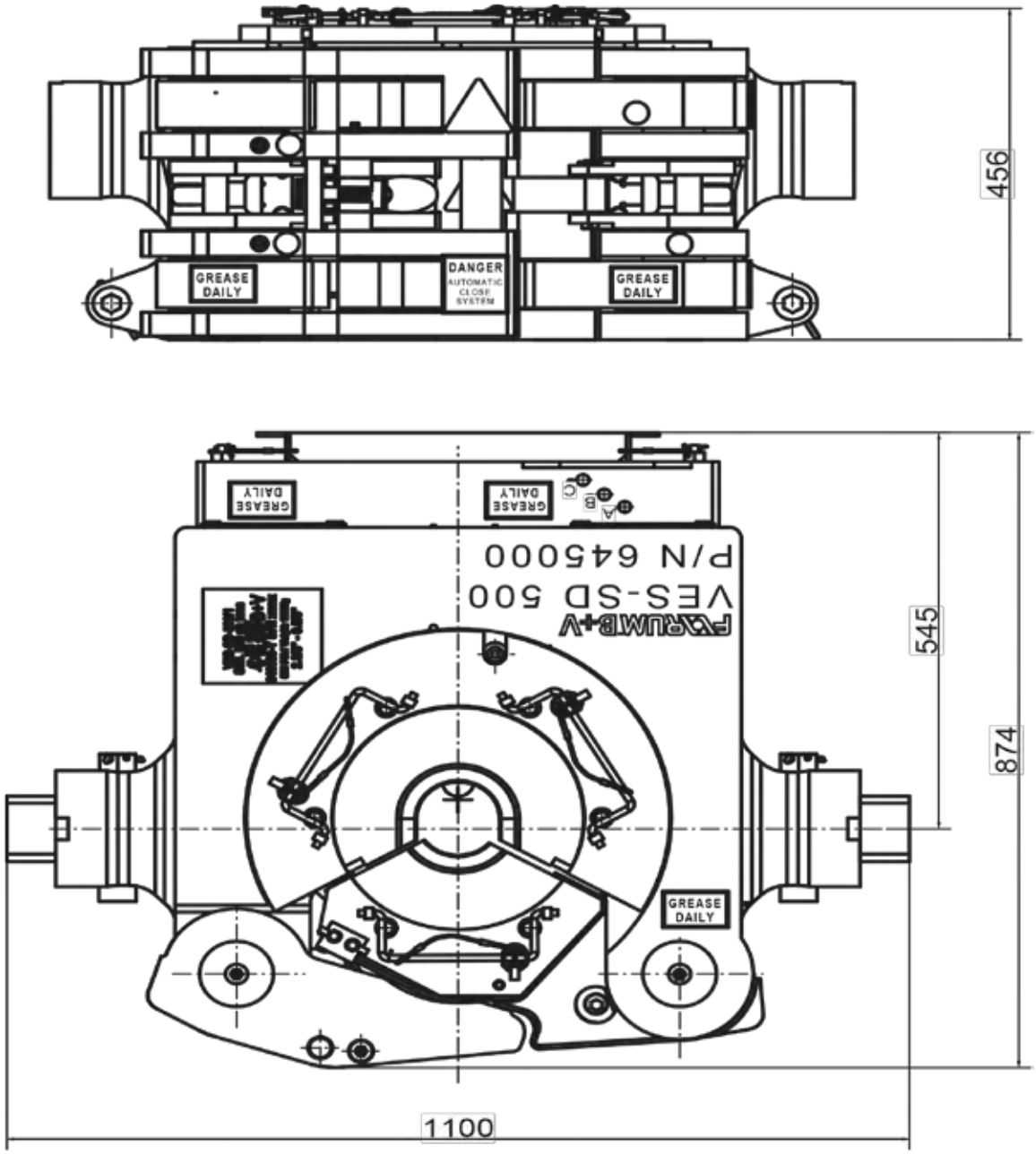


Fig. 10: VES SD500-1 Dimensions

1.4.3 VES SD 500 / 2 Main Dimensions

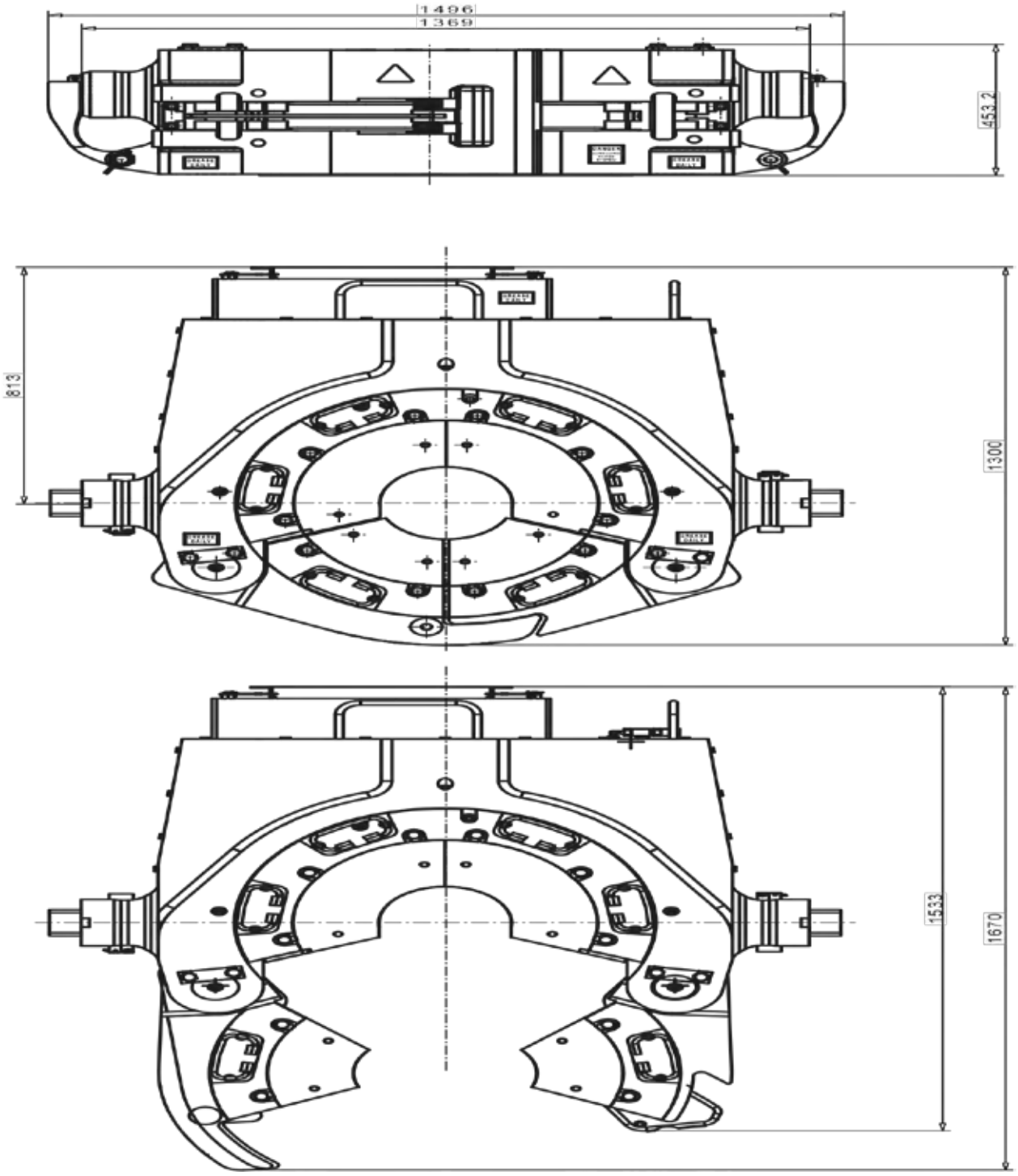


Fig. 11: VES SD500-1 Dimensions

1.4.4 VES SD 500-3 Main Dimensions

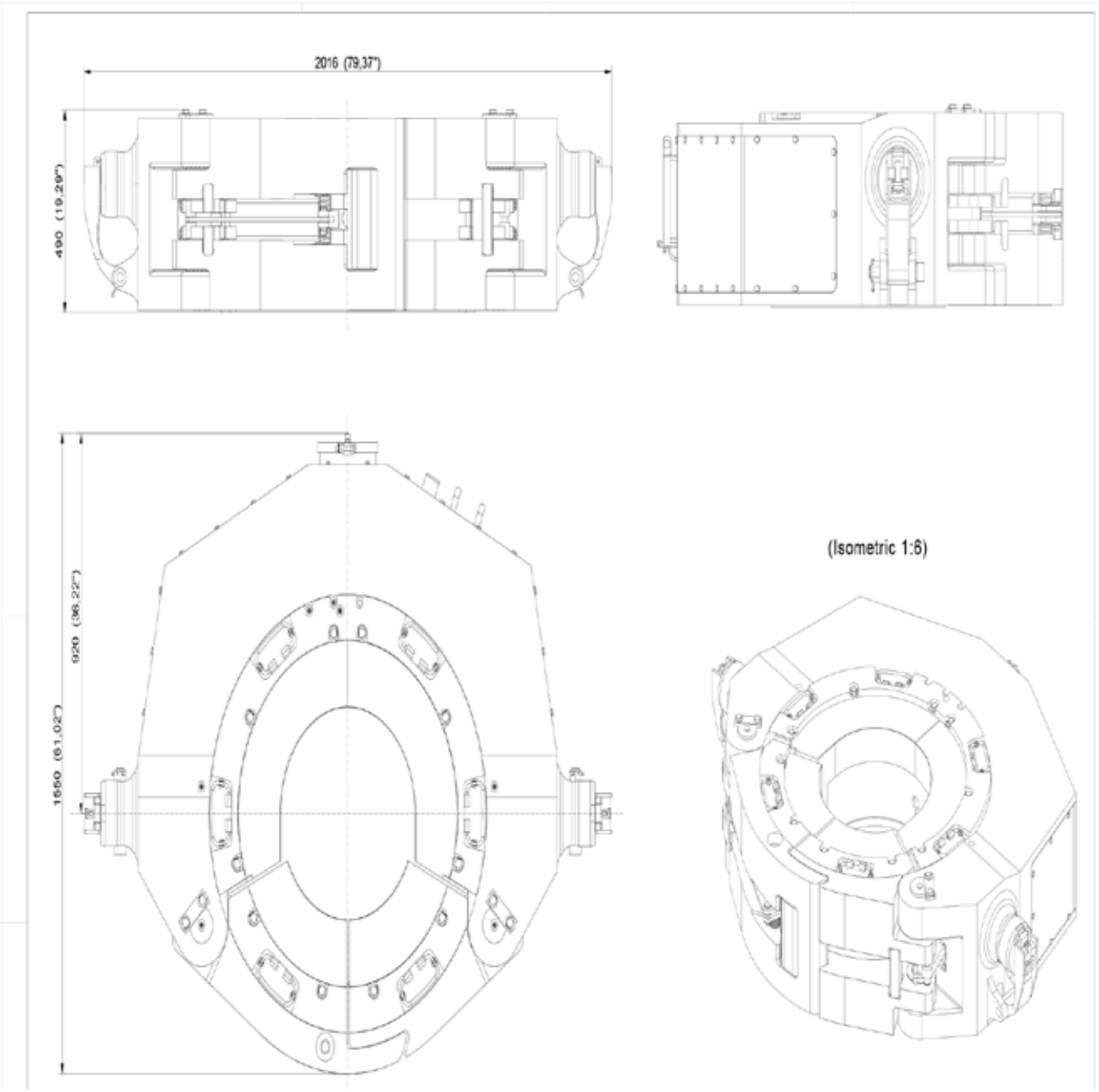


Fig. 12: VES SD500-1 Dimensions

1.4.4.1 VES SD 750 / 1000 Main Dimensions

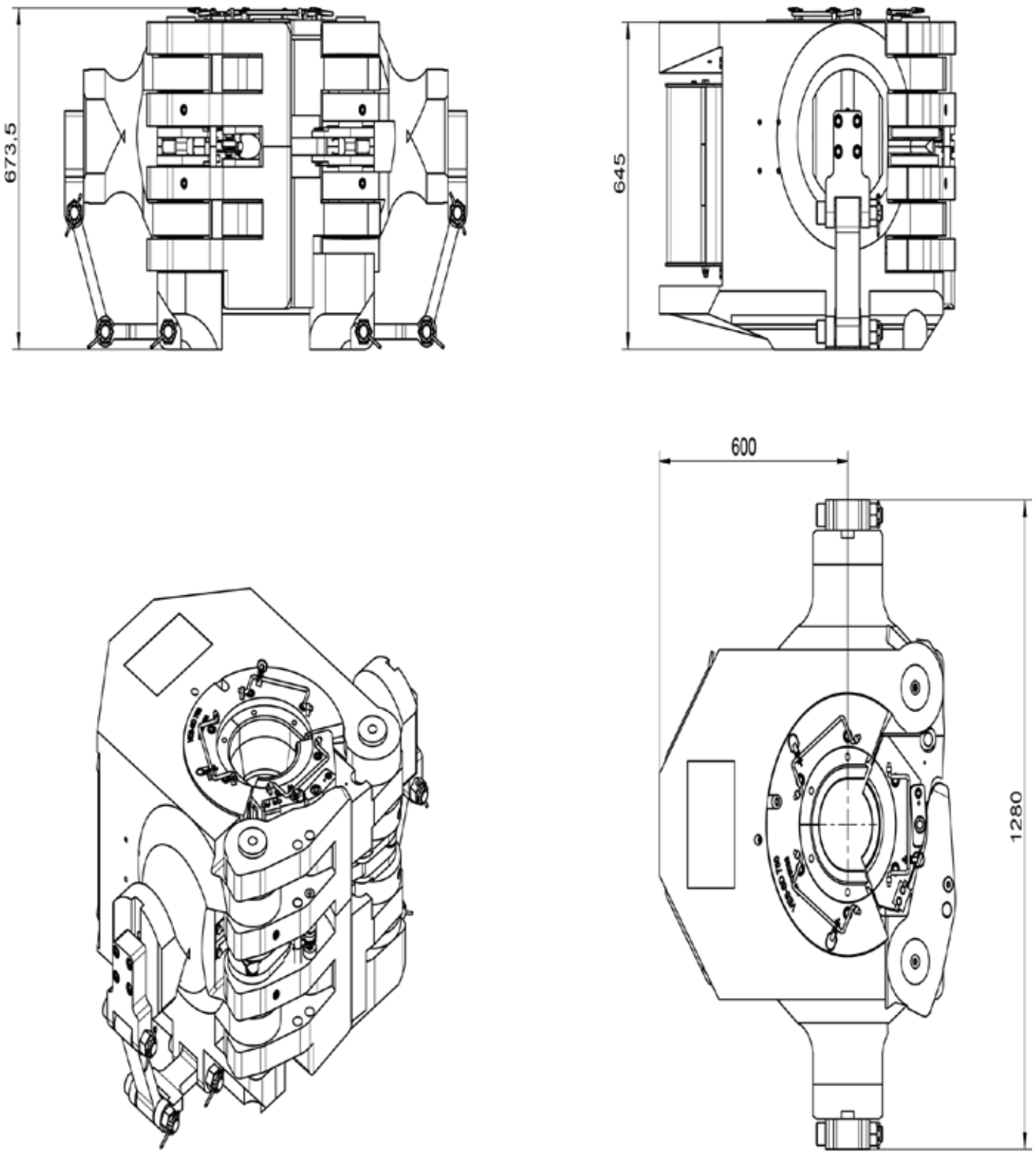


Fig. 13: VES SD500-1 Dimensions

1.4.5 FORUM Handling Tools Elevator Rotator Systems for VES SD Elevator

The FORUM Handling Tools Elevator Rotators are designed to be used for rotating an elevator.
For use with the VES SD elevators specially designed Adapter Kits based on the type series must be installed.

Technical Data

Name	Single Elevator Rotator	Double Elevator Rotator
Partnumber	see table	645 800
Rotator Adapter	see table	see table
Bushing Assembly	see table	-
Working pressure	160 bar (2320 PSI)	160 bar (2320 PSI)
Max. pressure	300 bar (4350 PSI)	300 bar (4350 PSI)
Required Flow rate	2.2 to 10 GPM (8,3 - 37,9 Lpm)	2.2 to 10 GPM (8,3 - 37,9 Lpm)
Temperature range:	- 20° C to + 60° C (- 4° F to 140° F)	
Rotation Angle:	+90° up / -55° down (double-acting) +90° up (single-acting)	240° (+120° doors up / -120° doors down)
Weight	250 kg (551 Lb)	560 kg (1,234 Lb)*

* weight per pair

Modification Kit for FORUM Handling Tools Single Elevator Rotator and FORUM Handling Tools Double Elevator Rotator

	Single Elevator Rotator (including Link adapter and bushing assembly)	Adapter for double Elevator Rotator
VES SD 350	678800-500-1 (single-acting) 678801-500-1 (double-acting)	648 120
VES SD 500	678800-500-1 (single-acting) 678801-500-1 (double-acting)	648 120
VES SD 750	678800-750-1 (single-acting) 678801-750-1 (double-acting)	678 120

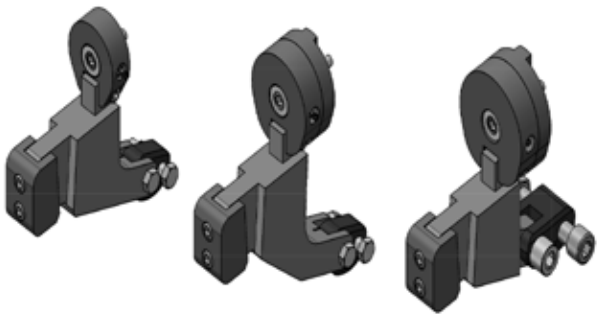
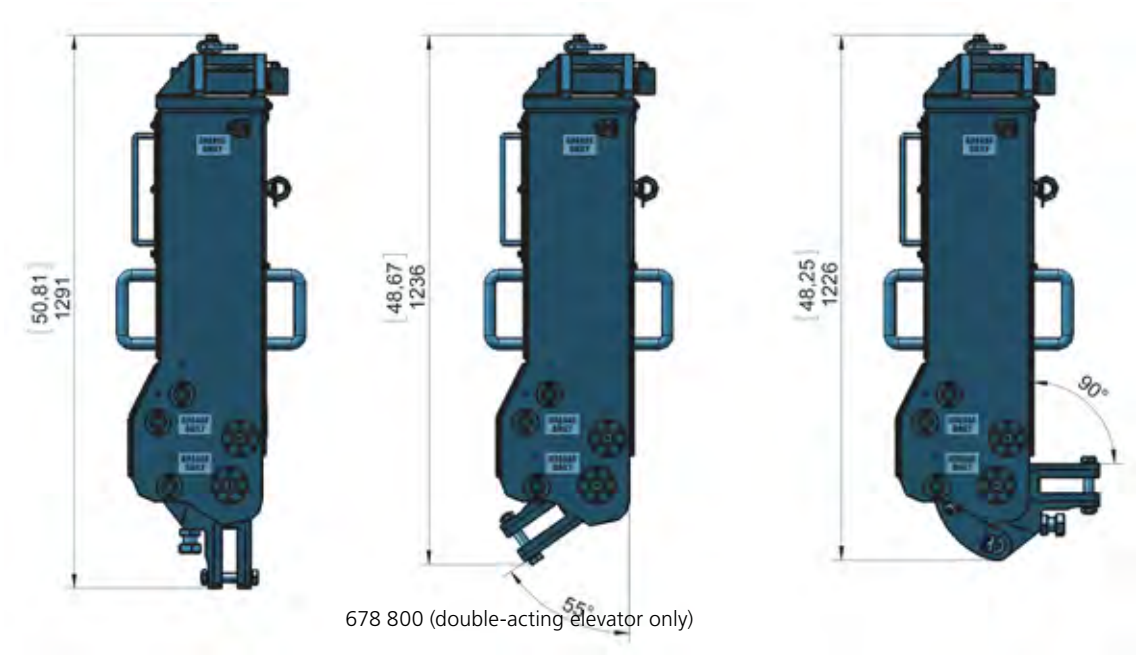


Fig. 14: Elevator Rotator Adapter illustration

Fig. 15: Single Elevator Rotator Link Bushing

1.4.5.1 FORUM Handling Tools Single Elevator Rotator System

Main Dimensions



678 800 (double-acting elevator only)

Fig. 16: FORUM Handling Tools Single Elevator Rotator System Main Dimensions

1.4.5.2 FORUM Handling Tools Double Elevator Rotator System

Main Dimensions

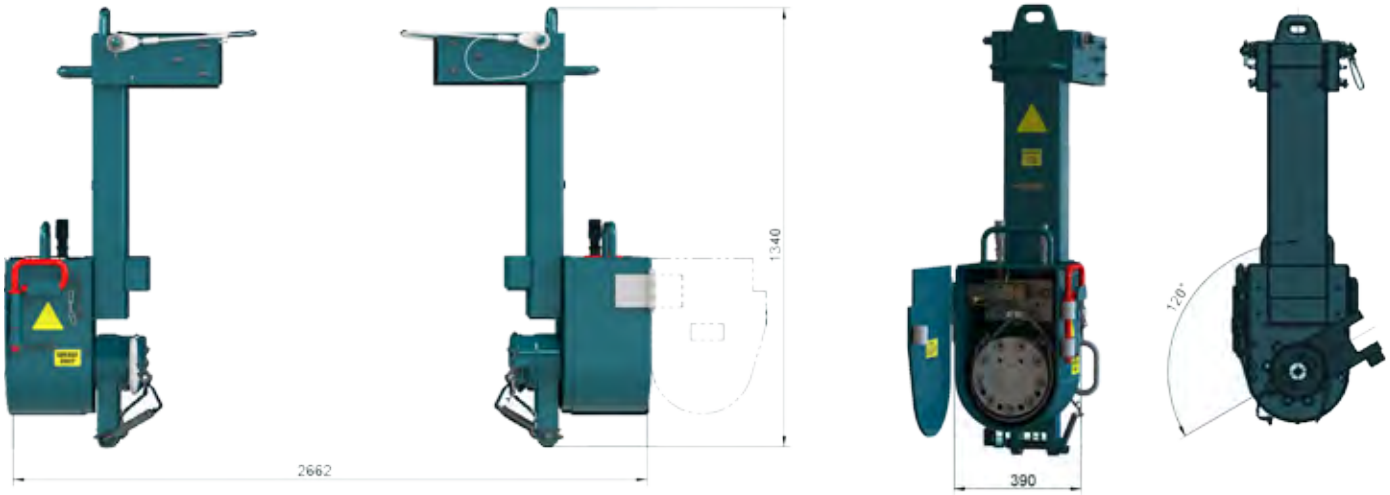


Fig. 17: FORUM Handling Tools Double Elevator Rotator System Main Dimensions

1.5 Functional Description

When the door and the Latch are open, the pipe can be placed in the Elevator.

The VES SD closes and latches through operator actuation after the pipe reached the interior of the Elevator.
At this stage the Elevator is secured against pipe loosing and can be used for its intended function.
For the VES SD with an automatic open / close system via Control Switch (preferable in the drillers cabin) the position is controlled by valves which give output signals that can be used for the Control Switch.

WARNING The VES SD must be closed and latched completely. Otherwise, safety can not guaranteed.

WARNING The lifting of vertical pipes is to be performed carefully and must be monitored. The picking up of horizontal or tilted pipes is dangerous and not permitted by FORUM Handling Tools.

WARNING If the operator considers to use the Elevator for other operations than the intended use (for example handling of horizontal pipes), it is mandatory to make an additional risk analysis.

1.6 Operational Environment

The VES SD are designed and constructed for use in the drilling industry on ships and platforms.

The Equipment complies with the Machinery Directive 2006 / 42 / EC.

The equipment is approved for operation in explosion hazard areas. For equipments containing any hydraulic powered parts, the directive 2014 / 34 / EU “Equipment and protective systems in potentially explosive atmospheres” applies. The corresponding ATEX certificates are present in the Data book.

The Classification in accordance with CE (with reference to the ATEX guideline) is as followed:

CE Ex II 2G IIB T5 for hydraulic and pneumatic tools

or

CE Ex II 2G IIB T6 for manual tools

with

CE	CE- marking (with reference to the ATEX guideline)
Ex	Marking of the equipment for the Ex- range
II	Equipment Group (II)
2	Equipment Category
G	For explosive mixtures of air and combustible gases, mists or vapors (G)
IIB	Category for Gases
T5 / T6	Temperature class

1.7 Hazardous Locations

This section shows hazardous locations.

Fig. 18: VES SD Hazardous Locations

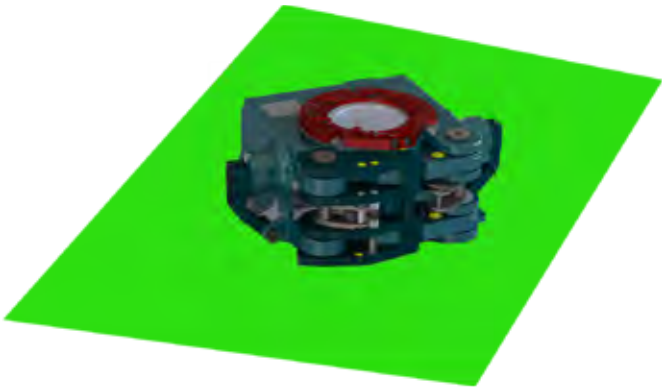


Fig. 19: VES SD Maintenance and Storage

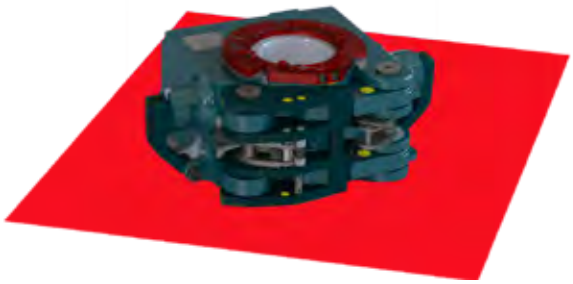


Fig. 20: VES SD Working place operation

1.8 Optional Accessories

To ease the handling and to support the device functions following accessories are available from FORUM Handling Tools . Please contact your local FORUM Handling Tools representative for detailed information.

Grease Pump **P/N 775810**

Manual grease pump to apply grease on the device grease points.

1.8.1 Recommended Hydraulic Fluid

FORUM Handling Tools recommends use of the following hydraulic fluids under various ambient conditions:

Brand	Flash point [°F/(°C)]	Above – 4 °F (-20 °C)	Flash point [°F/(°C)]
Aral	435.2 (224)	Aral Vitam GF 46	392 (200)
Castrol	392 (200)	Hyspin AWS-46	366.8 (186)
Gulf	410 (210)	Harmony 46AW	395.6 (202)
Shell	424.4 (218)	Tellus Tonna	408.2 (209)
Finke	572 (300)	Aviaticon HY-HE-46	509 (265)
Fuchs	428 (220)	Renolin MR 10	410 (210)

1.8.2 Recommended Lubricants

FORUM Handling Tools recommends use of the following lubricants for effective lubrication under various ambient conditions:

Brand	Name	Temperature range*	Remarks
Finke	Aviaticon XRF Low-Viscosity Grease	-20. . +29 °C (-4. . +84.2 °F)	NLGI 0
Fuchs	NESSOS SF0 EP grease for non-oil tight gear trains	-20. . +29 °C (-4. . +84.2 °F)	NLGI 0 DIN 51826 GPOF-25 DIN 51502 GPOF-25
Castrol	MP grease	-20. . +29 °C (-4. . +84.2 °F)	
Chevron	Avi-Motive W	-20. . +29 °C (-4. . +84.2 °F)	
Exxon	Lidok EP2	-20. . +29 °C (-4. . +84.2 °F)	
Gulf	Gulfcrown EP@	-20. . +29 °C (-4. . +84.2 °F)	
Mobil	Mobilux EP2	-20. . +29 °C (-4. . +84.2 °F)	
Shell	Alvania EP2	-20. . +29 °C (-4. . +84.2 °F)	
Texaco	Multifak EP2	-20. . +29 °C (-4. . +84.2 °F)	
Union	Unoba EP2	-20. . +29 °C (-4. . +84.2 °F)	

* For temperatures above +30 °C (+86 °F)
FORUM Handling Tools recommends using the specified lubricants in consistency class NLGI 2.

1.9 Equipment Markings

The markings are generally used for traceability and provide general information about the component/ device. All markings are in compliance to the latest API 8C and at least include the following information:

General Markings according to API 8C

- API Stamp (API monogram, spec, license)
- Manufacturer's specifications (FORUM logo)
- Production Date (Month / Year)
- Part number (marking P/N before the part number)
- Serial number (marking S/N before the serial number)
- Load Rating
- Equipment weight
- CE-ATEX marking (CE Ex II 2G IIB T5 / T6)
- Country of manufacture

The email address of the manufacturer is given on the support sticker if service is required.

Fig. 21: Contact with Technical Support

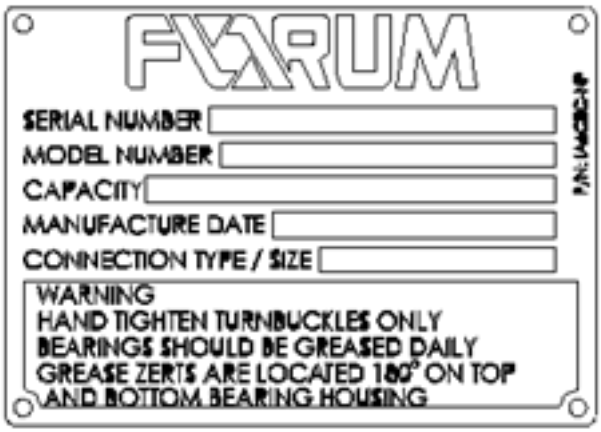


Fig. 22: Machine marking

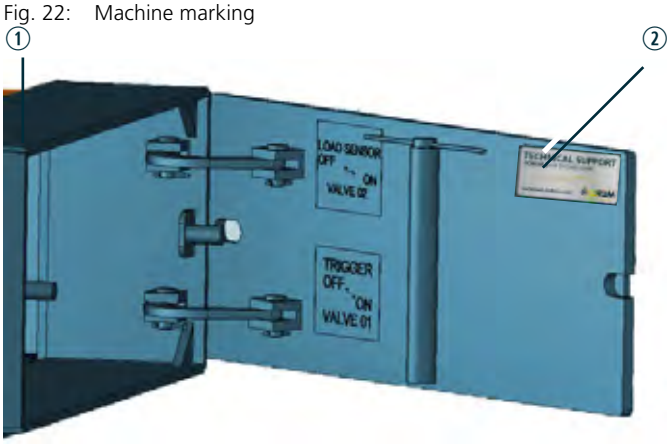


Fig. 23: Position of rating plate (1) and support sticker (2)

1.10 Controls and Component Sizes

The pipe diameters and matching components for the VES SD are listed with part numbers.
To order components please contact the FORUM Handling Tools Service Department at the address given under Contact.

⚠ **CAUTION** always ensure that the correct size Bushings are installed for a defined pipe diameter.

1.10.1 Controls

Operation of the VES SD is controlled remotely from the doghouse or driller cabin. The connections for the hydraulic controls are located on the hydraulic assembly.

List of optional Control Switch

Following Control Switch are available for the VES-SD.
For Installation of the Control Switch refer to Control Switch manual.

Info

Please contact the FORUM Handling Tools Technical Support or one of the authorized service companies specified in Chapter 1.9 to order a Control Switch or in the event of any questions.

PN	Description	Dimension	Function
2646	**Control Switch for VES-SD: Ex-proofed for Group II Zone 1 Gas - Ex II 2G T5 , for 24 V DC**	500x500x300	- OPEN/CLOSE (pneumatic piloted) - ROTATION (electric piloted) - FLOW control (electric piloted)
2647	**Control Switch for VES-SD: Ex-proofed for Group II Zone 1 Gas - Ex II 2G T5 , for 24 V DC**	500x500x300	- ROTATION (electric piloted) - FLOW control (hydraulic piloted)
2648	**Control Switch for VES-SD: Ex-proofed for Group II Zone 1 Gas - Ex II 2G T5 , for 24 V DC**	500x500x300	- ROTATION (electric piloted) - FLOW control (electric piloted)
645003-3	**Control Switch for VES-SD: Ex-proofed for Group II Zone 1 Gas - Ex II 2G T5 , for 24 V DC**	500x220x220	- OPEN/CLOSE (electric piloted) - Feedback signal when elevator is properly closed and locked (pressure switch converts hydraulic to electrical signal)
2649	**Control Switch for VES-SD: Ex-proofed for Group II Zone 1 Gas - Ex II 2G T5 , for 24 V DC**	500x500x300	- OPEN/CLOSE (electric piloted) - ROTATION (electric piloted) - FLOW control (electric piloted)
2649-10	**Control Switch for VES-SD: (Like CU 2649 with different box dimensions) Ex-proofed for Group II Zone 1 Gas - Ex II 2G T5 , for 24 V DC**	350x350x210	- OPEN/CLOSE (electric piloted) - ROTATION (electric piloted) - FLOW control (electric piloted)

1.10.2 Component Sizes and Drill Strings

The pipe diameters and matching components are listed with part numbers below for precise layout of the VES SD with the desired drill string. To order components please contact the FORUM Handling Tools Service Department at the address given under Contact.

⚠ CAUTION Always ensure that the right bushings are installed. Never operate the VES SD without bushings .

1.10.2.1 VES SD350-1 and VES SD500-1- Bushings

Part number	Description and Pipe size
645031-101	Bushing for 2.3/8" EU Drill Pipe, 18°;Shoulder, 500 ton rating
645031-103	Bushing for 2.7/8" EU Drill Pipe, 18°;Shoulder, 500 ton rating
645031-105	Bushing for 3.1/2" EU Drill Pipe, 18°;Shoulder, 500 ton rating
645031-106	Bushing for 4" IU Drill Pipe, 18°;Shoulder, 500 ton rating
645031-107	Bushing for 4" EU, 4.1/2" IU / IEU Drill Pipe, 18°;Shoulder, 500 ton rating
645031-109	Bushing for 4 1/2" EU and 5" IEU Drill Pipe, 18°;Shoulder, 500 ton rating
645031-109 HB	Bushing for 5"IEU Drill Pipe, 18°;Shoulder, Hard Banding
645031-111	Bushing for 5.1/2" IEU Drill Pipe,;18° Shoulder, 500 ton rating
645031-112	Bushing for 6.906 IEU Drill Pipe,;18° Shoulder, 500 ton rating
645031-113	Bushing for 6.5/8" IEU Drill Pipe,;18° Shoulder, 500 ton rating (OBSOLETE)
645031-114	Bushing for 6.5/8" IEU Drill Pipe, max. 8.1/2";Tool Joint 18° Shoulder, 500
645031-114 HB	Bushing for 6.5/8"IEU Drill Pipe,;18° Shoulder, Hard Banding;
645031-115	Bushing for 5.7/8" Drill Pipe, with 18° Shoulder,;500 ton rating
645031-118	Bushing for 5 1/2 S150 DP 18°;VES -SD 500 Frame 1
645031-121	Bushing for 1,05" Plan Tubing,;500 ton rating
645031-122	Bushing for 1,05" EU Tubing,;500 ton rating
645031-123	Bushing for 1,315" Plan Tubing,;500 ton rating
645031-124	Bushing for 1,135" EU Tubing,;500 ton rating
645031-125	Bushing for 1,66" Plan Tubing,;500 ton rating
645031-126	Bushing for 1,66" EU Tubing,;500 ton rating
645031-127	Bushing for 1,9" Plan Tubing,;500 ton rating
645031-128	Bushing for 1,9" EU Tubing,;500 ton rating
645031-129	Bushing for 2.3/8" Plan Tubing,;500 ton rating
645031-130	Bushing for 2.3/8" EU Tubing,;500 ton rating
645031-131	Bushing for 2.7/8" Plan Tubing,;500 ton rating
645031-132	Bushing for 2.7/8" EU Tubing,;500 ton rating
645031-133	Bushing for 3.1/2" Plan Tubing,;500 ton rating
645031-134	Bushing for 3.1/2" EU Tubing,;500 ton rating
645031-135	Bushing for 4" Plan Tubing,;500 ton rating
645031-136	Bushing for 4" EU Tubing,;500 ton rating
645031-137	Bushing for 4.1/2" Plan Tubing,;500 ton rating
645031-138	Bushing for 4.1/2" EU Tubing,;500 ton rating
645031-139	Bushing for 5" Plan Tubing,;500 ton rating
645031-140	Bushing for 5" EU Tubing,;500 ton rating
645031-141	Bushing for 5.1/2" Plan Tubing,;500 ton rating
645031-155	Bushing for 5.7/8" Drill Pipe, with 18° Shoulder,;500 ton rating
645031-170 HB	Bushing for 6.5/8"HW Drill Pipe,;18° Shoulder, Hard Banding
645031-172	Bushing for 5.3/4" IEU Drill Pipe,;18° Shoulder, 500 ton rating
645031-182	Bushing for 4.3/4" Drill Collar with;Zip Groove, 500 ton rating
645031-187	Bushing for 6.1/4" Drill Collar with;Zip Groove, 500 ton rating
645031-188	Bushing for 6.1/2" Drill Collar with Zip;Groove, 500 ton rating
645031-189	Bushing for 6.3/4" Drill Collar with;Zip Groove, 500 ton rating
645031-190	Bushing for 7" Drill Collar with;Zip Groove, 500 ton rating
645031-194	Bushing for 8" Drill Collar with Zip;Groove, 500 ton rating
645031-195	Bushing for 8.1/4" Drill Collar with;Zip Groove, 500 ton rating
645031-198	Bushing for 9" Drill Collar with;Zip Groove, 500 ton rating
645031-199	Bushing for 9.1/2" Drill Collar with;Zip Groove, 500 ton rating
645031-206	Bushing for 3.1/8" Drill Collar with;Zip Groove, 500 ton rating
645031-207	Bushing for 3.3/8" Drill Collar with;Zip Groove, 500 ton rating
645031-221	Bushing for 4.1/2" Casing, 500 ton;rating
645031-223	Bushing for 5" Casing, 500 ton rating

Part number	Description and Pipe size
645031-224	Bushing for 5.1/2" Casing, 500 ton;rating
645031-228	Bushing for 6.5/8" Casing, 500 ton;rating
645031-229	Bushing for 7" Casing, 500 ton rating
645031-231	Bushing for 7.5/8" Casing,;500 ton rating
645031-232	Bushing for 8" Casing, 500 ton rating
645031-236	Bushing for 9.5/8" Casing, 500 ton;rating
645031-237	Bushing for 10" Casing, 500 ton rating
645031-262	Bushing for 5 1/2" VAM Top HC-Connection for;FORUM Handling Tools VES-SD 500 Elevator
645031-263	Bushing for 8.3/4" for Riser Running , 500 ton;rating;
645031-265	Bushing for 9.7/8" Casing, 500 ton rating
645031-276	Bushing for 4.3/4" Plain Drill Collar;500 ton rating
645031-287	Bushing for 6.3/4" Plain Drill Collar;500 ton rating
645031-293	Bushing for 8" Plain Drill Collar; 500 ton rating
645031-298	Bushing for 9.1/2" Plain Drill Collar;500 ton rating
645031-308	Bushing for 3.1/8" Drill Collar without;Zip Groove, 500 ton rating
645031-532	Bushing for 8" Riser, 500 ton rating

1.10.2.2 VES SD500-2 - Bushings

Part number	Description and Pipe size
645230-236	Bushing for 9.5/8" Casing, 500 ton rating
645230-237	Bushing for 10" Casing, 500 ton rating
645230-238	Bushing for 10.3/4" Casing, 500 ton rating
645230-239	Bushing for 11.3/4" Casing, 500 ton rating
645230-240	Bushing for 12" Casing, 500 ton rating
645230-241	Bushing for 12.4/3" Casing, 500 ton rating
645230-242	Bushing for 13" Casing, 500 ton rating
645230-243	Bushing for 13.3/8" Casing, 500 ton rating
645230-244	Bushing for 14.3/4" Casing, 500 ton rating
645230-245	Bushing for 16" Casing, 500 ton rating
645230-246	Bushing for 16.3/4" Casing, 500 ton rating
645230-247	Bushing for 18" Casing, 500 ton rating
645230-248	Bushing for 18.5/8" Casing, 500 ton rating
645230-249	Bushing for 20" Casing, 500 ton rating
645230-255	Bushing for 14" Casing, 500 ton rating
645230-259	Bushing for 13.5/8" Casing, 500 ton rating
645230-260	Bushing for 12.7/8" Casing, 500 ton rating
645230-262	Bushing for 11.7/8" Casing, 500 ton rating
645230-264	Bushing for 15" Casing, 500 ton rating
645230-265	Bushing for 9.7/8" Casing, 500 ton rating
645230-267	Bushing for 17" Casing, 500 ton rating
645230-270	Bushing for 13.1/2" Casing, 500 ton rating
645230-311	Bushing for 16,338" Casing, 500 ton rating
645230-401	Bushing for 13.3/8"& 13.1/2" Casing, 500 ton rating
645230-404	Bushing for 18.3/4" Casing, 500 ton rating
645230-405	Bushing for 17.7/8" Casing, 500 ton rating

1.10.2.3 VES SD500-3- Bushings

Part number	Description and Pipe size
648606-249	Bushing Assembly for AMP 500-3,;20" Casing
648606-253	Bushing Assembly for AMP 500-3,;30" Casing
648606-254	Bushing Assembly for AMP 500-3,;24" Casing
648606-261	Bushing Assembly for AMP 500-3,;22" Casing

1.10.2.4 VES SD750 / 1000 - Bushings

Part number	Description and Pipe size
675030-101	Bushing for 2.3/8" EU Drill Pipe, 18°;Shoulder, 750 ton rating
675030-103	Bushing for 2.7/8" EU Drill Pipe, 18°;Shoulder, 750 ton rating
675030-105	Bushing for 3.1/2" EU Drill Pipe, 18°;Shoulder, 750 ton rating
675030-106	Bushing for 4" IU Drill Pipe, 18°;Shoulder, 750 ton rating
675030-107	Bushing for 4" EU, 4.1/2" IU / IEU Drill Pipe, 18°;Shoulder, 750 ton rating
675030-109	Bushing for 4 1/2" EU and 5" IEU Drill Pipe, 18°;Shoulder, 750 ton rating
675030-109 HB	Bushing for 5"IEU Drill Pipe, 18°;Shoulder, Hard Banding
675030-111	Bushing for 5.1/2" IEU Drill Pipe,;18° Shoulder, 750 ton rating
675030-112	Bushing for 6.906 IEU Drill Pipe,;18° Shoulder, 750 ton rating
675030-113	Bushing for 6.5/8" IEU Drill Pipe,;18° Shoulder, 750 ton rating (OBSOLETE)
675030-114	Bushing for 6.5/8" IEU Drill Pipe, max. 8.1/2";Tool Joint 18° Shoulder, 500
675030-114 HB	Bushing for 6.5/8"IEU Drill Pipe,;18° Shoulder, Hard Banding;
675030-115	Bushing for 5.7/8" Drill Pipe, with 18° Shoulder,;750 ton rating
675030-118	Bushing for 5 1/2 S150 DP 18°;VES -SD 500 Frame 1
675030-121	Bushing for 1,05" Plan Tubing,;750 ton rating
675030-122	Bushing for 1,05" EU Tubing,;750 ton rating
675030-123	Bushing for 1,315" Plan Tubing,;750 ton rating
675030-124	Bushing for 1,135" EU Tubing,;750 ton rating
675030-125	Bushing for 1,66" Plan Tubing,;750 ton rating
675030-126	Bushing for 1,66" EU Tubing,;750 ton rating
675030-127	Bushing for 1,9" Plan Tubing,;750 ton rating
675030-128	Bushing for 1,9" EU Tubing,;750 ton rating
675030-129	Bushing for 2.3/8" Plan Tubing,;750 ton rating
675030-130	Bushing for 2.3/8" EU Tubing,;750 ton rating
675030-131	Bushing for 2.7/8" Plan Tubing,;750 ton rating
675030-132	Bushing for 2.7/8" EU Tubing,;750 ton rating
675030-133	Bushing for 3.1/2" Plan Tubing,;750 ton rating
675030-134	Bushing for 3.1/2" EU Tubing,;750 ton rating
675030-135	Bushing for 4" Plan Tubing,;750 ton rating
675030-136	Bushing for 4" EU Tubing,;750 ton rating
675030-137	Bushing for 4.1/2" Plan Tubing,;750 ton rating
675030-138	Bushing for 4.1/2" EU Tubing,;750 ton rating
675030-139	Bushing for 5" Plan Tubing,;750 ton rating
675030-140	Bushing for 5" EU Tubing,;750 ton rating
675030-141	Bushing for 5.1/2" Plan Tubing,;750 ton rating
675030-155	Bushing for 5.7/8" Drill Pipe, with 18° Shoulder,;750 ton rating
675030-170 HB	Bushing for 6.5/8"HW Drill Pipe,;18° Shoulder, Hard Banding
675030-172	Bushing for 5.3/4" IEU Drill Pipe,;18° Shoulder, 750 ton rating
675030-182	Bushing for 4.3/4" Drill Collar with;Zip Groove, 750 ton rating
675030-187	Bushing for 6.1/4" Drill Collar with;Zip Groove, 750 ton rating
675030-188	Bushing for 6.1/2" Drill Collar with Zip;Groove, 750 ton rating
675030-189	Bushing for 6.3/4" Drill Collar with;Zip Groove, 750 ton rating
675030-190	Bushing for 7" Drill Collar with;Zip Groove, 750 ton rating
675030-194	Bushing for 8" Drill Collar with Zip;Groove, 750 ton rating
675030-195	Bushing for 8.1/4" Drill Collar with;Zip Groove, 750 ton rating
675030-198	Bushing for 9" Drill Collar with;Zip Groove, 750 ton rating
675030-199	Bushing for 9.1/2" Drill Collar with;Zip Groove, 750 ton rating
675030-206	Bushing for 3.1/8" Drill Collar with;Zip Groove, 750 ton rating
675030-207	Bushing for 3.3/8" Drill Collar with;Zip Groove, 750 ton rating
675030-221	Bushing for 4.1/2" Casing, 750 ton;rating
675030-223	Bushing for 5" Casing, 750 ton rating

Part number	Description and Pipe size
675030-224	Bushing for 5.1/2" Casing, 750 ton;rating
675030-228	Bushing for 6.5/8" Casing, 750 ton;rating
675030-229	Bushing for 7" Casing, 750 ton rating
675030-231	Bushing for 7.5/8" Casing,;750 ton rating
675030-232	Bushing for 8" Casing, 750 ton rating
675030-236	Bushing for 9.5/8" Casing, 750 ton;rating
675030-237	Bushing for 10" Casing, 750 ton rating
675030-262	Bushing for 5 1/2" VAM Top HC-Connection for;FORUM Handling Tools VES-SD 500 Elevator
675030-263	Bushing for 8.3/4" for Riser Running , 750 ton;rating;
675030-265	Bushing for 9.7/8" Casing, 750 ton rating
675030-276	Bushing for 4.3/4" Plain Drill Collar;750 ton rating
675030-287	Bushing for 6.3/4" Plain Drill Collar;750 ton rating
675030-293	Bushing for 8" Plain Drill Collar; 750 ton rating
675030-298	Bushing for 9.1/2" Plain Drill Collar;750 ton rating
675030-308	Bushing for 3.1/8" Drill Collar without;Zip Groove, 750 ton rating
675030-532	Bushing for 8" Riser Running Tool, 1000 ton rating
675030-533	Bushing for 8.1/2" Riser Running Tool, 1000 ton rating
675030-536	Bushing for9.5/8" Riser Running Too, 1000 ton rating
675030-632	Bushing for 8" Casing, 1000 ton rating

1.11 RFID-Chip Equipped Handling Tool Equipment

INFO

For further information, you may access the Forum/IC Database from the FET Website or at www.infochip.com

FORUM Handling Tools outfits/supplies certain equipment with patent pending RFID Technology. This technology allows for easy real-time access to pertinent equipment information and technical documentation anytime, anywhere. The database is accessible via the internet or mobile application.

Tier I Access – General Access

As standard, the customer will be assigned and issued login information to the database provided for their assets/equipment. Once logged into the database, customers will be able to see all assets assigned to them. Attached to each asset is complete documentation including all contents of databook related to that specific asset. The customer will be able to view, download and print all documents associated with their particular assets.

Tier II Access – User Access

Customers opting for improved access as a system user will have the full functionality of Tier I Access but will be able to manipulate their assets. Additional functionality includes but is not limited to:

- Assigning Inspection and Certification due dates and reminders.
- Attaching Internal Inspection Checklists/ Documentation.
- Managing Asset Locations.
- Assigning Internal Asset/Serial Numbers.

INFO

For detailed RFID instruction, please refer to Forum Document 1155081, FORUM RFID User Manual (refer to section XII “Online Technical Document access” on page 12).

Frequently Asked Questions (FAQ)

- How do I know if my equipment has RFID?

» RFID tags are embedded and clearly marked (“RFID”) on equipment in inconspicuous locations generally at the upper visible part of the equipment.

- What type of RFID tag are we using?

» The RFID tags used in FORUM equipment operate on the UHF Frequency.

- How can I scan the tag?

» Standard NFC UHF Frequency Reader (available through Forum).

- What is on the tag/chip?

» The chip identification number is the only information physically on the chip. All other information is stored on the cloud-based database associated with the chip identification number.

- Whom do I contact to get Tier I access or to inquire about Tier II access?

» Forum Sales personnel can help with basic access and upgrade information.

SAFETY

2 Safety

The VES SDs are designed and produced with consideration of all required safety precautions.

Failure to observe the safety precautions and operating instructions specified in this manual can lead to hazardous situations when operating the equipment. While it is not possible to eliminate all hazardous situations with awareness and instruction from this manual, good judgement should be used at all times surrounding the use of this equipment.

This equipment should only be used for its intended purpose.

Rectify all faults immediately which could have a negative effect on the equipment safety.

2.1 General Safety Precautions

Ensure that work on the Equipment, particularly installation, maintenance and repair work, is performed only by personnel with the necessary qualifications and who are familiar with the associated risks (refer to section VI “Obligations of the Operating Company” on page 7).

For safe and proper operation of the Equipment it is essential that all personnel working on the Equipment take the prescribed safety measures and observe the safety precautions specified in this operating manual.

Before switching on and before working on the Equipment always ensure that no one is put in a hazardous situation.

All safety features must be installed completely before switching on the Equipment.

Safety features may be released only when:

1. The entire Equipment is switched off and
2. switching back on unintentionally is not possible.

The Equipment contains components subject to wear. After longer periods of operation the safety can be reduced due to wear. Service the Equipment regularly in compliance with the maintenance chart (refer to section 6.2 “Inspections” on page 188) to ensure that all safety requirements are always fulfilled. Check the specified wear limits regularly. Replace worn or defective parts immediately with new parts.

If safe operation is no longer guaranteed, switch off the Equipment and secure it against being switched back on unintentionally. Advise the responsible service organization.

Rectify every fault, which affects the safety, immediately.

2.2 Safety Equipment

The Double Door Elevator VES SD is equipped with various safety features for protection of the operating personnel:

- During operation all moving parts are secured against reaching in by screwed covers.
- The hydraulic lines are connected with safety quick-release couplings.
- Hazard points on the Equipment are marked with signs („Safety Precautions“ on page 36), indicating the type and consequences of a hazard as well as measures to prevent it.
- All components, particularly parts requiring replacement during conversion work when changing pipe sizes, are equipped with threaded holes for screwing in load bolts or with fixed load bolts.
- External hoses are provided with a chafe guard.
- Never open the Elevator when load is still suspended by the Elevator.

» Never remove the safety equipment or replace it with safety equipment not approved by FORUM Handling Tools. Failure to observe this instruction can lead to hazardous situations for which FORUM Handling Tools cannot be held responsible.

» Always keep all safety equipment in working condition and check integrity regularly.

Fig. 24: Center Latch Elevator type series hazardous areas

2.3 Safety Precautions

⚠ Warning

Reuse of safety components can cause accidents.

» Never reuse safety - relevant parts (such as securing cables or plates, discs or washers).

» Replace such components with new safety parts.

⚠ Caution

The operating company is responsible for ensuring safe and correct use of the equipment within the sense of the hazard and risk analysis.

The operating company is also obligated to issue and supervise observance of operating instructions on safe use as well as to observe the instructions in this operating manual.

2.4 Operation Manual and Equipment

The safety precautions in this operating manual are indicated using standardized depictions and symbols. Examples of the symbols and terms used in this manual are explained below. These are used in the form shown wherever possible hazards are present.

⚠ DANGER

Suspended load!

This indicates injury risks from transporting heavy components.

⚠ DANGER

Tipping hazard for components!

This indicates injury risks from tipping components.

⚠ WARNING

Danger of pinching/crushing hands!

This indicates injury risks from moving parts, which pose a hazard of pinching or crushing hands.

⚠ WARNING

Danger of pinching/crushing feet!

This indicates injury risks from moving parts, which pose a hazard of pinching or crushing feet.

⚠ Caution

Risk of stumbling/tripping!

This symbol warns of tripping hazards, which can lead to stumbling resulting in injuries.

⚠ WARNING

Health hazards from service products!

This symbol warns of health hazards resulting from contact of service products (e.g. lubricants) with the skin, mucous membranes, eyes and respiratory paths.

2.5 Safety Precautions against Remaining Hazards

This Equipment was designed and produced in consideration of the safety precautions specified in EC Directive 2006 / 42 / EU on Machinery.

The Equipment may be used only for:

- Its intended purpose (refer to section II “Intended Use” on page 5).
- When it is in a technically safe state.

Nevertheless, it is not possible to completely exclude all hazardous situations which could arise when the Equipment is used. Reference is made to these remaining risks at the beginning of each section and at the corresponding points in the description and measures for avoiding these risks are explained.

⚠ WARNING

Mechanically generated sparks

During some troubleshooting tasks, like such as clamping components, the use of metal tools like hammers can generate sparks.

- The use of metallic tools like hammers in hazardous areas must be prohibited by the operating company.

» For loosening of clamping components only nonmetallic (plastic) hammer, which are approved for use in hazardous areas, may be used.

Info

The operating company is responsible for ensuring that all personnel working on the equipment is familiar with the remaining risks and observe the appropriate safety precautions.

2.5.1 Warning and Safety Instructions on Machine

Hazard points are indicated by special stickers on the machine. Ensure that these are always kept in an easily legible state and replaced as required.

Fig. 25: Safety Precautions on Machine

1

⚠ WARNING

Danger of pinching/ crushing hands!

Keep clear of moving parts during operation.

WARNING sign
"Hazard – Hand Injury"
ANSI Z535.4
PN 671640-1

2

⚠ NOTE

Lifting point locations are marked on the device, where slings can be securely fastened. Thus, the safe transport of FORUM Handling Tools equipment is ensured..

3

⚠ WARNING

Danger of pinching/ crushing body!

This indicates injury risks from moving parts, which pose a hazard of pinching or crushing the body.

WARNING sign
"Body crushing"
ANSI Z535.4
PN 671641

4

WARNING sign
General WARNING
PN 671638

5

Support sticker
PN 613129

2.5.2 Incorrect Handling of Hydraulic Equipment

⚠ WARNING

Defective hydraulic lines pose an injury hazard!

» Route hydraulic lines safely and check regularly for damage.

» Provide lines with chafe protection.

» Replace defective lines immediately.

⚠ WARNING

Separated hydraulic lines pose an injury hazard!

» Hydraulic fluid can escape under high pressure.

» Always relieve pressure in hydraulic equipment before working on Equipment.

» Check hydraulic connections regularly to ensure that they are properly fastened.

⚠ WARNING

Hydraulic fluid can pose a health hazard!

» Hydraulic fluids can lead to skin and eye injury and poisoning symptoms upon contact.

» Avoid direct contact with hydraulic fluids.

WEAR EYE PROTECTION!

WEAR PROTECTIVE GLOVES!

Hydraulic lines which are weakened due to incorrect routing or damage can burst under load. The hydraulic fluid then escapes under pressure resulting in a powerful jet, which can lead to skin or eye injury.

For this reason always

- Lay hydraulic lines so that they are not kinked or pinched.
- Check regularly for damage and replace as required.

Always wear your personal protective equipment.

⚠ CAUTION

Danger of stumbling and Equipment defects!

Before turning the drilling table ensure that the supply lines for the Double Door Elevator VES SD are disconnected, to prevent the hoses from tearing.

Hydraulic system safety instructions

1. Release the pressure in all lines carrying hydraulic oil prior to any maintenance and repair work.
   - Lower all hydraulically controlled components to the ground.
   - Move all control levers of the hydraulic control valves several times.
2. Hydraulic oil escaping under high pressure can penetrate the skin and cause serious injuries. Always consult a doctor immediately even if the wound seems insignificant – otherwise serious infections could set in!
3. Replace the hose or line if one of the problems mentioned below is detected.
   - Damaged or leaky hydraulic seals.
   - Worn or torn shells or uncovered reinforcement branches.
   - Expanded shells in several positions.
   - Foreign bodies jammed or stuck in protective layers.
4. Re-tighten leaking screwed fittings and hose connections only when the system is not under pressure; i.e. release the pressure before working on pressurized lines!
5. Never weld or solder damaged or leaking pressure lines and screw connections.
   Replace damaged parts with new ones!
6. Never search for leaks with your bare hands or eyes, always wear protective gloves and eye protection!
   - Use paper or wood to check for minor leaks.
7. Leaks and damaged pressure lines must be immediately repaired or replaced.

2.5.3 Risk of Stumbling/Tripping

⚠ CAUTION

Risk of stumbling/tripping!

When VES SD are installed in level with or above rig floor.

DO NOT RUN AND watch step.

2.5.4 Danger of Pinching/Crushing

⚠ WARNING

Danger of pinching/crushing hands!

Moving parts pose a hazard during assembly, set-up and conversion work as well as during operation.

NEVER reach between moving components.

⚠ WARNING

Danger of pinching/crushing feet!

Moving parts pose a hazard during assembly, set-up and conversion work as well as during operation.

NEVER stand below moving components.

⚠ WARNING

Danger of pinching/crushing body!

Moving parts pose a hazard during assembly, set-up and conversion work as well as during operation.

NEVER stand between moving components.

During assembly, set-up and conversion work as well as during operation pinching/crushing hazards can be posed.

Pay attention to hands, feet and body when performing the work specified. Always ensure that no one is in a hazardous position.

» Always wear your personal protective equipment.

2.5.5 Human Error

Ignorance of hazards, inattentiveness and limited reactions can lead to hazard situations while working with the VES SD.

Safe Work

1. All personnel working on the equipments are responsible for paying attention to their colleagues.
2. Consumption of alcohol and drugs is prohibited.
3. Work on the VES SD is not permissible after taking medication which reduces reactions.
4. AT LEAST visual contact must exist between the operator in the doghouse and the personnel at the VES SD, to allow communication via hand signals.
5. The personal protective equipment must always be kept and used in perfect condition.
6. All personnel working on the VES SD, must be familiar with and observe the safety precautions in this instruction manual and on the equipment.
7. The instructions for handling and maintenance intervals specified in this operating manual must be observed.
8. Keep a copy of this operating manual in the vicinity of the equipment, where it is accessible at all times.

2.6 Organizational Measures

The operating company is responsible for ensuring that all legally and officially prescribed approvals for operation of the Equipment are present and in compliance with national laws and regulations. The required personal protective equipment (refer to section IX “Personal Protective Equipment (PPE)” on page 10) must be provided by the company operating the Equipment. All safety features present must be checked regularly in compliance with national and local requirements. Warning signs and safety notices on the Equipment must be legible at all times and replaced as required. The operating instructions must be kept so that they are available to those operating the Equipment at all times.

Personal Protective Equipment

The required Personal Protective Equipment (PPE) must be used when operating the Equipment. This is to be provided by the operating company.

The following PPE is recommended:

- Oil resistant protective clothing,
- Protective gloves,
- Eye protection,
- Safety shoes,
- Protective helmet.

All parts of the protective equipment must be checked regularly for damage in compliance with the specific national regulations and replaced as required.

2.7 Accidents, Fire

Basic rules in event of accidents or fire

1. Move accident victims out of hazard area and switch off Equipment immediately.
2. Administer first-aid.
3. Alarm rescue services and fire department immediately and inform supervisor.

In addition all national, local and internal plant regulations for fire fighting in explosion hazard areas apply.

SAFETY INSTRUCTIONS

for SD-Series Elevator

⚠ WARNING

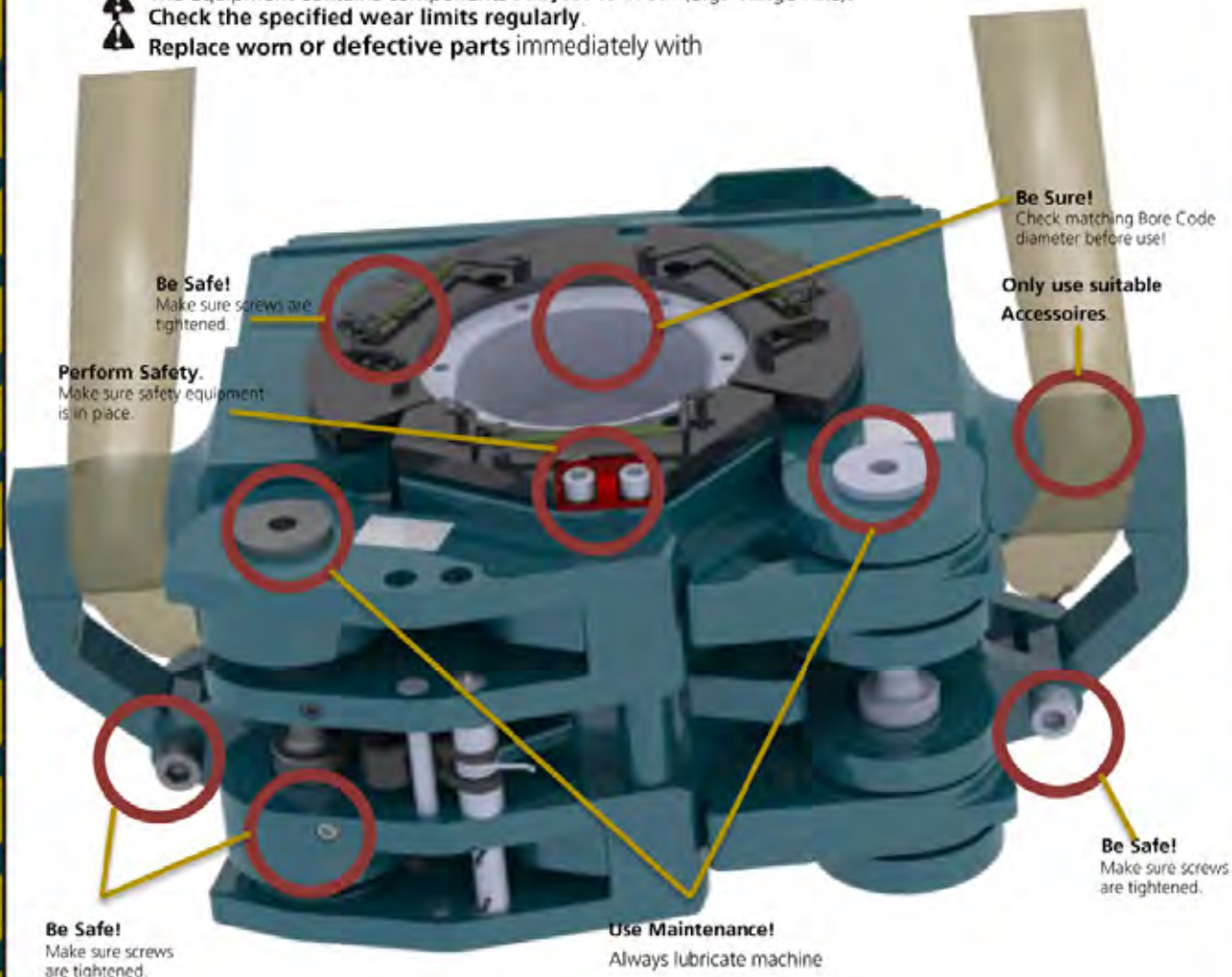
To reduce the risk of injury, everyone using, installing, performing maintenance, changing accessories on, or working with this tool must read and understand these instructions before operation.

__OUR__ goal is to produce tools that help you work safely and efficiently.
The most important safety device for this tool is __YOU__.
__YOUR__ good judgement is the best protection against injury.

The **FORUM Handling Tools** elevator were designed and produced in consideration of all required safety precautions. For safe and proper use it is essential that all personnel working on the machine take the prescribed safety measures and observe the safety precautions specified when operating the machine.

▶ Inspection Guide

- **Use the equipment** only for the intended purpose in a safe state.
- **Rectify all faults** immediately which could have a negative effect on the safety.
- **All safety features** must be **installed** completely before operation.
- The equipment contains components **subject to wear** (e.g. Hinge Pins).
- **Check the specified wear limits regularly**.
- **Replace worn or defective parts** immediately with



FORUM™ Pipe Handling Tools

DO NOT DISCARD - GIVE TO OPERATOR

SAFETY INSTRUCTIONS

for SD-Series Elevator

⚠ WARNING

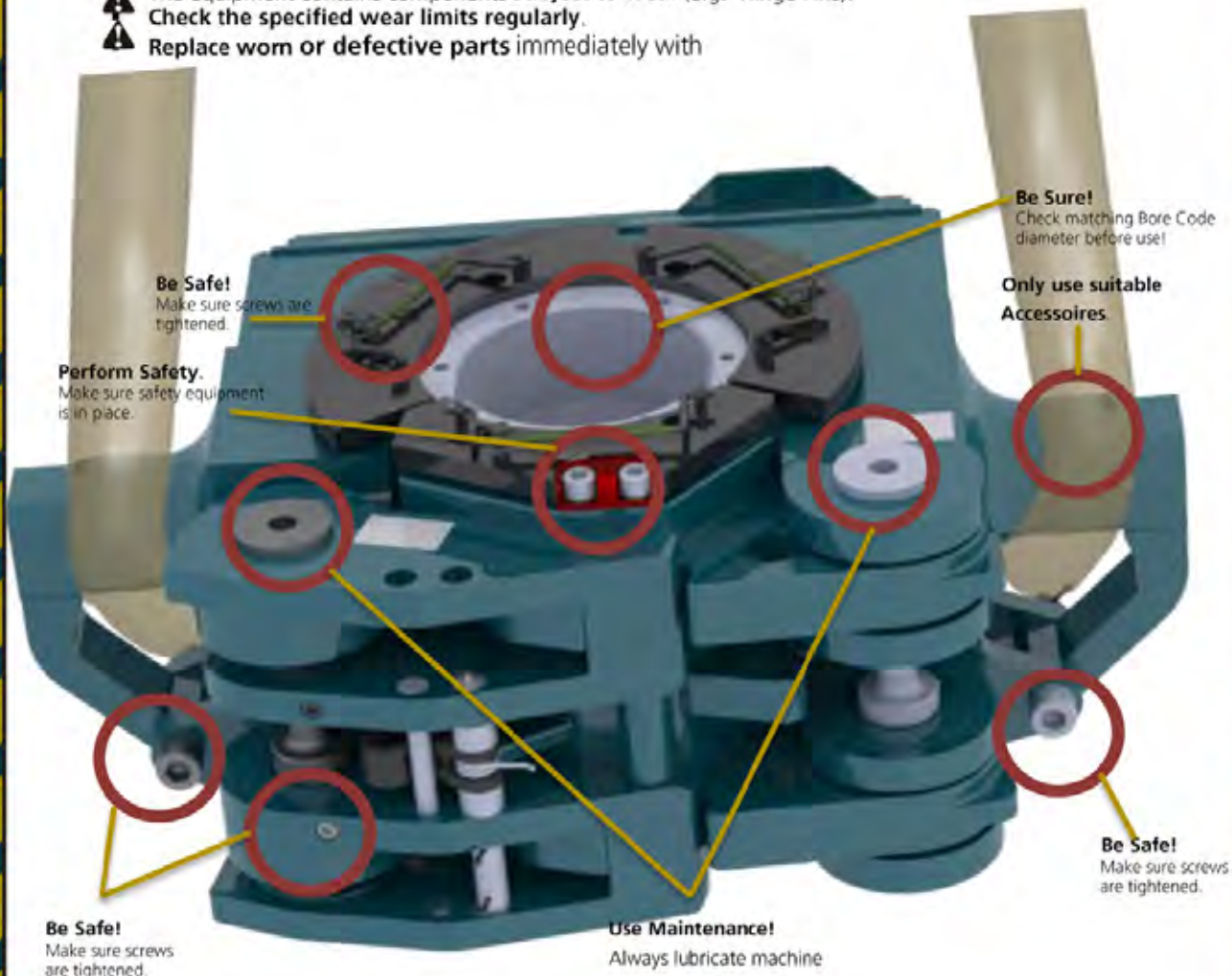
To reduce the risk of injury, everyone using, installing, performing maintenance, changing accessories on, or working with this tool must read and understand these instructions before operation.

***OUR** goal is to produce tools that help you work safely and efficiently.*
*The most important safety device for this tool is **YOU**.*
***YOUR** good judgement is the best protection against injury.*

The **FORUM Handling Tools** elevator were designed and produced in consideration of all required safety precautions. For safe and proper use it is essential that all personnel working on the machine take the prescribed safety measures and observe the safety precautions specified when operating the machine.

▶ Inspection Guide

- **Use the equipment** only for the intended purpose in a safe state.
- **Rectify all faults** immediately which could have a negative effect on the safety.
- **All safety features** must be **installed** completely before operation.
- The equipment contains components **subject to wear** (e.g. Hinge Pins).
- **Check the specified wear limits regularly**.
- **Replace worn or defective parts** immediately with



FORUM™ Pipe Handling Tools

DO NOT DISCARD - GIVE TO OPERATOR

TRANSPORT/ SETUP

3 Transport / Setup

Ensure that setup and installation work are accomplished only by sufficiently qualified and trained personnel.

Read these instructions carefully before setting up the machine and putting it into service.

3.1 Delivery

The VES SD and all accessory parts are shipped on transport pallets or - crates. All items on the pallets are secured against tipping and slipping with transport straps.

» Instructions for safe transport are attached to the transport crate.

» Transport the packed equipment as specified in these instructions.

3.1.1 Scope of Delivery

Info

The contract documents and shipment papers specify the precise scope of delivery. Check these documents carefully on delivery. In the event of any discrepancies please contact the FORUM Handling Tools representative specified in Chapter „Contact worldwide“ on page 11 immediately.

The scope of delivery includes all components required for the intended operation of the Double Door Elevator VES SD as described in Chapter „1.2 Assemblies and Components“.

3.1.2 Unpacking and Disposal of Packing Material

Remove the transport packaging and transport aids before hoisting the Equipment.

NOTE

» Do not remove transport retainers.

» The transport retainers should be removed only at the installation site just before startup.

Check scope of delivery.

1. Is any transport damage visible?
2. Is the shipment complete? Compare the scope of delivery with the specifications in the shipping documents.

If the Equipment has been damaged during transport or the shipment is incomplete, please notify the manufacturer immediately (refer to section XI “Contact worldwide” on page 11).

Dispose of the packaging material ecologically in compliance with all applicable regulations.

3.1.3 Intermediate Storage

If intermediate storage of the Equipment is necessary, observe the following:

- Leave the Equipment it its transport packaging. This provides sufficient protection against external influences.
- Secure the Equipment to prevent it from slipping or falling due to motion.

Fig. 26: Typical transport and conservation packing for VES SD

3.2 Transport

⚠ DANGER

Suspended load!

The falling load can cause severe, even lethal injuries.

» NEVER stand beneath or in the swing area of lifted loads

WEAR PROTECTIVE HELMET!

WEAR PROTECTIVE GLOVES!

WEAR SAFETY SHOES!

⚠ NOTE

Safe Lifting Points!

- Lifting point locations, especially bores for load hooks are marked on the device.
- Make Sure all load hooks are fully installed in the lifting point

» Thus, the safe transport of FORUM Handling Tools equipment is ensured.

⚠ NOTE

Internal transport on site!

- Lifting point locations, especially bores for load hooks are designed for installation lifting.
- It is advised to use pallets for longer component transports.

» Use a pallet and place Slip assembly front side down for transport.

» Use a pallet and place body assembly uptight for transport.

Principles for transport

1. Ensure that transport routes are sufficiently dimensioned and marked.
   ▶ Ensure that persons are aware that a transport takes place.
2. Always use pallets for longer transport distances.
3. The total weight (object to be transported + means of transport, e.g. forklift) must not exceed the supporting capacity of the subsurface.
4. Ensure that such work is performed only by sufficiently qualified personnel.
5. Always shut off Equipment before transport and secure against starting back up unintentionally.
   ▶ Start de-installation only after residual energy has been dissipated.
6. Ensure that visual and audio contact exists between the crane operator and operating personnel.
7. Secure the area against unauthorized entry.
   ▶ If necessary mark the area with information signs to warn of maintenance and repair work.
8. Secure moving parts in suitable manner
9. Use only approved slinging and transport equipment, which is in perfect condition and suitable for the intended purpose.
   ▶ Observe specified load limits.
10. Secure Equipment against Slipping/sliding.
    ▶ Observe Equipment weight.
    ▶ Observe center of gravity.
11. Never stand under suspended loads.
12. Transport the Equipment carefully.
    ▶ Do not fasten, lift or pull Equipment on parts, that could be damaged.
    ▶ Avoid sudden stops.
13. Always use hoisting equipment (slings, hoisting cables, shackles, etc.), which has been inspected and is sufficiently dimensioned.
14. Ensure that all installation and hoisting procedures are accomplished in compliance with recognized rules of practice and industrial standards.

» **For detailed weight specifications refer to section 1.3 “Technical Data Type series” on page 19**

3.3 Lifting arrangements

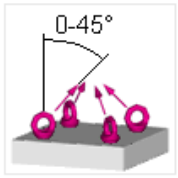
This topic is indicated to show save lifting arrangements for the main assemblies.

It may show the VES SD in different assembled states, refer to the suitable set-up section for assemble tasks.

3.3.1 Lifting safety on installation site

Hoist the Equipment safely

1. Attach the VES SD only at the lifting points provided for transport.
2. Use hoisting chains/cable with circular slings with a load carrying capacity appropriate to the weight of the VES SD.
3. Attach the hoisting chains/cableso that they are tensioned straight without kinks.
4. Use hoisting chains/cable and load hooks with sufficient supporting capacity.



⚠ NOTE

Lifting angle limited to 45°!

The hoisting eyes installed are suitable for 1500kg each. Therefore the lifting angle of the hoisting equipment might not succeed 45°.

⚠ NOTE

Lifting Points!

Lifting point locations are marked on the device, where slings can be securely fastened. Thus, the safe transport of FORUM Handling Tools equipment is ensured.

⚠ DANGER

Safe Lifting!

Always Make sure that the load hooks are fully installed in the lifting points before lifting the VES SD .

⚠ DANGER

Suspended load!

The falling load can cause severe, even lethal injuries.

» NEVER stand beneath or in the swing area of lifted loads

» AlWAYS use the marked lifting points to lift the VES SD

3.3.2 VES SD Lifting arrangement

1. Fasten the lifting material on VES SD lifting points.
2. Lift the VES SD slightly to tension the lifting material.

⚠ WARNING Danger of collision with swinging loads! Ensure that no one is present in the swing range of the machine.

3. Lift the VES SD.
4. Move the VES SD to the installation location.
5. Set the VES SD down carefully on a suitable subsurface.

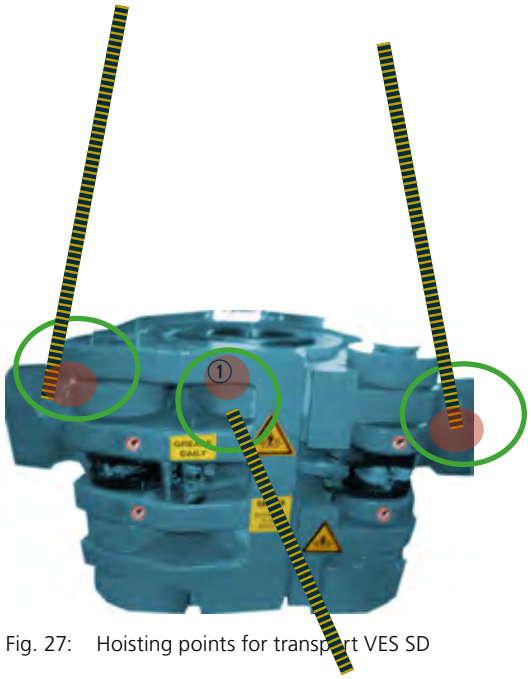


Fig. 27: Hoisting points for transport VES SD

⚠ NOTE

Lifting guidance on transport!

Some members of the VES SD type series are especially equipped with a guidance lifting point ①. If necessary a lifting eye for the guidance rope can be installed in a bore on the VES SD body .

3.3.3 Double Rotator Lifting arrangement

1. Fasten the lifting material on Double Rotator lifting points.
2. Lift the Double Rotator slightly to tension the lifting material.

⚠ WARNING Danger of collision with swinging loads! Ensure that no one is present in the swing range of the machine.

3. Lift the Double Rotator.
4. Move the Double Rotator to the installation location.
5. Set the Double Rotator down carefully on a suitable subsurface.

Fig. 28: Hoisting points for transport Double Rotator

3.3.4 Single Rotator Lifting arrangement

1. Fasten the lifting material on Single Rotator lifting points.
2. Lift the Single Rotator slightly to tension the lifting material.

⚠ WARNING Danger of collision with swinging loads! Ensure that no one is present in the swing range of the machine.

3. Lift the Single Rotator
4. Move the Single Rotator to the installation location.
5. Set the Single Rotator down carefully on a suitable subsurface.

Fig. 29: Hoisting points for transport Single Rotator

3.3.5 Space Requirement

During operation the VES SD is connected to the Top drive in vertical drilling direction via elevator links.

A free space of approx. 10 m² around the VES SD is required for work (e.g. maintenance work).

Fig. 30: VES SD. Hazardous Locations

Maintenance work

- A free space of approx. 4 m² around the VES SD is required for work (e.g. maintenance work).

Lifting and Operation

- A free space of approx. 1 m around the VES SD is required for Lifting and operation .
  Stay additionally away from the Load hooks.

Operation

- A free space of approx. 1 m around the VES SD is required for operation.
  Stay additionally away from the lifting assembly.

3.3.6 Installation site requirement

The VES SD is designed and constructed for use in the drilling industry on ships and platforms.

» The tool complies with the Machinery Directive 2006 / 42 / EC.

» For machines containing any hydraulic powered parts, the Directive 2014 / 34 / EC "Equipment and protective systems in potentially explosive atmospheres" applies.

Hydraulic Supply Connection requirements

Hydraulic operating pressure	140 bars (2.027 psi)

refer to section 4.6.1 "Hydraulic fine adjustment" on page 76

Hydraulic pressure	
140 - 210 bar (2030 - 3046 psi	Operating pressure (Line P,T,C1)
40 - 210 bar (2031 - 3046 psi)	Pilot/feedback pressure (Line XP):
85 bar (1233 psi)	Close Elevator (XP1)
110 bar (1595 psi)	Elevator closed and Load attached (XP2)
170 bar (2466 psi)	Open Elevator (XP3)
85 - 110 bar (1233 - 1595 psi)	Floating pressure (Line FL):

3.4 Set-up, Installation and Arrangement

The VES SD is completely pre-assembled before shipment, so that it can be installed immediately after unpacking at the installation site.

INFO

Installation/Change

Only one process (Installation or Removal) is described in the following instructions. For the missing process description perform the described tasks in reverse order.

Tools

The following tools are required:

- Crane
- Suitable hoisting equipment

WEAR PROTECTIVE HELMET!

WEAR PROTECTIVE GLOVES!

WEAR SAFETY SHOES!

⚠ DANGER

Suspended load!

The falling load can cause severe, even lethal injuries.

» NEVER stand beneath or in the swing area of lifted loads

⚠ WARNING

Danger of pinching/crushing hands!

Severe pinching/crushing up to loss of limbs.

» NEVER reach between body and bottom guide assembly when setting down.

⚠ WARNING

Pinching/crushing hazard from lowering body!

Severe pinching/crushing up to loss of limbs.

» NEVER step beneath the VES SD with feet.

Installing optional accessories and tools to the VES SD

List of optional accessories and tools

Following optional accessories and tools are available for the VES-SD.

Name	Description
Bushing	The design of the bushing segments allows the VES SD to grip casing with uniform radial pressure, ensuring a safe hold while minimizing the possibility of damage to the pipe. Refer to „Drawing, Parts List and Spare Parts“ on page 83.
Single Rotator	The FORUM Handling Tools Rotators are designed to be used for rotating an elevator. Refer to „Elevator Rotator Systems for Elevator“ on page 25.
Double rotator	

3.5.1.1 Mounting the VES SD to elevator links

1. Remove the transport packaging and transport aids from the VES SD.
2. Install the approbate bushings to the VES SD in order to ensure safe hoisting.
3. Position the VES SD on the rig near the links.

Mounting the VES SD to elevator links

4. Place the elevator on a plane surface.
5. After the elevator has been placed on the ground the link adapter ① can be opened.

For type series without quick release stake:

6. Loosen upper attachment screws in Link block stake ②.

For type series with quick release stake:

7. 3. Move release handle upwards ②.
8. Open Link block stake with a downwards move.
9. Move the lower opening of the links ③ over the lifting ears of the VES SD.
10. Move Link block stake upwards.

For type series without quick release stake:

11. Tighten screws with 231 lbf-ft / 313 Nm.

For type series with quick release stake:

12. 7. Press Link block stake in attachment plate. Listen to audio arrestment noise to verify attachment.

⚠ WARNING Pinching and crushing!

The links must be handled and guided from the outside of the Lifting ear opening of the VES SD. Use ropes to adjust the links.

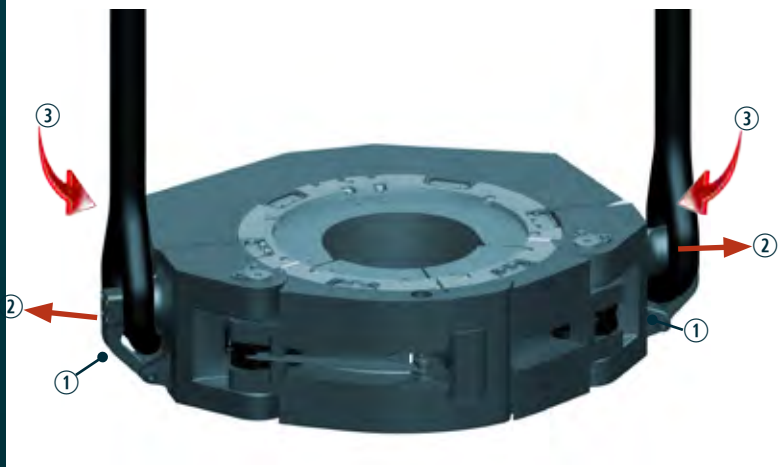


Fig. 43: Mounting the VES SD to elevator links

3.5.1.2 Installation of riser running tool bushing

The installation of riser running tool bushing is the same as for standard bushing.

See also “Installing and removing the required bushing” at page 24. Installation of riser running tool bushing

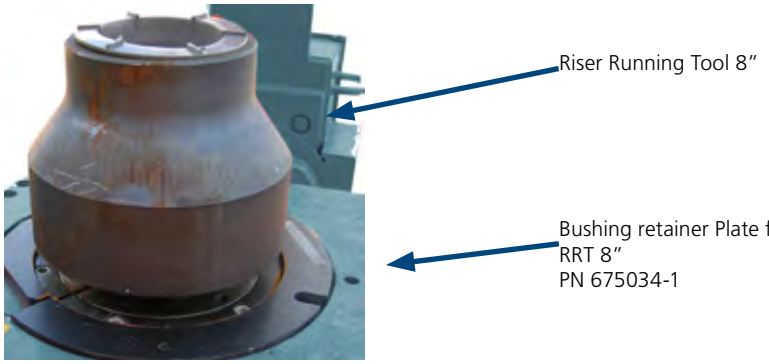


Fig. 44: VES SD 750 - Moving the trigger

3.4.6.1 Installation and change of Elevator bushings

Make sure that the elevator bushings installed to the VES SD match with the expected load. Additionally only use pairing bushings with the same size and serial number.

A set of bushings consists of five segments.

⚠ WARNING

NEVER operate the VES SD without bushings!

Tools

- Approbate lifting equipment to lift the VES SD
- Screw wrench
- Bushing lifting handle (P/N 645234)
  - see Tool Kit for VES-SD Elevators (P/N 648100-TK)

for

Preparations

1. Place the elevator on a plane surface.
2. Remove closing trigger (see chapter 3.6.3)

Installation

3. Perform the remove tasks in reversed order.

Bushings removal [VES SD500-1 and VES SD750]

A bushing consists three parts, one door segments, and two segments in the elevator frame.

The doors must be open in order to change the required bushing.

1. Remove the cotter pin from the ring, followed by the lifting clip
2. Remove the cover ring (body and doors) by loosening the Retainer Bolts (counter clockwise rotation)
3. Install eyebolts or Bushing lifting handle to bushing.
4. Remove Bushings from VES SD.
   Remove the door segment first, and then the two body segments.
5. Repeat step 1. to 4. for the remaining segments.

NOTE The design of the VES SD500-1 and VES SD750 has been updated due to a safety design revision regarding the bushing retainer plate (see Safety Notice 30 and Installation Instructions to SN 30, annexed in chapter 7 Drawings).
PLEASE make sure the Retrofit kit is installed on your VES SD500-1 and VES SD750.

NOTE Before installing a new bushing, the seating area in the elevator must be cleaned and lubricated.

Fig. 45: VES SD 750

Fig. 46: Opening doors VES SD 750

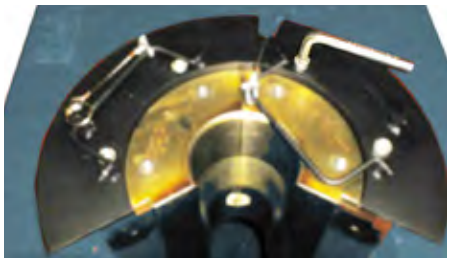


Fig. 47: Loosen cover ring VES SD 750

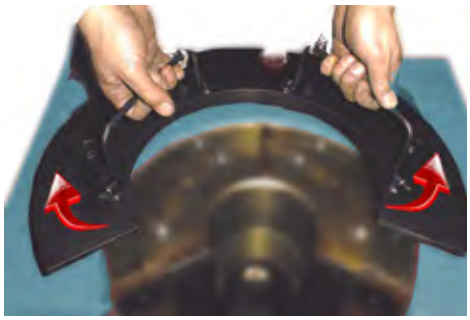


Fig. 48: Remove cover ring VES SD 750

Fig. 49: Remove bushing VES SD 750

Bushings removal [VES SD500-2 and VES SD500-3]

A bushing consists of four parts, two door segments, and two segments in the elevator frame.

The doors must be open in order to equip the elevator with the required bushing.

1. Remove the cotter pin from the ring, followed by the lifting clip

2. Remove the cover ring (body and doors) by loosening the Retainer Bolts (counter clockwise rotation)

3. Install eyebolts or Bushing lifting handle to bushing.

4. Remove Bushings from VES SD.
   Remove the door segments first, and then the two body segments.

5. Repeat step 1. to 4. for the remaining segments.

NOTE Before installing a new bushing, the seating area in the elevator must be cleaned and lubricated.

Fig. 50: VES SD 500-2

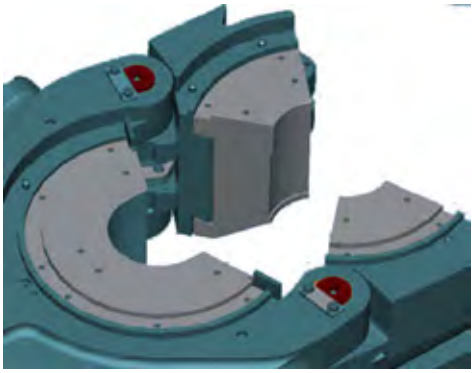


Fig. 51: Opening doors VES SD 500-2

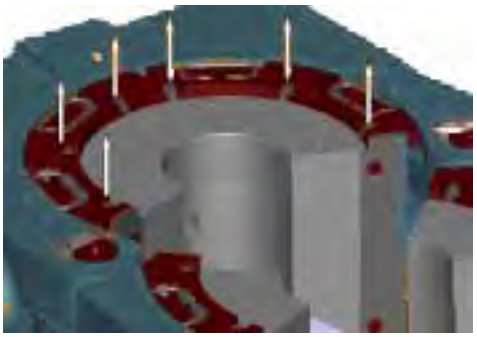


Fig. 52: Loosen cover ring VES SD 500-2

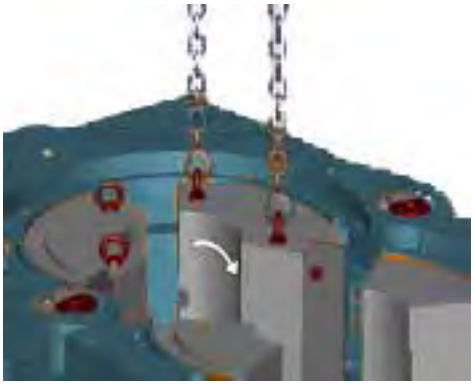


Fig. 53: Remove bushing VES SD 500-2

⚠ NOTE

Function Test of the Load Sensor

After a new bushing is installed, the load sensor must be checked.

For testing, an approx. 150 kg weight is placed on top of the Elevator.

» Watch the segment 1 sagging down and test that the elevator can not be opened.

3.4.6.2 Remove closing trigger

To ease bushing installation, the closing trigger should be moved backwards.

1. Open the rear cover of the elevator after having removed the cotter pin.

2. The closing trigger removal tool is located inside the hinged cover.

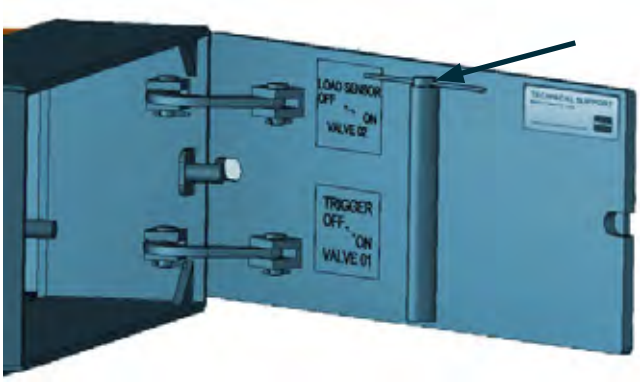


Fig. 54: VES SD - closing trigger removal tool location

3. Position the tool in bore on top of the body in order to remove the clamping screw from the elevator.

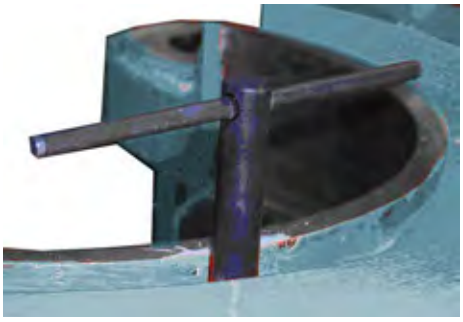


Fig. 55: VES SD 750 - Tool installation

4. After loosening the clamping screw the closing trigger can be moved through the rear.

Fig. 56: VES SD 750 - Moving the trigger

5. When installing the closing trigger, make sure to insert it until the bushing stops and fix it with the clamping screw. Do not fit the clamping screw until the bushing is completely seated.

6. If the closing trigger does not completely rest on the stop, the elevator will not close ④ only close very slowly.
7. By actuating the stopcock, the elevator can be closed even without pipes.

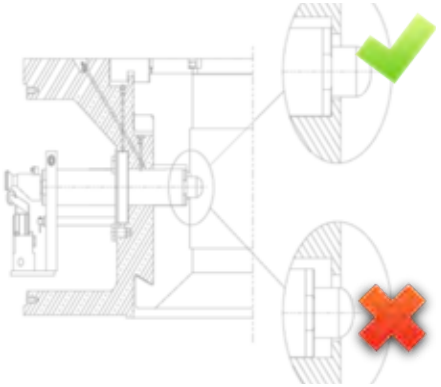


Fig. 57: Remove bushing VES SD 750

3.4.6.3 Installation the Double Elevator Rotator

In order to install the Double Elevator Rotator for each FORUM Handling Tools VES SD type elevator rotator adapter are available which must be installed.

A set of elevator rotator adapter consists of one pair segments.

⚠ WARNING

NEVER operate the rotator without suitable elevator rotator adapter!

Tools

- Approbate lifting equipment to lift the Double Elevator Rotator
- Screw wrench

Installation

1. Place the elevator on a plane surface.
2. Install the approbate elevator rotator adapter to the VES SD to ensure safe fitting of the rotator.
3. Remove screws ① ② in securing adapter ③ and remove securing adapter ③.

Fig. 31: Removing the VES SD securing adapter

4. Install adapter plate ④ and securing adapter t from elevator rotator to VES SD.
5. Attach adapter plate ④ and securing adapter t with screws.
   Tighten screw with 231 lbf-ft / 313 Nm.

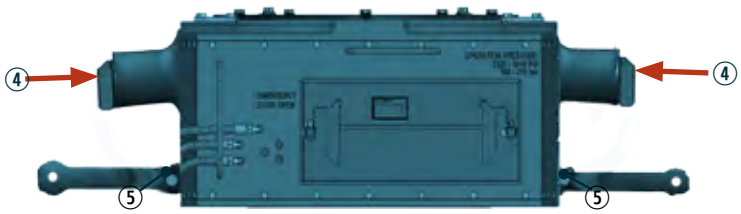


Fig. 32: Installation of the elevator Rotator adapter to the VES SD

6. Move the lower opening of the links y over the lifting ears of the VES SD.

⚠ WARNING Pinching and crushing!

The links must be handled and guided from the outside of the Lifting ear opening of the VES SD. Use ropes to adjust the links.

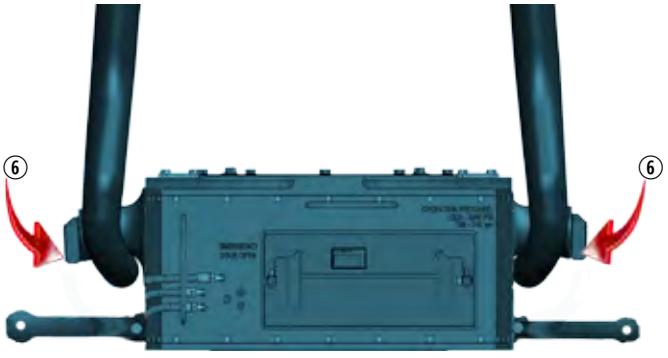


Fig. 33: Mounting the VES SD to elevator links

7. Attach elevator rotator to crane.
8. Lift elevator rotator carefully to the VES SD.
9. Position lower attachment bracket of elevator rotator in elevator securing adapter.

10. Install the Locking Pin ① in adapter plate.
11. Place and tighten screw ② in elevator securing adapter with 231 lbf-ft / 313 Nm.
12. Repeat steps 7. - 11. on the other side of the VES SD.
13. Secure the elevator links with safety rope on elevator rotator top.

» The Double Elevator Rotator is installed to the VES SD.

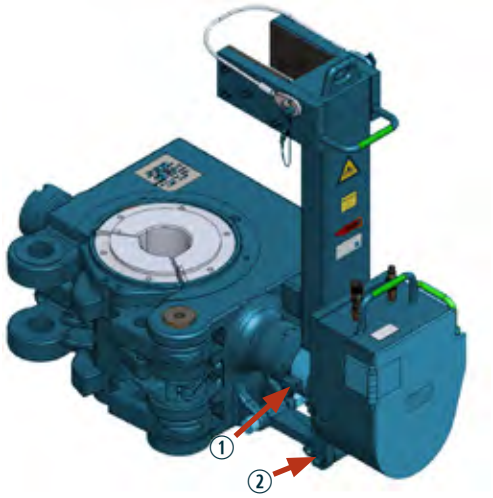


Fig. 34: Mounting elevator rotator to the VES SD

⚠ WARNING

Never use the lifting eyes for carrying the elevator/rotator-system.

The eyebolts on top of the Double Elevator Rotation System must never be used for lifting the elevator!

The eyebolts are only attachment points for handling the elevator.

» Lifting the elevator/rotator-system is allowed in links only.

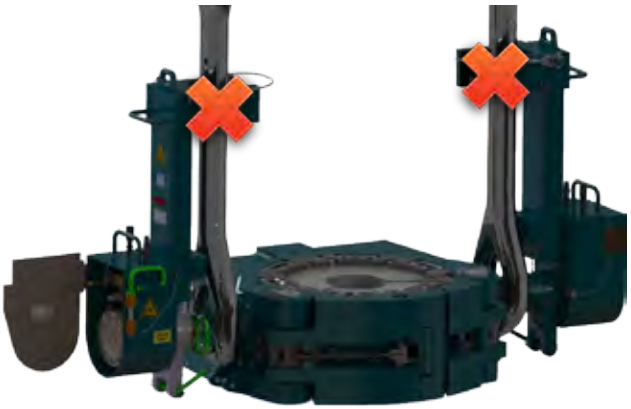


Fig. 35: Double Elevator Rotator Mounted (VES-SD500-2)

Removal

1. Perform the installation tasks in reversed order.

3.4.1 Installation the Single Elevator Rotator

In order to install the Single Elevator Rotator for each FORUM Handling Tools VES SD type elevator rotator adapter are available which must be installed.

A set of elevator rotator adapter consists of one segments.

⚠ WARNING

NEVER operate the rotator without suitable elevator rotator adapter!

Tools

- Approbate lifting equipment to lift the Single Elevator Rotator
- Screw wrench

Installation

1. Place the elevator on a plane surface.
2. Remove screws ① ② in securing adapter ③ and remove securing adapter ③.

Fig. 36: Removing the VES SD securing adapter

3. Install adapter plate ④ and securing adapter t from elevator rotator adapter kit to VES SD.
4. Attach adapter plate ④ and securing adapter t with screws.
   Tighten screw with 231 lbf-ft / 313 Nm.

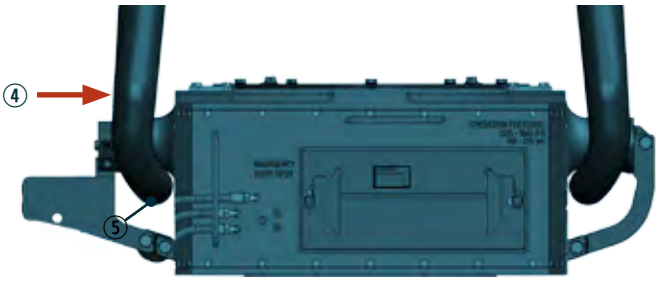


Fig. 37: Installation of the elevator Rotator adapter to the VES SD

⚠ WARNING Pinching and crushing!

The links must be handled and guided from the outside of the Lifting ear opening of the VES SD. Use ropes to adjust the links.

5. Install approbate link bushing (2x) to single elevator rotator y and secure with screws and washer u (6x).
   Tighten screw with 231 lbf-ft / 313 Nm.

Fig. 38: Mounting link bushings to elevator rotator

6. Open upper Link attachment ① of rotator.

Fig. 39: Mounting elevator rotator to the VES SD

7. Attach elevator rotator ② to crane.
8. Lift elevator rotator carefully to the VES SD.
9. Position lower attachment bracket of elevator rotator in elevator securing adapter ③.

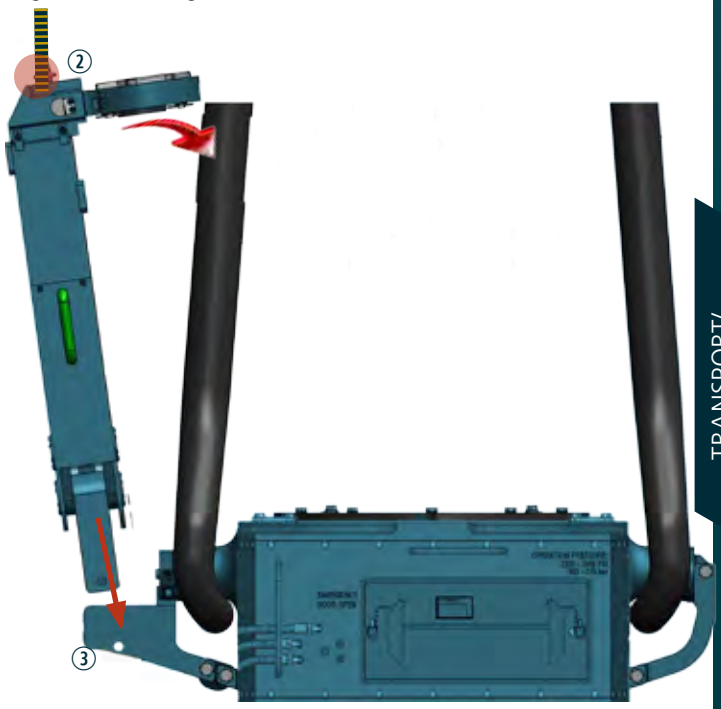


Fig. 40: Mounting elevator rotator to the VES SD

10. Place and tighten screw, nut and washer ④ in elevator securing adapter with 231 lbf-ft / 313 Nm.
11. Close upper Link attachment t of rotator.
12. Secure Link attachment to link and secure with screw t.

» The Double Elevator Rotator is installed to the VES SD.

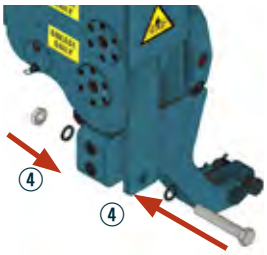


Fig. 41: Mounting elevator rotator to the VES SD

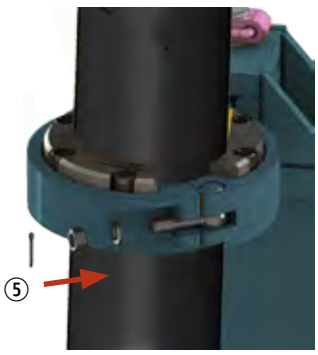


Fig. 42: Mounting elevator rotator to the VES SD

Removal

1. Perform the installation tasks in reversed order.

3.5 Installation Checklists

⚠ **WARNING** Lift the VES SD on the lifting points only.
⚠ **WARNING** Wear your personal protection equipment at all times.
Basically the Elevator has to be installed as shown in the manual.

OK	☐	Make sure the required bushings are installed before first use.
OK	☐	Make sure the bushings are fixed with the Bushing Retainer.
OK	☐	Make sure Hydraulic Pressure is switched on.

Hydraulic Connections

OK	☐	Make sure the controls are connected to the Hydraulic Power Supply.	
OK	☐	Check if all hydraulic connections correctly installed.	
OK	☐	Operating pressure	160 -210 bar (2320-3046 PSI)
OK	☐	Volumetric flow	6 Gpm (22l/m) up to 10 Gpm (44 l/m)

Function test

There are two possibilities to carry out the function test:

1. VES-SD Elevator standing on the floor
2. VES-SD Elevator installed into the links

OK	☐	Close elevator.
OK	☐	Open elevator.
OK	☐	Close elevator.
OK	☐	Check if elevator is properly closed and latched
OK	☐	Check signal elevator closed is present.
OK	☐	Check all tools are removed from the elevator.

COMMISSIONING / OPERATION

4 Commissioning and Operation

Ensure that the elevators are operated only by personnel trained for this work and familiar with the risks involved in operating the Equipment.

Read these instructions carefully before setting up the Equipment and putting it into operation.

INFO

FORUM Handling Tools recommends having the VES SD put into service by FORUM Handling Tools .

4.1 Commissioning

⚠ WARNING

Danger of pinching/crushing feet!

Transporting and setting down heavy components.

NEVER step below moving Equipment parts.

⚠ WARNING

Separated hydraulic lines pose an injury hazard!

This symbol is used to mark areas where injuries are possible from disconnecting hydraulic lines in which the pressure has NOT been relieved.

⚠ WARNING

Defective hydraulic lines pose an injury hazard!

This symbol is used to mark areas where injuries are possible from defective hydraulic lines.

⚠ WARNING

Health hazards from service products!

This symbol warns of health hazards resulting from contact of service products (e.g. lubricants, hydraulic fluids) with the skin, mucous membranes, eyes and respiratory paths.

⚠ DANGER

Suspended load!

The falling load can cause severe, even lethal injuries.

» NEVER stand under suspended loads.

» NEVER stand in the swing area of suspended loads.

⚠ WARNING

Danger of pinching/crushing body!

» DO NOT step between the unsecured shells of the doors.

» DO NOT stand within the opening range of the door while it is being opened or closed!

4.1.1 Safety Considerations

Safety considerations for operation

1. Do not touch the VES SD in operation
2. During operation keep a safe distance from the VES SD.
3. Before initial start-up and before every start of operation, check for the proper function of the Feedback signals in order to avoid accidents during operation!

4.1.2 Initial Operation

Perform following function tests:

1. Remedy all defects noted during checks.

⚠ **CAUTION** Never attempt to start up when defective.

4.1.3 Safety checks before initial operation

Functional checks before initial operation

1. Check elevator opens by hydraulic pressure.
2. Check feedback signal indicates elevator closed and latched.
3. Check required bushings are installed before first use.
4. Check all bushing segments are of same size and serial number.
5. Check if bushings are fixed correctly.
6. Check all safety / lock wire is present.
7. Check if the feedback valve is present.
8. Check elevator opens by hydraulic pressure.
9. Pick up a pipe.
10. Check feedback signal is given when the elevator is closed and latched.
11. Check if elevator opens after giving command "open elevator".

WEAR EYE PROTECTION!

WEAR PROTECTIVE HELMET!

WEAR PROTECTIVE GLOVES!

WEAR SAFETY SHOES!

Safety check Procedure

» Remedy all defects noted during checks.

⚠ **CAUTION** Never attempt to start up when defective.

» Activate hydraulic system.
Ensure that required operating data is observed:

Hydraulic specifications	
Operating pressure	160 -210 bar (2320-3046 PSI)
Volumetric flow	6 Gpm (22 l/m) up to 10 Gpm (44 l/m)
Couplings:	
2 hydraulic lines to open and close	(⅜" – coupling)
1 hydraulic line as feed back signal	(¼" – coupling

⚠ **CAUTION** Never attempt to start up when defective.

4.2 Connecting the Hydraulic System

Ensure that work on the hydraulic system is performed only by personnel trained for such work and conscious of the risks involved.

Read these instructions carefully before performing any work on the hydraulic system.

⚠ WARNING

Hydraulic fluid can pose a health hazard!

Hydraulic fluid can injure the skin, mucous membranes or eyes on contact.

Do NOT touch hydraulic fluids.

ALWAYS wear appropriate protective equipment.

WEAR EYE PROTECTION!

WEAR PROTECTIVE GLOVES!

NOTE

During installation, when setting up and taking down as well as during operation of the VES SD ensure that the hydraulic lines do not chafe. If necessary provide hydraulic lines with chafe guard.

Info

Bleeding

The hydraulic system in the VES SD is bled at the factory. Ensure that the rig's own supply connections are bled before connecting the VES SD.

4.2.1 Connecting the Hydraulics

Hydraulic specifications	
Operating pressure	160 -210 bar (2320-3046 PSI)
Volumetric flow	6 Gpm (22 l/m) up to 10 Gpm (44 l/m)

Forum Access Oil Tools Connections:	
Connection A:	Hydraulic fluid pressure at connection **A** closes the Elevator.
Connection B:	Hydraulic fluid pressure at connection **B** opens the Elevator.
Connection C:	When the Elevator is completely closed via connection **A**, connection **C** applies a hydraulic pressure of approximately working pressure.

Couplings:

2 hydraulic lines to open and close	(⅜" – coupling)
1 hydraulic line as feed back signal	(¼" – coupling

VC Connections

The elevator has three connections (P, T, XP) on the rear side.

Connection P	Pressure line
Connection T	Return line
Connection XP	Pilot line

4.2.1.1 Control Switch

Lines A, B and C (resp. T,P XP) are connected from the elevator to the Control Switch (optional equipment). The Control Switch has three outputs S1, S2 and S3 that lead to the driller cabin.

Two other outputs (T and P) connect the Control Switch to the hydraulic ring line or the hydraulic power unit.

1. Check the condition of the Elevator (no loose parts).
2. Place the Elevator on the rig floor.
3. Connect the hydraulic output lines and couplings of the Elevator with the rig connection lines.

⚠ **WARNING** Before every Start of operation, check for proper function of the feedback signals!

4.2.1.2 Additional feedback signal (FL)

The additional Feedback signal is given on -FL devices after a pipe has been picked up and locked in the elevator. The two different feedback signals can be read out by the pressure value.

1. Feedback Signal
   (elevator closed): 85 bar
2. 2. Feedback signal
   (elevator closed and load attached): 110 bar

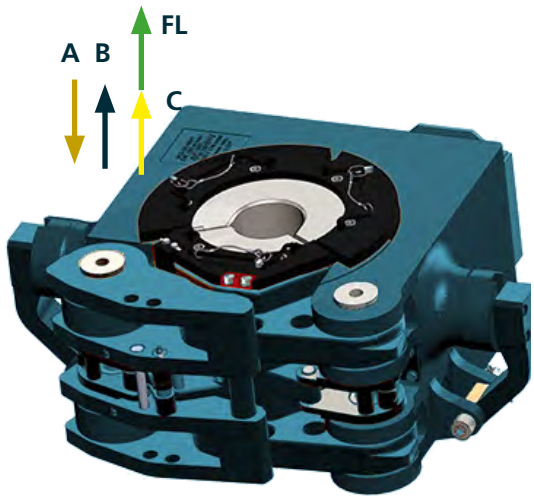


Fig. 58: VES SD additional feedback

4.2.2 Installation Schematics

4.2.2.1 Hydraulic Connections for VES SD with Double rotator with FORUM Handling Tools connections

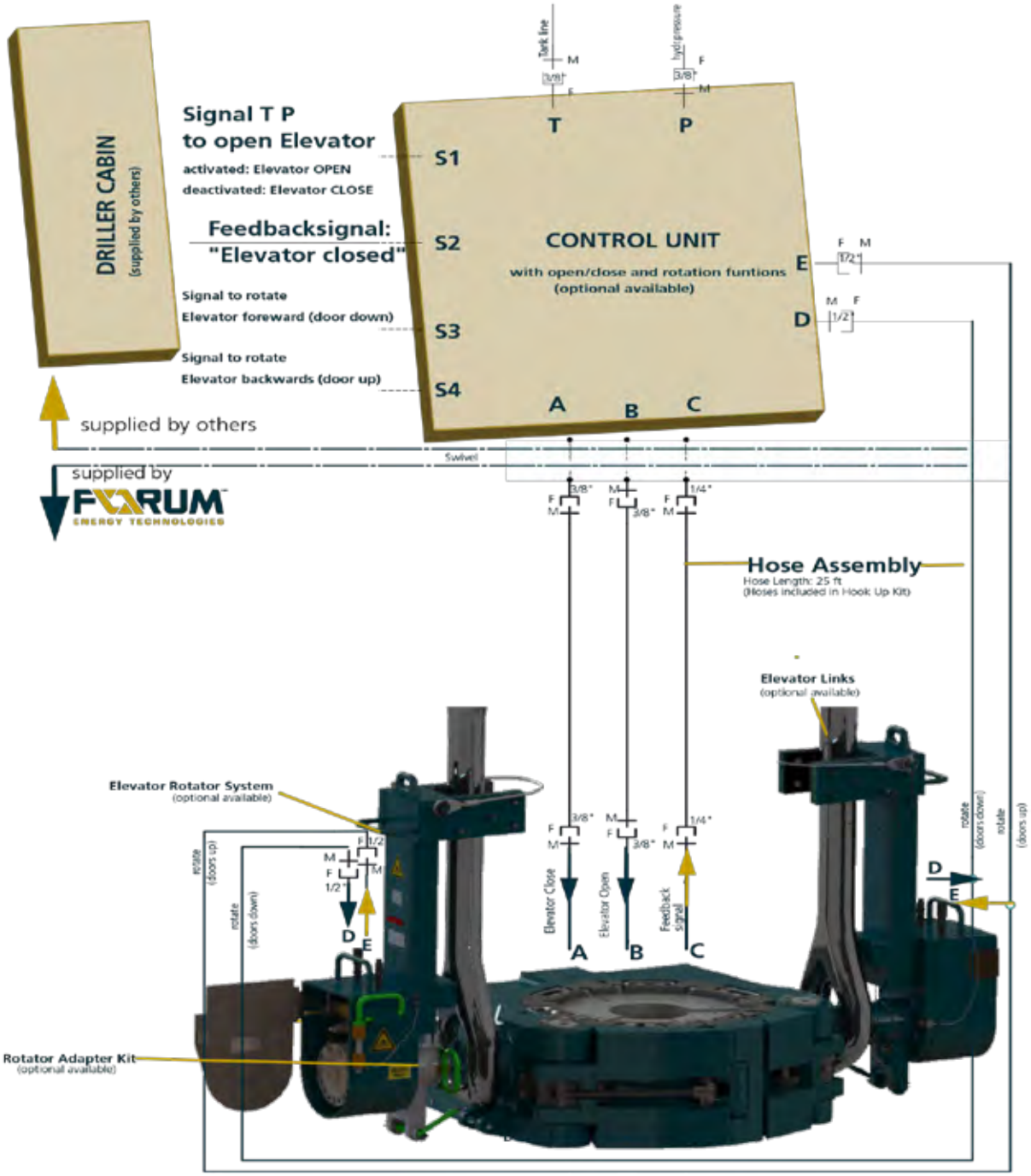


Fig. 59: Hydraulic and Pneumatic Connections for VES SD 500-2 with Double rotator

4.2.2.2 Hydraulic Connections for VES SD with Single rotator with VC connections

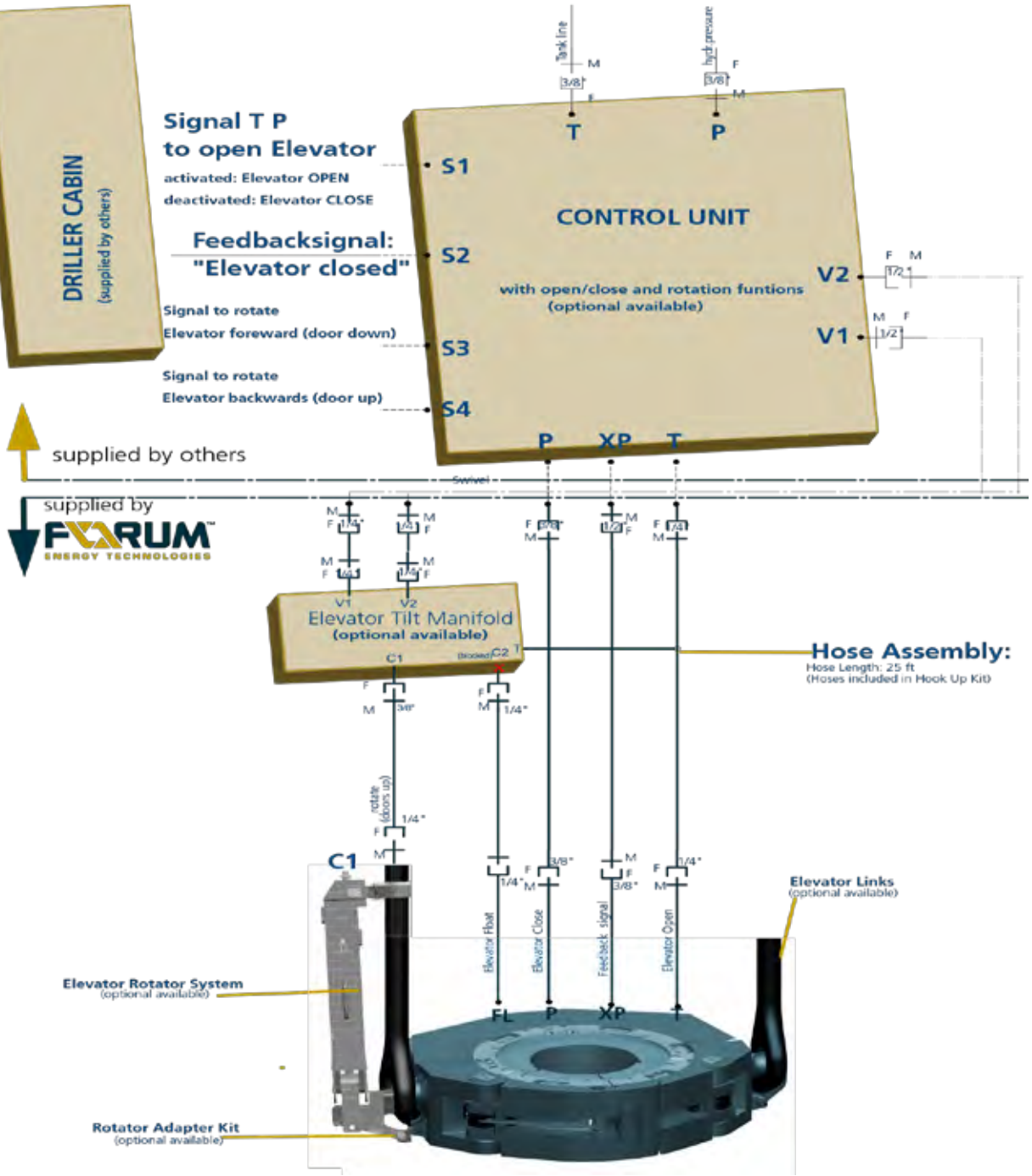


Fig. 60: Hydraulic and Pneumatic Connections for VES SD 500-3 with Single rotator with VC connections

⚠ NOTE

Notes to Installation Schematic!

» FORUM Handling Tools does not supply electrical cable outside of Control Switch and does not supply installation of electrical cable.

» If AMP, Rotation System or Control Switch is delivered without Hook Up Kit, then FORUM Handling Tools supplies complete couplings (both male and female) with outside thread for connection (see table for different thread sizes).

Electric connection

S1	24V DC, (cable gland: cable diameter 4-9 mm)
S2	max. 250V DC, (cable gland: cable diameter 4-9 mm)
S3	24V DC, (cable gland: cable diameter 4-9 mm)
S4	24V DC, (cable gland: cable diameter 4-9mm)

Hydraulic pressure

140 - 210 bar (2030 - 3046 psi	Operating pressure (Line P,T,C1)
40 - 210 bar (2031 - 3046 psi)	Pilot/feedback pressure (Line XP):
85 bar (1233 psi)	Close Elevator (XP1)
110 bar (1595 psi)	Elevator closed and Load attached (XP2)
170 bar (2466 psi)	Open Elevator (XP3)
85 - 110 bar (1233 - 1595 psi)	Floating pressure (Line FL):

Caption

A	Elevator close
B	Elevator open
B5	Elevator float
C	Feedback Signal
E	Rotation forward (doors down)
FL	Rotation backward (doors up)
T	Return line
P	Pressure line
S1	Signal to open Elevator
S2	Feedback Signal (when Elevator closed)
S3	Signal to rotate forward (doors down)
S4	Signal to rotate backward (doors up)
M	Male coupling
F	Female coupling

Function Table (Elevator Tilt Manifold)

V1	V2	x	C1	
⊖	⊖	⊖	⊖	**hold**
✓	⊖	⊖	✓	**rotate (doors upwards)**
⊖	✓	⊖	⊖	**float**
✓	✓	⊖	⊖	**float**
⊖	⊖	✓	⊖	**float**
✓	⊖	✓	⊖	**float**
⊖	✓	✓	⊖	**float**
✓	✓	✓	⊖	**float**

⊖ De-pressurized ⊖ Blocked ✓ Pressurized

4.2.3 Hydraulic connection of the Rotators

Double Elevator Rotator

Pressure line: male coupling.

Return line: female coupling.

⚠ WARNING If the rotation system is connected correctly, it will move upward (doors upwards)

Change the direction of rotation.

Be sure changing direction of rotation is necessary !

Make sure both sides of the Rotation system are being set up in the same direction

There is no switch for changing directions in the Control Switch

1. Open the door by removing securing pin.
2. Pull the cotter spring pin out of the securing plate.
3. Lift up the securing plate.
4. The direction in which the lever has to be pushed is visible. It is marked which rotation direction the system will have after switching.
5. Push the lever into the new position.

⚠ WARNING Always check if the rotation direction is the same at both sides!

6. Check both sides have the same rotational direction.
7. Close the rotation system and secure the door with the safety pin.
8. After using the rotation system always check if the system has been reset to the "door up" position, to make sure the Elevator will work properly when used again.

⚠ WARNING If the two sides of the rotation system are not turning into the same direction, damage can be caused to the Elevator and the Rotation System.
In this case all equipment has to be inspected in a FORUM Handling Tools authorized work shop.

Float Mode

For switching the rotation system into 'float mode", e.g. when picking up pipe from the V-door, follow this procedure

9. Set the hydraulic block in to "Float ON" position. To turn the valve, the tool from the Elevator P/N 775813 can be used.
10. Make sure to bring the system back into the "Float OFF" position.

⚠ Note Make sure both Rotation Systems are in the same position.

Fig. 61: Double Elevator Rotator hydraulics

Fig. 62: Double Elevator Rotator hydraulics Float setting

4.6 VES-SD Elevator Commissioning checklist

FORUM Handling Tools strongly recommends to accomplish the Elevator commissioning with the FORUM Handling Tools Commissioning Service.

⚠ NOTE: Read manual before first use !

OK	☐	Check crew is aware of all danger regarding handling the FORUM Handling Tools tool.
OK	☐	Go through manual with crew.

Prior to use of the FORUM Handling Tools Elevator following checks must be carried out :

Scope of supply

OK	☐	Cross check all delivered parts.

Hydraulic Characteristics

OK	☐	Operating pressure	160 - 210 bar (2320 - 3046 PSI)
OK	☐	Volumetric flow	6 Gpm (22 l/m) to 10 Gpm (37 l/m)

Check and Lubrication

OK	☐	Check elevator is in closed position.
OK	☐	Check Hydraulic Supply lines are disconnected.
OK	☐	Apply grease to all greasing points until grease is visibly coming out of the bores.
OK	☐	Check if elevator is installed as outlined in manual.
OK	☐	Connect feedback line.

Function Test

OK	☐	Check elevator opens by hydraulic pressure.
OK	☐	Check feedback signal indicates elevator closed and latched.
OK	☐	Check required bushings are installed before first use.
OK	☐	Check all bushing segments are of same size and serial number.
OK	☐	Check if bushings are fixed correctly.
OK	☐	Check all safety / lock wire is present.
OK	☐	Check if the feedback valve is present.
OK	☐	Check elevator opens by hydraulic pressure.
OK	☐	Pick up a pipe.
OK	☐	Check feedback signal is given when the elevator is closed and latched.
OK	☐	Check if elevator opens after giving command “open elevator”.

4.3 Operating the VES SD

⚠ WARNING

Danger of pinching/crushing body!

The body may fall shut.

» DO NOT step between the unsecured shells of the open body.

» DO NOT remove the spreading Equipment BEFORE closing the body and securing it with the hinge pin.

⚠ WARNING

Danger of pinching/crushing feet!

Transporting and setting down heavy components.

NEVER step below moving Equipment parts.

⚠ WARNING

Separated hydraulic lines pose an injury hazard!

This symbol is used to mark areas where injuries are possible from disconnecting hydraulic lines in which the pressure has NOT been relieved.

⚠ WARNING

Defective hydraulic lines pose an injury hazard!

This symbol is used to mark areas where injuries are possible from defective hydraulic lines.

⚠ WARNING

Health hazards from service products!

This symbol warns of health hazards resulting from contact of service products (e.g. lubricants, hydraulic fluids) with the skin, mucous membranes, eyes and respiratory paths.

Safety precautions

11. Be particularly careful in during operation.
12. Ensure that visual contact is always present between the deck personnel, and the operator in the doghouse.

Operational safety

1. The 1 inch turn buckles are to be tightened using the backup jam nut. Do not over tighten the turn buckles. Over tightening can cause injury and/or equipment malfunction.
2. Hydraulic pressure can cause serve injury. Always shut off the hydraulic supply, relieve hose pressure, and disconnect the Equipment from its supply source when not in use
3. Whipping hoses can cause serious injury. Always check for damaged or loose hoses or fittings Do not exceed maximum specified hydraulic pressures
4. Keep extremities and body parts clear of Kelly Spinner when in use.
5. Stay out of hazard zone while Equipment is in use.
6. Please follow all rules, regulations and legislation while working in these zones
7. It is recommended to have the VES SD operated by the driller.

4.3.1 Emergency Stop

No provisions have been made for equipping the VES SD with its own emergency stop switch.

For safe operation it is necessary to incorporate it into the emergency stop circuit in the rig's own hydraulic control.

4.3.2 Starting Back Up

4.3.2.1 Starting Back Up Normally

Proceed as follows to put Equipment back into service following maintenance work or breaks in operation:

1. Perform the safety checks and function tests described (refer to section 4.1.5 "Commissioning check list" on page 55).
2. Activate hydraulic system.

4.3.2.2 Starting Back Up Following an Emergency Stop

Proceed as follows to put the Equipment back into service following an emergency stop:

1. Ensure that the cause for the emergency stop has been remedied.
2. Check whether the drill string is held by the Elevator securely.
3. Ensure that the hydraulic system is operating properly.
4. Ensure that no one is in a hazardous position.
5. Release the emergency stop switch.
6. Perform the safety checks and function tests described (refer to section 4.1.5 "Commissioning check list" on page 55).
7. Activate hydraulic system.

4.3.3 Proper Shutdown

Proceed as follows to shut down the machine for maintenance work or breaks in operation.

1. Relieve the VES SD.

NOTE Ensure that the drill string is held securely (e.g. by Power Slip).

2. Open the AMP
3. Move the drill string out of the VES SD.
4. Switch off pressure to the VES SD.

4.3.4 Emergency open (Deactivating the load sensor)

In case that the elevator does not open and the elevator needs to get away from the pipe, an emergency valve can be activate.

The emergency valve is located at the rear door. To open the elevator in case of an emergency.

Eliminate the malfunction an carry out a function test before continue with standard operation.

⚠ WARNING

Danger of crushing!

When the pressure signal appears on the B port, the door will open, even under load.

Ball valve 02 (see hydraulic diagram) connects cylinder and the input port A directly. This bypass should be used only in case of emergency. To do this, open the rear door, turn the ball valve to the RIGHT.

Now the bypass is open and the load sensor DEACTIVATED.

NOTE Don't forget to switch the load sensor ON when returning to normal operation.

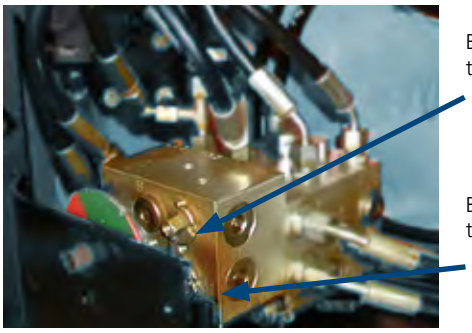


Fig. 63: VES SD Emergency Valve Location

Additional information about the ON/OFF position you can find on the rear door (green/red indication).

WARNING Use care handling the SD elevator with open bypass (for the load sensor). This bypass must be closed when the elevator is used during standard operation

4.3.5 Function Test of the Load Sensor

- Each time a new bushing is installed, the operation of the load sensor needs to be checked. The load sensor prevents the elevator from opening when the load is more than 150 kg.
- For testing, a weight is placed on top of the cover ring. The bushing will sag down approximately 5 mm, and the elevator can not be opened.
- If there is an interference, the elevator can be opened even though the load sensor is activated (Emergency Open).

⚠ WARNING: The emergency opening may not be used when the elevator is suspending a pipe.

4.3.6 Emergency open procedure

The emergency opening is on the rear of the elevator between the hydraulic connections A, B and C. It is labeled with "EMERGENCY OPEN".

The protruding rectangle is rotated 90 degrees to turn on the emergency opening. The closing trigger tool can be used for this.

⚠ WARNING: The emergency opening must always be reactivated after it is used, otherwise the load sensor will be deactivated which may result in a serious accident.

4.4 Handling Drill String

Operation MU (make up)

1. The floor man attaches a single joint elevator or pick up line to the next joint in the V-door when the elevator is lowered.
2. Lift the new joint from the V-door by lifting the elevator.
3. The floor man stabs the pipe on top of the pipe in the floor.
4. The elevator is lowered over the tool joint and the command “close elevator” is given.
5. A signal is given to the driller when the elevator is closed.
6. The pipe is made up.
7. The driller lifts the elevator in order to pick up the load.
8. The slips/spider is commanded to “open”, simultaneously, the driller picks up the elevator while the driller raises the spider/slips.
9. The driller lowers the string into the hole.
10. The floor man removes the single-joint elevator or pick-up line from the pipe.
11. The driller sets the spider/slips.
12. Open the Elevator and pick up a new section of pipe.

Operation BO (break out)

1. Pick up the string with the elevator.
2. Observe the Elevator is closed when the “elevator closed indication signal” is visible.
3. Raise the spider/slips.
4. Pull out the string.
5. Close the spider/slips
6. Release the string weight from the Elevator.
7. Now BO the stand or joint.
8. When the pipe is BO, pick up the stand and handle.

4.4.1 Elevator Rotator System operation

⚠ WARNING: It is not allowed to use the elevator with the doors pointing downwards.

⚠ WARNING: Make sure that the connections D and E are connected the same way, as otherwise the rotation motors rotate in different directions. This may result in damaging the Rotation System.

If a joint of pipe is in the elevator, the rotation system must be switched to “float”, before the elevator raises the pipe. The float-mode is reached by selecting the middle position of the $^4/_3$- way.

⚠ WARNING: Should the elevator be raised without selecting “float”, the elevator could be damaged beyond repair.

⚠ WARNING: Do not store the elevator with the rotation system connected to it. The rotator may fall and get damaged or cause injury.

⚠ WARNING: For handling of horizontal pipes it is recommended to rotate the elevator with latch in upright position.

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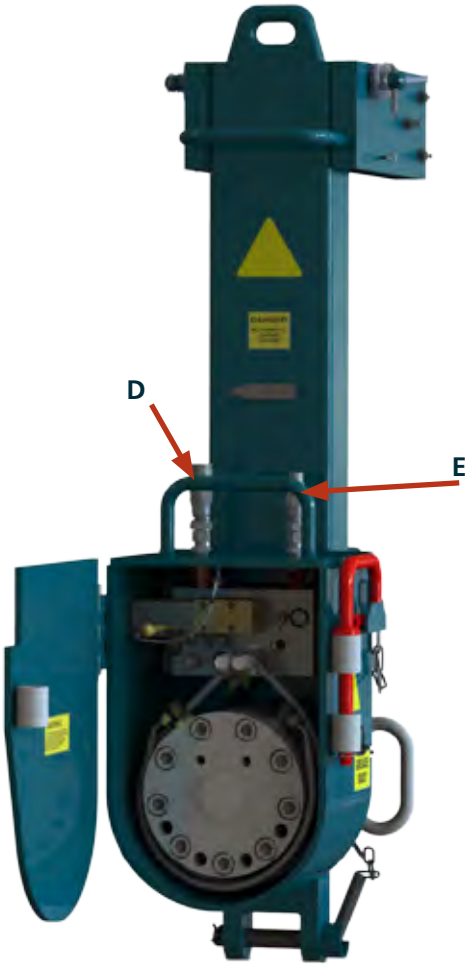


Fig. 64: VES SD Dual elevator Rotator system valves

Fig. 65: No pick up horizontal pipes with latch down

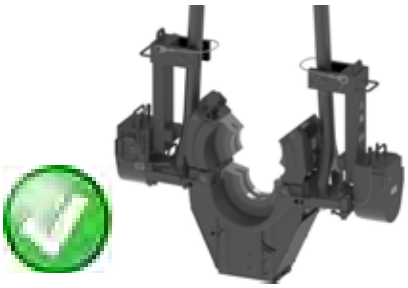


Fig. 66: Pick up horizontal pipes with latch up

4.5 Component installation and adjustment

4.5.1 Deactivating the trigger inside the elevator

1. The trigger system can be de-activated by opening the ball valve [1].
2. To do this, open the rear door, turn the ball valve [1], mounted in the left block counter-clockwise.
3. If there is pressure on port A (not B) the door closes immediately.
4. When the bypass is closed (ball valve closed) there is no direct connection between A port and cylinder. The door closes only when the trigger is activated by the pipe.
5. When the bypass is opened (ball valve open) the port A is connected to the cylinders directly. If there is pressure on port A, the door closes immediately.
6. The automatic function for CLOSE DOOR is not present.

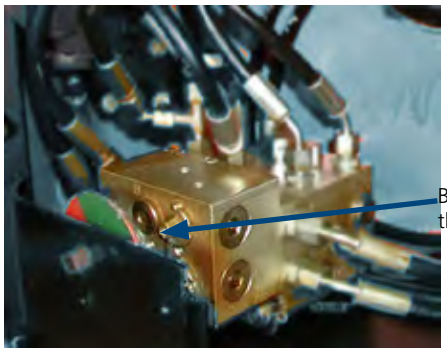


Fig. 67: VES SD Trigger Valve Location

4.5.2 Limiting the single elevator rotator

The max. movement of the single elevator rotator can be limited using the adjustment screw ①

1. Locate adjustment screw in elevator rotator ①.
2. Loosen screw and jam nut to full extend to enable a 90° movement (see illustration).
3. Tighten screw and jam nut to limit the movement.
4. Secure adjusted place with jam nut.

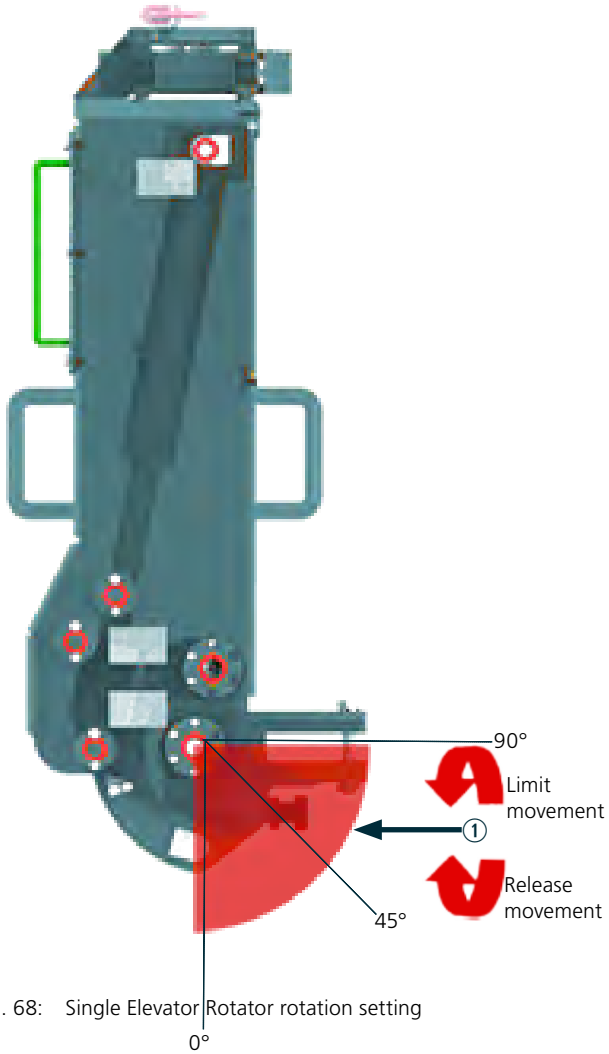


Fig. 68: Single Elevator Rotator rotation setting

4.6.1 Hydraulic fine adjustment

The hydraulic system of the Elevator is tested and delivered fully functional complete with the specified hydraulic power requirements. In case of a malfunction during the commissioning the following hydraulic settings can be carried out. Any changes in the settings are solely to FORUM Handling Tools personnel or to FORUM Handling Tools authorized and trained personnel. Failures may result in damages or severe personal injury.

⚠ WARNING: Wear on your personal protection equipment before any work is carried out.

⚠ WARNING: Oil leakage under pressure can cause severe personal injury to the eyes

⚠ WARNING: Ensure that the quick couplings between the tool and control console are properly connected before the start of the adjustment works. Wrong adjustments may cause serious injuries

⚠ WARNING: In case of any repair work be ensure that the Elevator is not under pressure and the quick couplings are disconnected

The hydraulic valves are in the the two manifold blocks (P/N 645295-1 and 645295-2 for FORUM Handling Tools devices)
(P/N 645307 and 645295-2 for VC devices).
All valve numbers are in accordance to the stamping on the manifold. Start with very little rotations (1/8 or 1/16) and verify the function again.
Following adjustment can be performed on Valves with
- for counter clockwise rotation and
- for clockwise rotation

4.6.1.1 Adjustments of the Door

Valve no.15 solely adjusts the opening of the door (if the door opens too early it will jam)
- causes earlier Door Opening.
- causes later Door Opening.

Valve no.16 is a fine-tuning adjustment valve for the door opening.

Valve no.06 adjusts the speed of the door closing.
- increase door closing speed
- reduce door closing speed

Valve no.07 adjusts the speed of the door opening.
- increase door opening speed
- reduce door opening speed

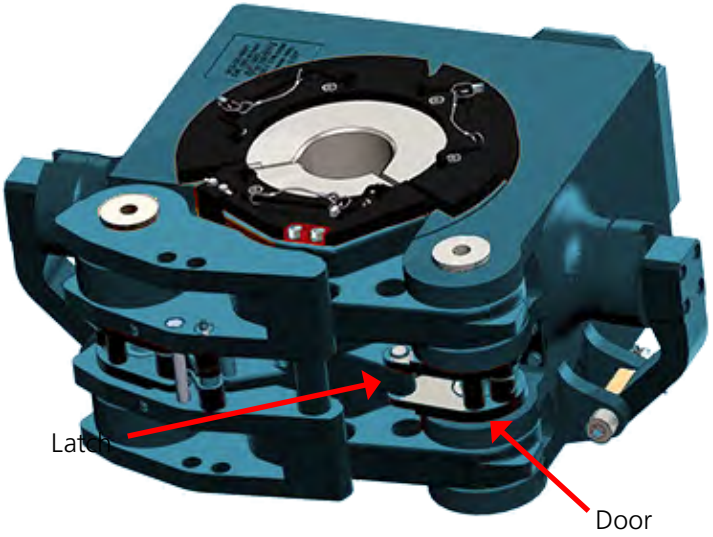


Fig. 70: Principle isometric view SD elevators

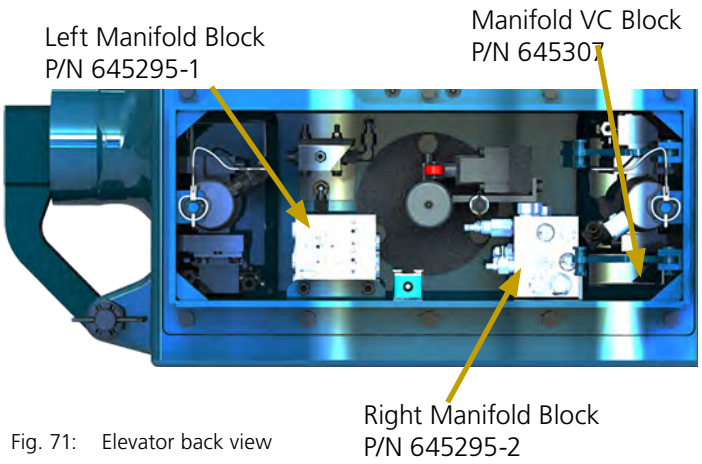


Fig. 71: Elevator back view

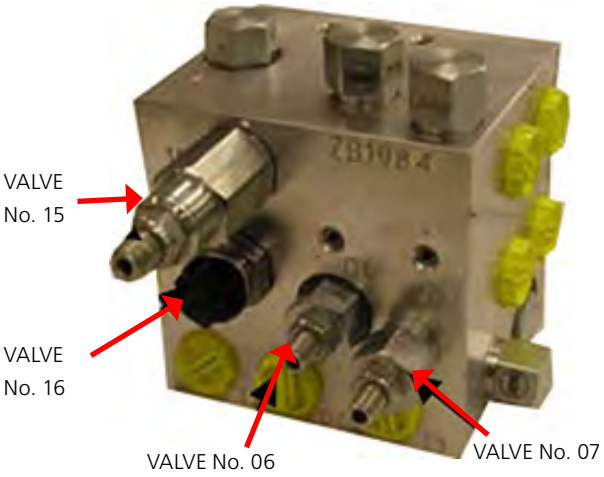


Fig. 69: HYDRAULIC MANIFOLD P/N 645295-2

4.6.1.2 Adjustments of the Latch (left door)

The Latch opens first and the door opens secondly. If the door/latch movement does not work smoothly, it is recommended to reduce the speed. Higher speed can cause a slip-stick effect while opening/closing (especially when the elevator is rotated with the Door/Latch in an upwards/ downwards position).

Valve no.09 adjusts the speed of the latch opening.

- increase the speed
- reduces the speed

Valve no.08 adjusts the speed of the latch closing.

- increases the speed
- reduces the speed

Fig. 72: HYDRAULIC MANIFOLD P/NP/N 645295-1

4.6.1.3 Adjustment for Hydraulic-System

Valve no.19 adjusts the feedback pressure (closing signal).

- reduce the feedback pressure
- increase the feedback pressure

NOTE The standard feedback pressure is adjusted at approx. 60 bar (870 psi).
(Standard setting: screw in Valve 19 completely by turning the Valve clockwise. Afterwards, rotate the Valve 1.1/3 turns counter clockwise).

Fig. 73: HYDRAULIC MANIFOLD P/N P/N 645295-1

Valve no. 22 adjusts the pilot pressure for the Elevator opening.

- reduce the pilot pressure
- increase the pilot pressure

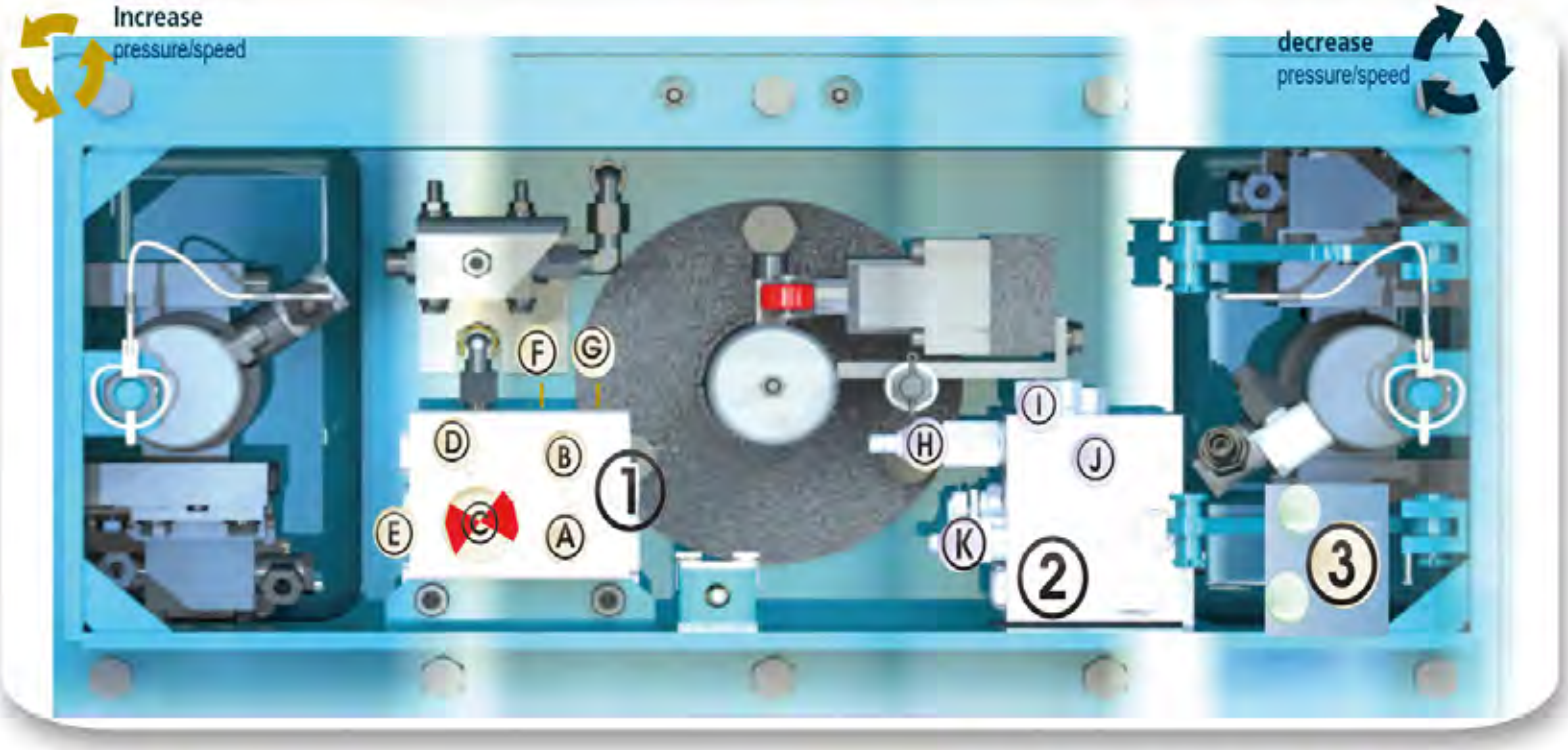
NOTE The standard pilot pressure is adjusted at approx. 100 bar (1450 psi).
(Standard setting: screw in Valve 22 completely by turning the Valve clockwise. Afterwards, rotate the Valve 2.1/3 turns counter clockwise).

Smart Solutions.
Powerful Products

SD Elevator Type Series
Valve Location and Ajustment

FORUM ENERGY TECHNOLOGIES

Operation Maintenance Instructions• Handling Equipment • Hoisting Equipment



① Manifold

- Ⓐ Trigger bypass
- Ⓑ Load sensor bypass
- Ⓒ Bypass A-B
- Ⓓ XP Signal pressure valve
- Ⓔ Pilot pressure valve
- Ⓕ Speed control valve LATCH
- Ⓖ Speed control valve LATCH

② Manifold

- Ⓗ Sequence valve
- Ⓘ Speed control valve DOOR
- Ⓙ Speed control valve DOOR
- Ⓚ Flow valve (fine tuning sequence)

Speed Adjustment LATCH

1. Use Block ① valve Ⓕ
2. Use Block ① valve Ⓖ (Located on manifold back)

Speed Adjustment DOOR

1. Use Block ② valve Ⓘ
2. Use Block ② valve Ⓙ

Pressure Adjustment

Feedback - Use Block ① valve Ⓓ

Pilot - Use Block ① valve Ⓔ

Pre-Adjustment LATCH +DOOR

1. Use Block ② sequence valve Ⓗ

System Bypass

1. Use Block ① valve Ⓒ

(Ⓐ-Ⓑ safe for maintenance)

The rotary control with **red** up shows hydraulic bypass operation

SD Elevator Type Series
Troubleshooting

① Check the hydraulic connections
② Check installed size components
③ Check Elevator lubrication status
④ Perform a functional check on Feedback, Load Sensor and Trigger

Ⓐ If the DOORS are not closing

1. Check System Pressure for elevator operation
2. Check selection of elevator on cyberbase screen (software/ Tripping or CSG elevator)
3. Check Trigger of over greasing inside
4. Check Trigger valve adjustment

Ⓑ If the DOORS close but the LATCH not

1. Check adjustment of the door sensor
2. Make sure the pilot pressure on XP is applied
3. Check the return line from the hydr. Cylinder

Ⓒ If no FEEDBACK is applied on the screen

1. Check latch sensor adjustment (slide in/out)
2. Check XP-close pressure setting (no feedback is applied if the pressure adjustment is below 55 bar)

Ⓓ If the LATCH opens but not the DOOR

1. Open the sequence and flow control valve fully
2. Make sure the pilot pressure on XP is applied
3. Check the return line from the hydr. Cylinder

Ⓔ If the LATCH and the DOOR won`t open

1. Check XP-open pilot pressure (~ 140 – 190 bar)
2. Check „P" pressure (~ 195 – 210 bar)
3. Actuate Load Sensor Bypass (Valve 2)
4. Operate by joystick to open elevator
5. Check applied grease to hinge pin

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SERVICE

5 Service

INFO

Operational safety and readiness of the Equipment do not only depend on your skill, but also on maintenance and servicing of the Equipment.

Insist on using original spare parts when carrying out maintenance and repair work. This ensures operational safety and readiness of your Equipment, and maintains its value.

5.1 Malfunction

If a malfunction occurs or the VES SD does not operate as expected, trouble shoot as follows:

If the cause of the malfunction cannot be determined and remedied, contact FORUM Handling Tools Technical Support.

1. Check hydraulic connections and hydraulic lines.
2. Check whether the on board hydraulic mains support is present.
3. Check whether the needed component size adapter have been installed for the size/type of pipe used.
4. Check for proper lubrication of the VES SD.
5. Check feedback for proper function.
6. Collect all information on the malfunction and define the problem.
7. Attempt to find a quick solution to the problem.
8. Check the last changes/modifications.
9. Isolate the problem.
10. Replace any defective components.

INFO

In the event of problems, which cannot be remedied with the aid of this manual, please contact the FORUM Handling Tools Technical Support or one of the authorized service companies specified (refer to section XI “Contact worldwide” on page 11).

5.2 Repair

5.2.1 Repair by Customer

It is only permissible for the customer/company operating the Equipment to replace defective parts with OEM (Original Equipment Manufacturer) parts approved by FORUM Handling Tools in conformance with the present operating instructions.

Use of parts not approved by FORUM Handling Tools voids the guarantee.

5.2.2 Repair by Manufacturer

Ensure that any repair work required on the VES SD is performed only by FORUM Handling Tools or an authorized service company.

INFO

Please contact the FORUM Handling Tools Technical Support or one of the authorized service companies specified (refer to section XI “Contact worldwide” on page 11). to perform repair or maintenance work.

5.2.3 Securing Screws with Nord Lock washers

Nord Lock bolt securing systems use geometry to safely lock bolted joints in the most critical applications. The key is the difference in angles. Since the cam angle „α“ is larger than the thread pitch „α“, the pair of washers expands more than the corresponding pitch of the thread. Any attempt from the bolt/nut to rotate loose is blocked by the wedge effect of the cams.

When the pushed movements of the device will get in contact with the under surface of the securing plate, this surface contact will secure the plate and prevents any motion in the axial direction.

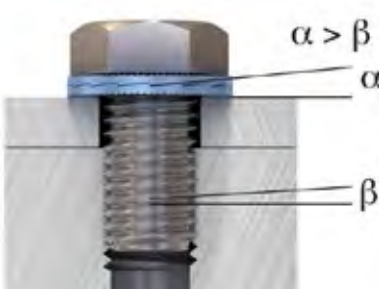


Fig. 74: Nord Lock Washer principle illustration

Fig. 75: Nord Lock Washer detailed illustration

Tightening torques for Nord Lock lock washers Several Nord Lock bolt securing systems are used on the VES SD to generate safely lock bolted joints. Regarding the fact that different sizes and metric grades are applied detailed information from Nord Lock is given in the annex (refer to annex) to generate safe maintenance by the user.

If the tightening torque needed to fasten a screw/nut is not explicitly written in this manual, please check the screw/ nut head an refer to the annex in order to find the required fastening torque:

The metric grade and make of the bolt can be seen on top of the bolt/nut.

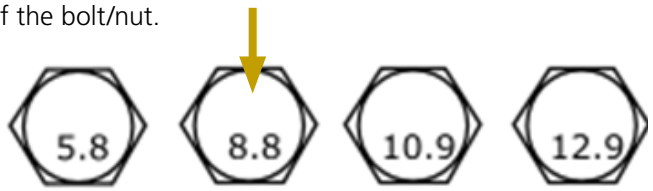


Fig. 76: Bolt head marking

On FORUM Handling Tools Pipe handling Equipment the metric grades 8.8, 10.9 and 12.9 are used and the tightening torques can be found via third party document in the annex.

⚠ WARNING Please pay extra attention to the method of tightening as the tightening torques may vary on the methods.

INFO

As a result from tests the NORD LOCK washers were safely secured even after reuse 30 times. Only a limited part of the clamp load was lost due to normal settlements between contact surfaces. The cam edges of the washers got rounded off but were still intact after the reuse test.

The best thing to do is to make ocular inspection of the washers during every maintenance.

Make sure that the cams (cam tops) look good and that the teeth are not worn off. Lubricate the joint and the mating surfaces if possible so that the friction conditions do not change. When reassembling, care should be taken that the two washer halves are mated correctly.

If all these criteria are met, the washers can be safely reused.

5.3 Drawing, Parts List and Spare Parts

5.3.1 Contact to Parts Department

INFO

Please contact the FORUM Handling Tools Technical Support or one of the authorized service companies specified (refer to section XI “Contact worldwide” on page 11). to order replacement parts or in the event of any questions.

5.3.2 Drawing and Parts List VES SD 350

5.3.2.1 Drawing 635000-Y VES-SD 350

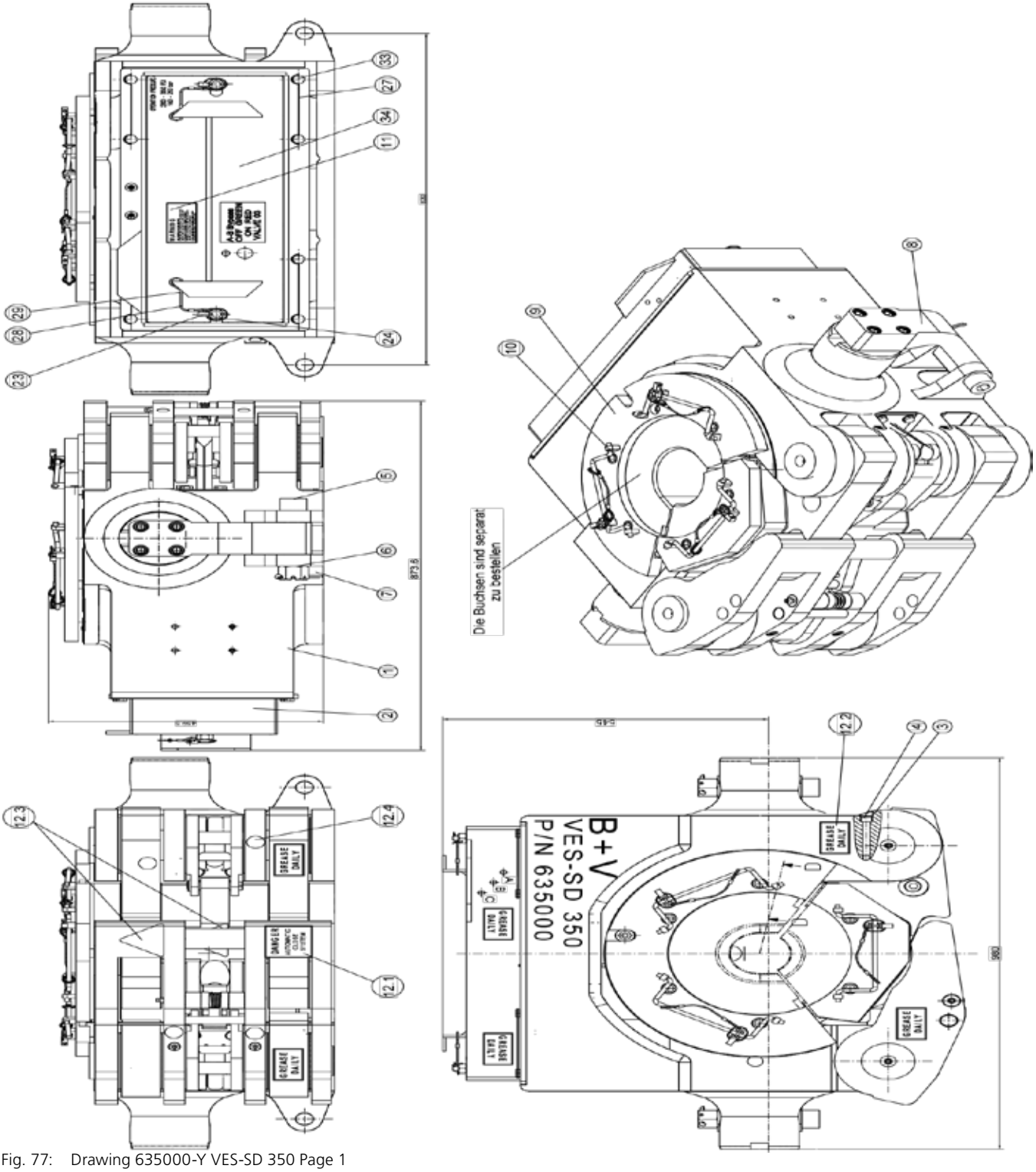


Fig. 77: Drawing 635000-Y VES-SD 350 Page 1

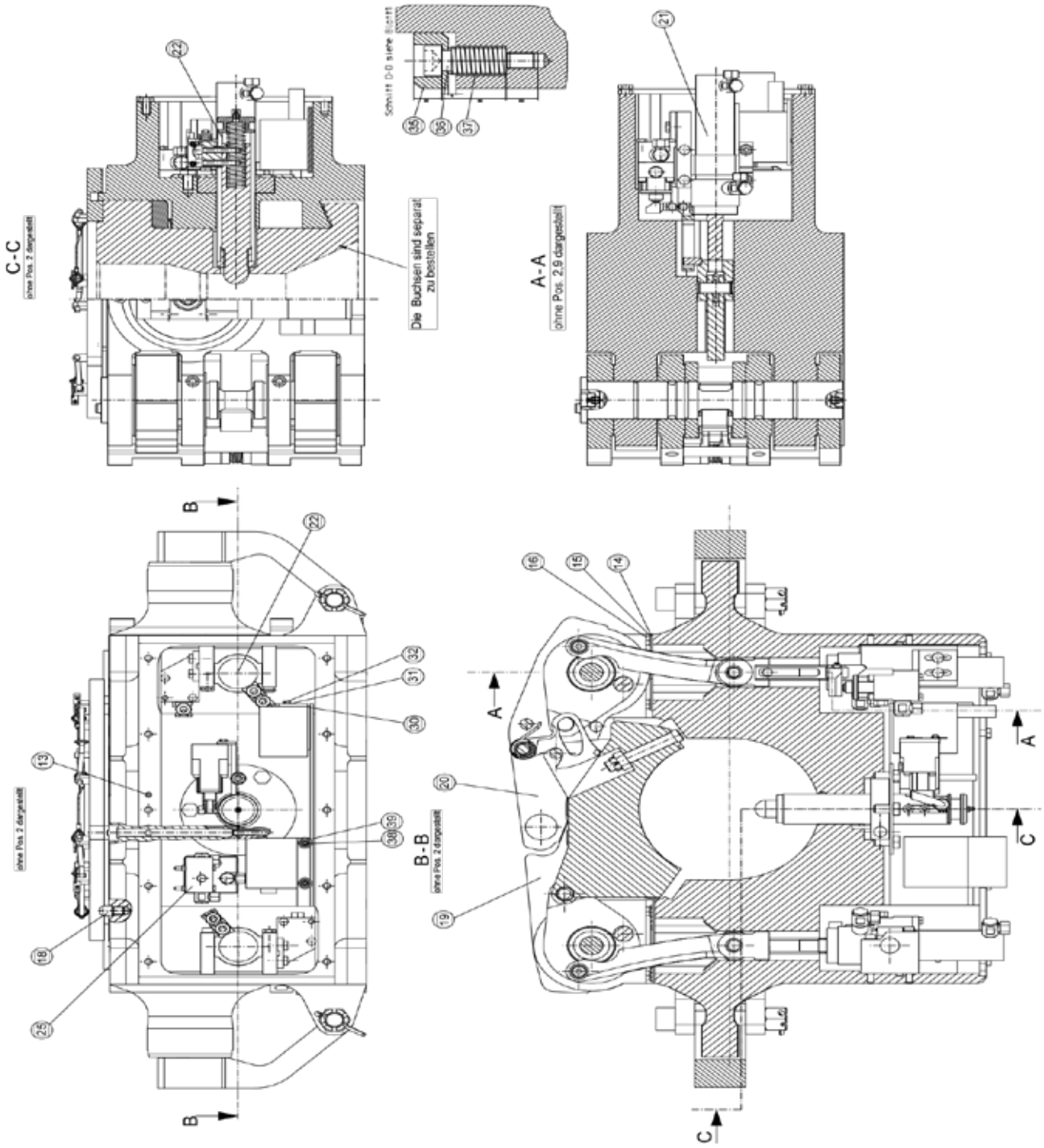


Fig. 78: Drawing 635000-Y VES-SD 350 Page 2

Part list 635000-Y VES-SD 350

No.	Qty.	Part No.	Description
1	1	645005	Elevator Body
2	1	645079-1	Rear Door and Cover Assembly
3	2	645027	Cylinder head screw
4	2	620608	Securing
5	2	645018	Screw
6	2	645019	Castle Nut
7	2	735404	Cotter Pin
8	2	645185-2	Safety Clamp
9	1	645033	Bushing Retainer Plate
10	6	735324	Screw
11	1	671638	Warning Sign FORUM Handling Tools
12.1	1	671639	Warning Sign “Automatic”
12.2	1	671642	Warning Sign “Grease”
12.3	2	671641	Warning Sign “Squire danger”
12.4	4	611524	Sticker "Don't touch"
13	2	70064	Grease Fitting R1/8”
14	1	645079	Rubber Cover Plate
15	12	735854	Retaining Washer
16	8	645198	Screw
18	2	645038	Bolt / Bolt
19	1	635306	Door Assembly, right
20	1	645305	Door Assembly, left
21	1	645298	Door and Latch Opening Assembly
22	1	645040	Trigger Assembly
23	2	645035	Link Pin
24	2	755137	Nut
25	1	645050	Load Safety assembly
27		755127	Safety Rope for Screws
28	2	643801	Rope ø 3mm
29	4	643801-11	Rope Clamp ø 3mm
30	1	645295-21	Plate for SD-Hydraulic Block
31	2	645059	Washer
32	2	643779-1	Screw
33	8	613823	Screw
34	1	775813	Square Box Wrench, SW9
35	1	645051	Cast ring
36	6	645052	Fitting screw
37	6	645055	Spring
38	2	675109	Screw
39	2	735854	Washer

5.3.2.2 Drawing 645003-6 Hydraulic Assembly Elevator

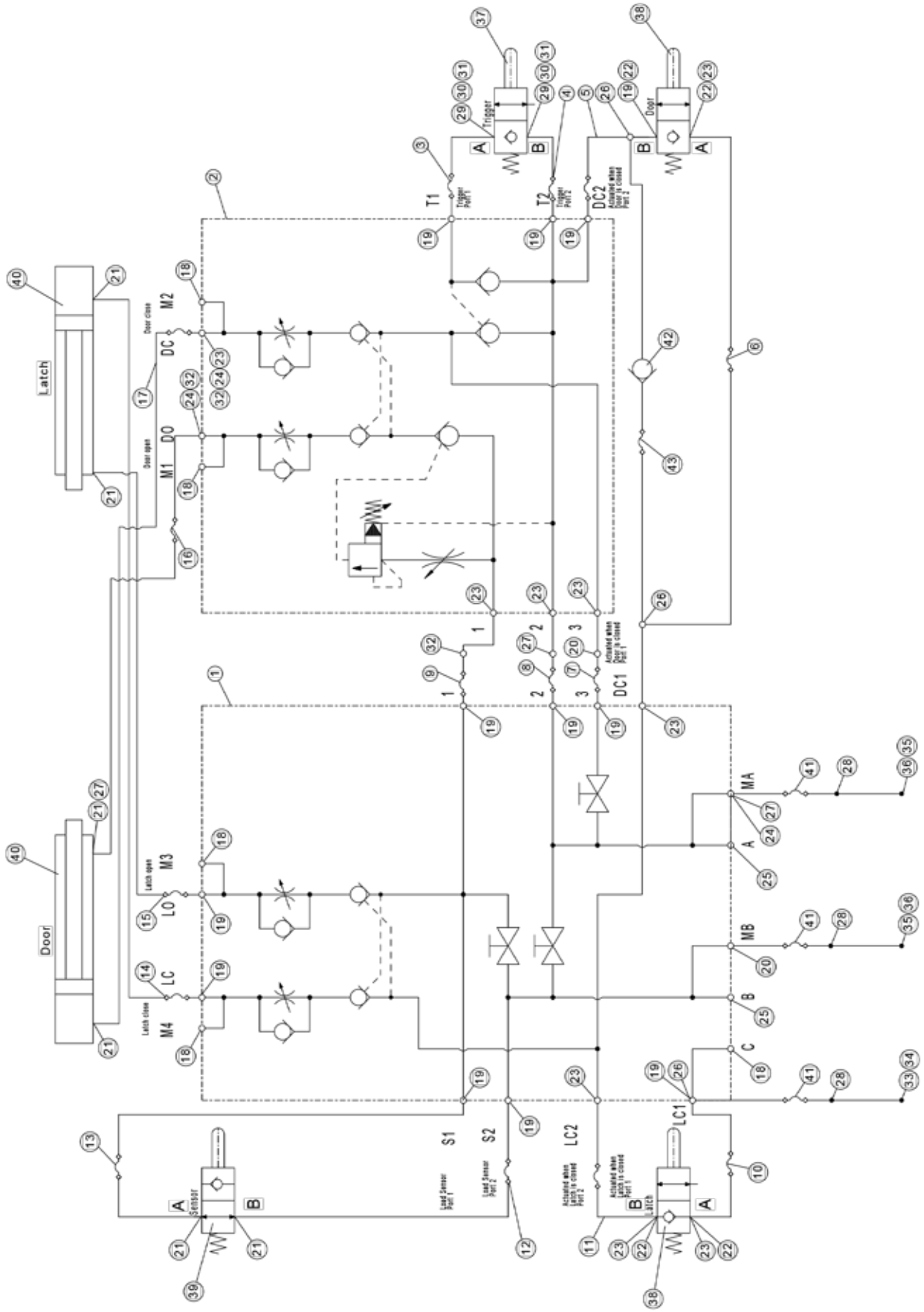


Fig. 79: 645003-6 Hydraulic Assembly Elevator

Part list 645003-6 Hydraulic Assembly Elevator

No.	Qty.	Part No.	Description
1	1	645295-1	Left hydraulic block assembly for SD elevator
2	1	645295-2	Right hydraulic block assembly for SD elevator
3	1	645142-T1	Hose Assembly
4	1	645142-T2	Hose Assembly
5	1	645142-DC2	Hose Assembly
6	1	645142-DC1	Hose Assembly
7	1	645142-3	Hose Assembly
8	1	645142-2	Hose Assembly
9	1	645142-1	Hose Assembly
10	1	645142-LC1	Hose Assembly
11	1	645142-LC2	Hose Assembly
12	1	645142-S2	Hose Assembly
13	1	645142-S1	Hose Assembly
14	1	645142-LC	Hose Assembly
15	1	645142-LO	Hose Assembly
16	1	645142-M1	Hose Assembly
17	1	645142-M2	Hose Assembly
18	5	612929	Blind screw
19	12	612944	Straight Connection 8L-1/4''
20	2	612945	Straight Connection 8L-8L
21	6	613943	Fitting
22	5	613944	Reducing Nippel G 1/4 A G 1/4 I
23	10	613945	Swivelling Screw Fitting
24	3	613946	Straight Connection
25	3	645092	Blind Screw
26	1	645095	L-Adapter
27	3	645096	L-Adapter
28	3	645106	Connection
29	2	755365	Banjo Coupling
30	2	755367	Adjustable Stud Elbow
31	2	755372	Standpipe Reducer
32	3	755738	90 degree Fitting, 8L
33	1	1014-M	Quick connect coupling 1/4 male
34	1	1014-F	Quick connect coupling 1/4 female
35	2	1038-F	Quick connect coupling 3/8 female
36	2	1038-M	Quick connect coupling 3/8 male
37	1	615414	Feedback valve
38	2	643779	2/2 Way Valve
39	1	645118	Valve
40	2	645297	Hydraulic Cylinder for SD 500fr1
41	3	645248-ABC	Hose Assembly
42	1	645110	Check valve
43	1	646308-11	Hose assembly

5.3.2.3 Drawing 635000-Y-FL VES-SD 350

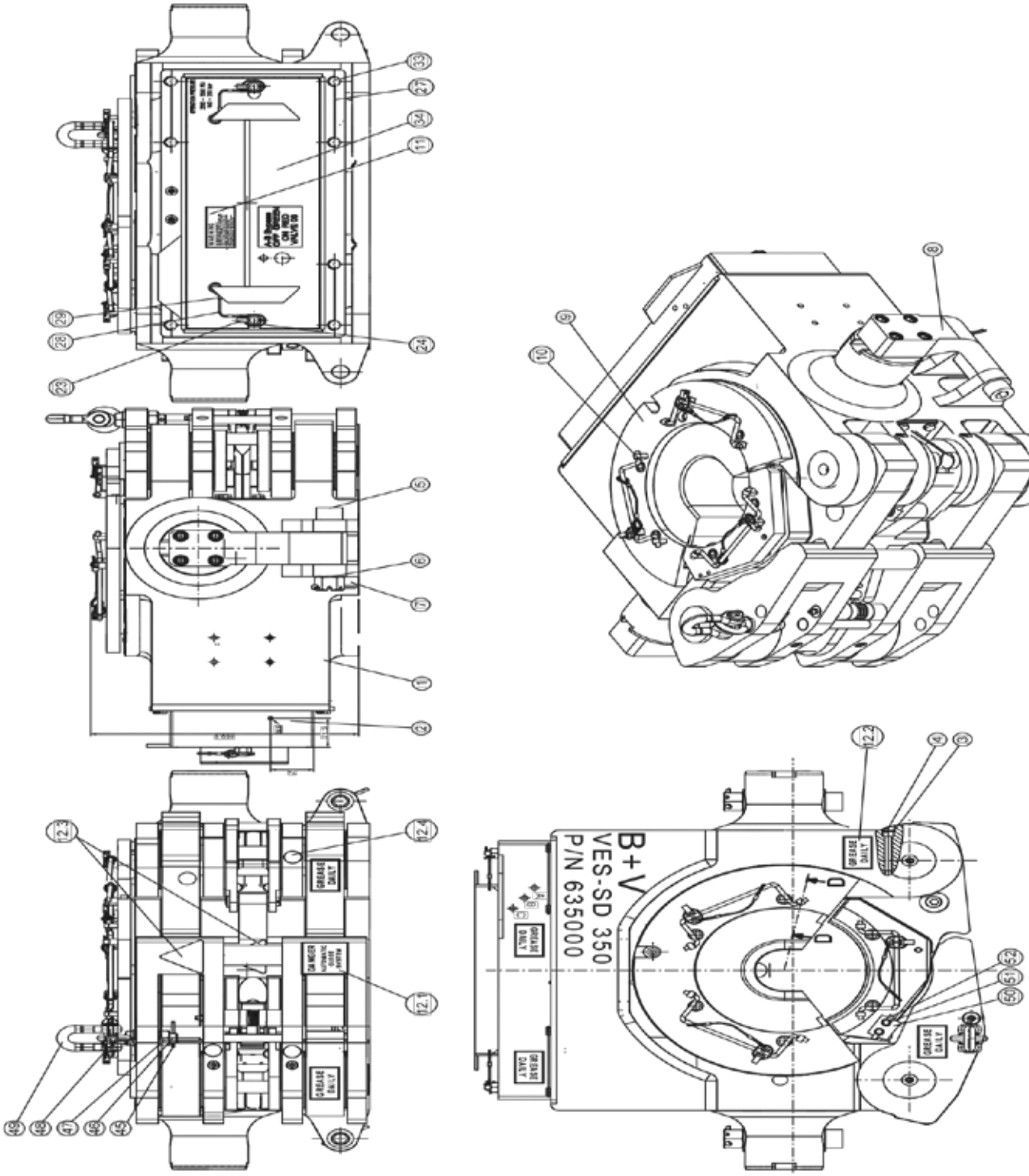


Fig. 80: Drawing 635000-Y -FL VES-SD 350 Page 1

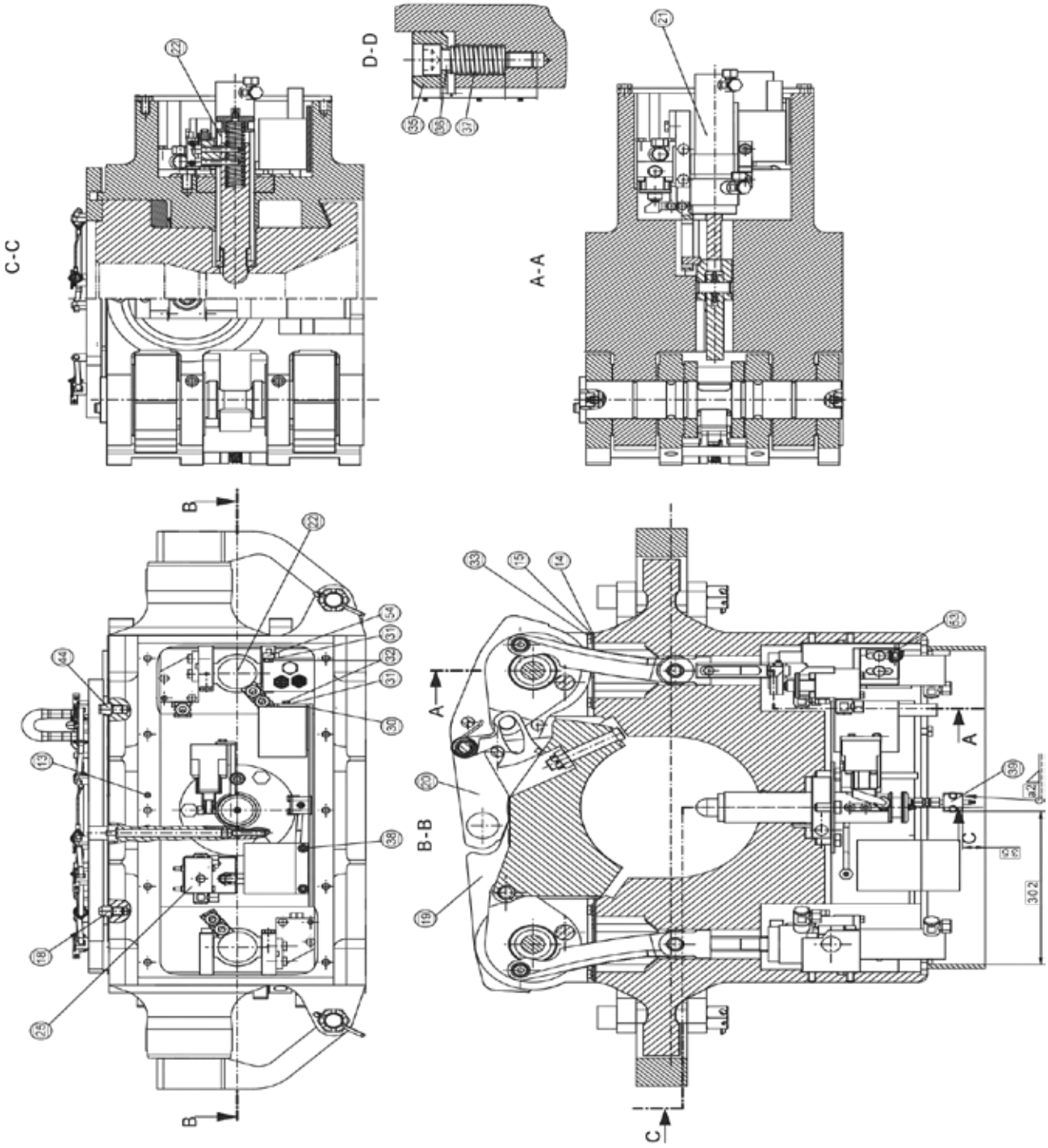


Fig. 81: Drawing 635000-Y-FL VES-SD 350 Page 2

Part list 635000-Y-FL VES-SD 350

No.	Qty.	Part No.	Description
1	1	645005	Elevator Body
2	1	645079-1	Rear Door and Cover Assembly
3	2	645027	Cylinder head screw
4	2	620608	Securing
5	2	645018	Screw
6	2	645019	Castle Nut
7	2	735404	Cotter Pin
8	2	645185-2	Link Block Assembly
9	1	645033	Bushing Retainer Plate
10	6	735324	Screw
11	1	671638	Warning Sign FORUM Handling Tools
12.1	1	671639	Warning Sign “Automatic”
12.2	1	671642	Warning Sign “Grease”
12.3	2	671164	Warning Sign “Squire danger”
12.4	4	611524	Sticker "Don't touch"
12.5	1	613129	Sticker Hotline
13	2	70064	Grease Fitting R1/8”
14	1	645079	Rubber Cover Plate
15	8	613825	Retaining Washer
18	1	645038	Bolt / Bolt
19	1	645306	Door Assembly, right
20	1	645305	Door Assembly, left
21	1	645298	Door and Latch Opening Assembly
22	1	645040	Trigger Assembly
23	2	645035	Link Pin
24	2	755137	Nut
25	1	645050	Load Safety assembly
27		755127	Safety Rope for Screws
28	2	643801	Rope ø 3mm
29	4	643801-1	Rope Clamp ø 3mm
30	1	645295-21	Plate for SD-Hydraulic Block
31	2	645059	Washer
32	2	643779-1	Screw
33	16	613823	Screw
34	1	775813	Square Box Wrench, SW9
35	1	645051	Cast ring
36	6	645052	Fitting screw
37	6	645055	Spring
38	2	675109	Screw
39	1	645050-3	Hose Assembly for Load Safety Devices
44	1	645038-1	Bolt
45	1	70263	Cotter Pin
46	1	635051	Pin
47	1	775015-1	Nut
48	1	755402	Eye Screw
49	1	752203	Shakle
50	1	646035	Holding plate
51	2	613782	Screw
52	2	645059	Washer
53	2	645054	Screw
54	1	646003-5	Plate for SD Hydraulic Block

5.3.2.4 Drawing 645003-6-FL Hydraulic Assembly Elevator

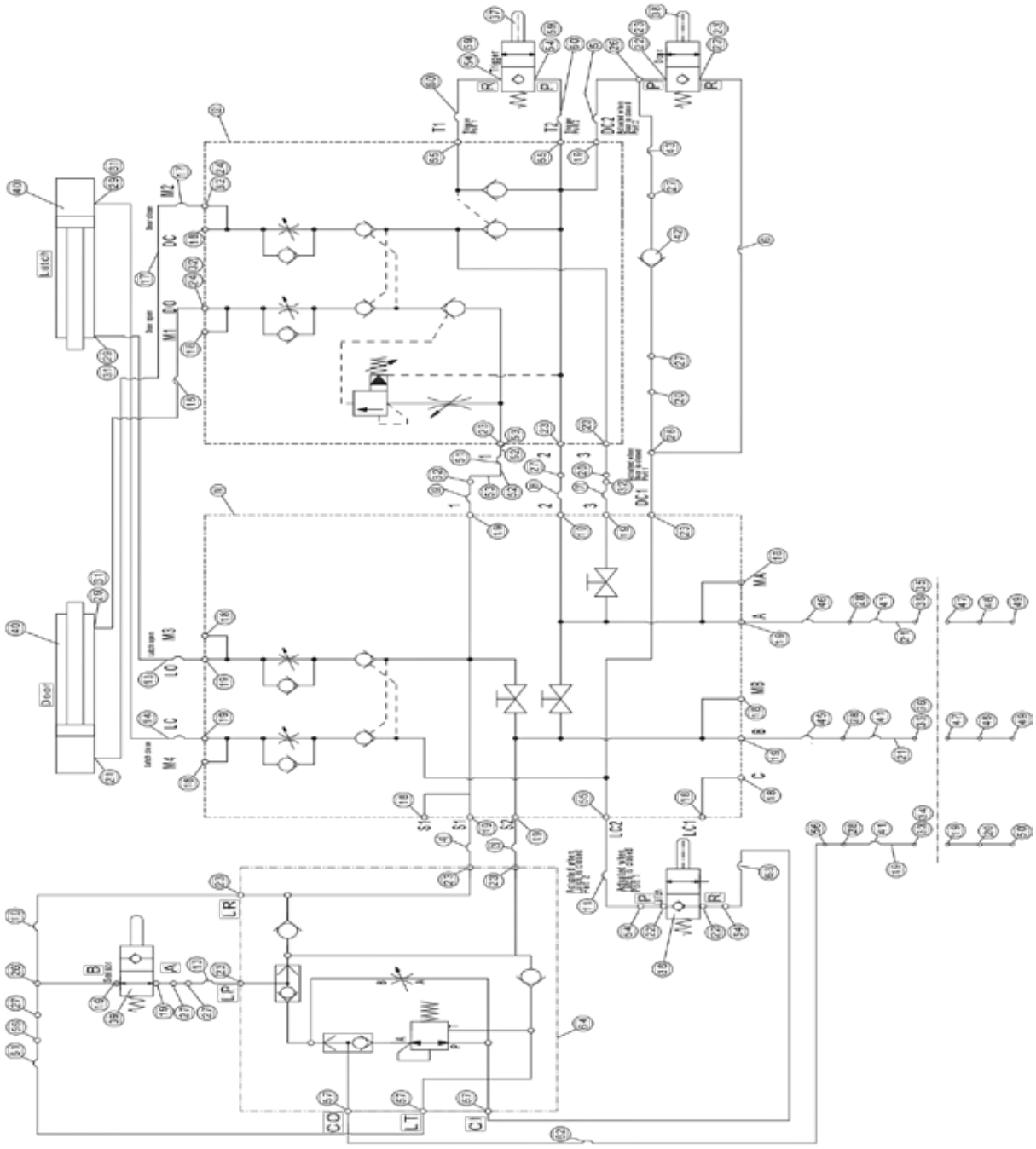


Fig. 82: 645003-6-FL Hydraulic Assembly Elevator

Part list 645003-6-FL Hydraulic Assembly Elevator

No.	Qty.	Part No.	Description
1	1	645295-1	Left hydraulic block assembly for SD elevator
2	1	645295-2	Right hydraulic block assembly for SD elevator
3	1	645142-T1	Hose Assembly
4	1	645142-T2	Hose Assembly
5	1	645142-DC2	Hose Assembly
6	1	645142-DC1	Hose Assembly
7	1	645142-3	Hose Assembly
8	1	645142-2	Hose Assembly
9	1	645142-1	Hose Assembly
10	1	645142-LC1	Hose Assembly
11	1	645142-4	Hose Assembly
12	-	-	-
13	1	645142-S1	Hose Assembly
14	1	645142-LC	Hose Assembly
15	1	645142-LO	Hose Assembly
16	1	645142-M1	Hose Assembly
17	1	645142-M2	Hose Assembly
18	9	612929	Blind screw
19	15	612944	Straight Connection 8L-1/4''
20	3	612945	Straight Connection 8L-8L
21	6	613943	Fitting
22	6	613944	Reducing Nippel G 1/4 A G 1/4 I
23	14	613945	Swivelling Screw Fitting
24	2	613946	Straight Connection
25	-	-	-
26	4	645095	T-connection
27	6	645096	L-Adapter
28	3	645106	Connection
29	3	755365	Banjo Coupling
30	-	-	-
31	3	755372	Standpipe Reducer
32	4	755738	90 degree Fitting, 8L
33	1	612965	Quick connect coupling 1/4 male
34	1	612966	Quick connect coupling 1/4 female
35	2	612937	Quick connect coupling 3/8 female
36	2	612936	Quick connect coupling 3/8 male
37	1	615914	Feedback valve
38	2	643779	2/2 Way Valve
39	1	87997	Valve
40	2	645297	Hydraulic Cylinder for SD 500fr1
41	3	645248-ABC	Hose Assembly
42	1	645110	Check valve
43	1	646308-11	Hose assembly
44	1	645142-LC1-C	Hose assembly
45	1	645142-B-B	Hose assembly
46	1	645142-A-A	Hose assembly
47	2	755373	Straight male stud coupling
48	2	755364	swivel reducer
49	2	645116	Direct pipe fitting
50	1	645117	Direct pipe fitting
51	1	645093	Hydraulic pipe
52	2	790206	Nut
53	2	790206-1	Cutting ring
54	4	671551-6	Banjo coupling 90°
55	3	671551-1	Fitting straight
56	2	671551-3	Fitting
57	3	775094-2	90 degree Fitting
58	-	-	-

No.	Qty.	Part No.	Description
59	2	775094-3	Adjustable Stud Elbow
60	2	645142-5	Hose Assembly
61	1	645142-6	Hose Assembly
62	1	645142-7	Hose Assembly
63	1	645142-8	Hose Assembly
64	1	646003-3	Hydraulic Block feedback signal

5.3.3 Drawing and Parts List VES SD 500-1

5.3.3.1 Drawing 646000-Y VES-SD 500-1

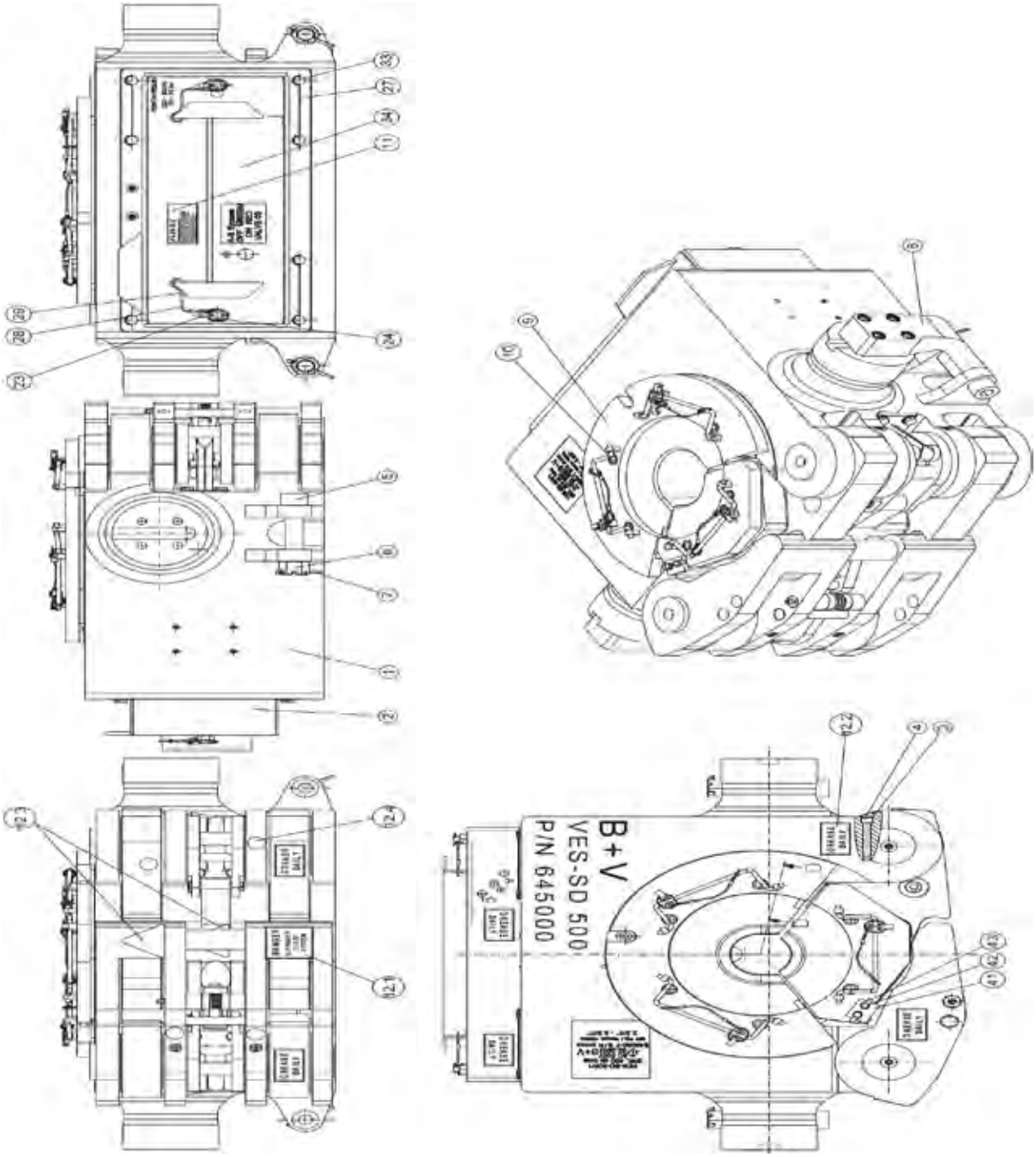


Fig. 83: Drawing 646000-Y VES-SD 500-1 Page 1

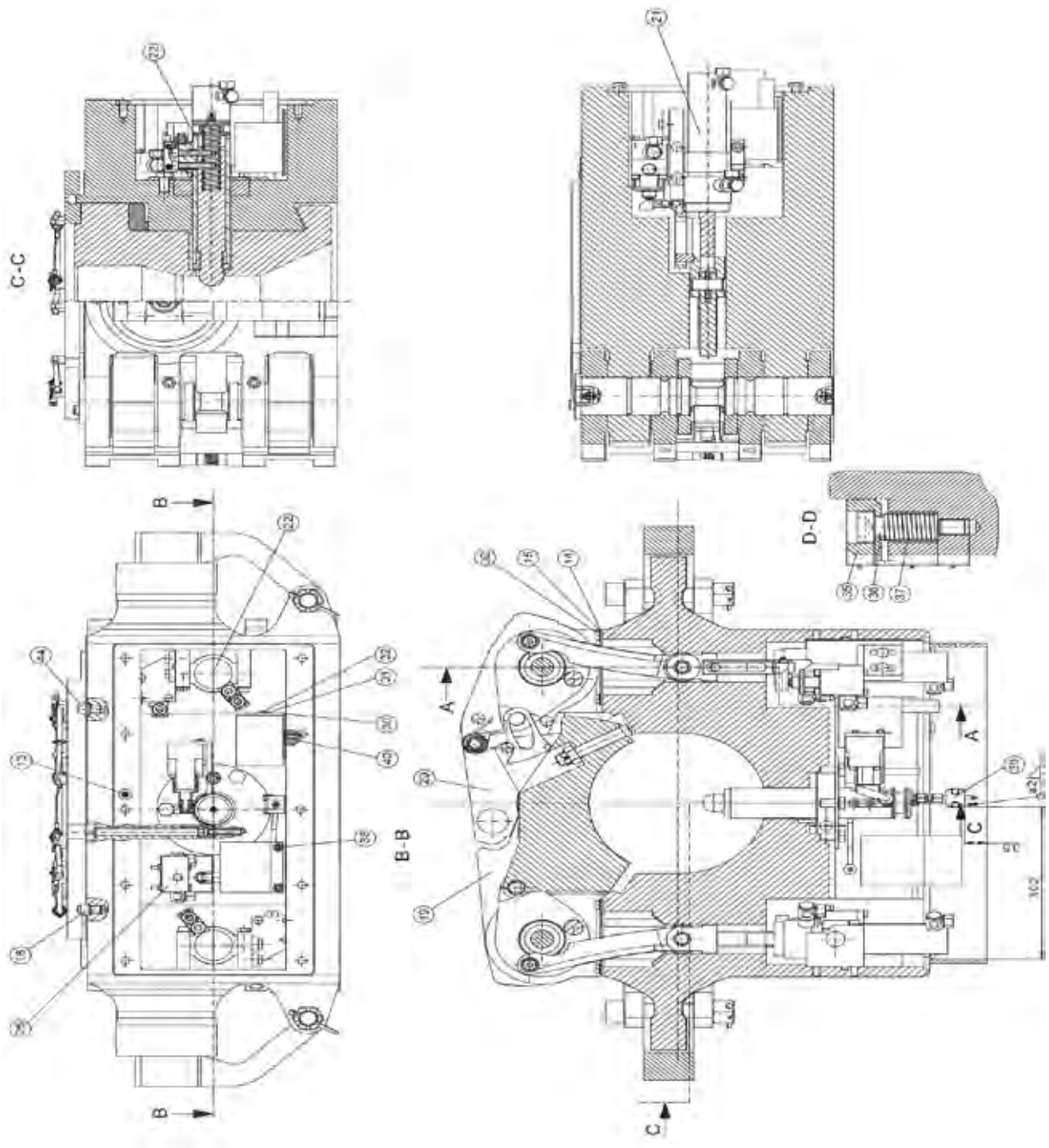


Fig. 84: Drawing 646000-Y VES-SD 500-1 Page 2

Part list 646000-Y VES-SD 500-1

No.	Qty.	Part No.	Description
1	1	645005	Elevator Body
2	1	645079-1	Rear Door and Cover Assembly
3	2	645027	Cylinder head screw
4	2	620608	Securing
5	2	645018	Screw
6	2	645019	Castle Nut
7	2	735404	Cotter Pin
8	2	645185-2	Link Block Assembly
9	1	645033	Bushing Retainer Plate
10	6	735324	Screw
11	1	671638	Warning Sign FORUM Handling Tools
12.1	1	671639	Warning Sign “Automatic”
12.2	1	671642	Warning Sign “Grease”
12.3	2	671164	Warning Sign “Squire danger”
12.4	4	611524	Sticker "Don't touch"
13	2	70064	Grease Fitting R1/8”
14	1	645079	Rubber Cover Plate
15	8	613825	Retaining Washer
16	8	645198	Screw
18	1	645038	Bolt / Bolt
19	1	645306	Door Assembly, right
20	1	645305	Door Assembly, left
21	1	645298	Door and Latch Opening Assembly
22	1	645040	Trigger Assembly
23	2	645035	Link Pin
24	2	755137	Nut
25	1	645050	Load Safety assembly
27		755127	Safety Rope for Screws
28	2	643801	Rope ø 3mm
29	4	643801-1	Rope Clamp ø 3mm
30	1	645295-21	Plate for SD-Hydraulic Block
31	2	645059	Washer
32	2	643779-1	Screw
33	16	613823	Screw
34	1	775813	Square Box Wrench, SW9
35	1	645051	Cast ring
36	6	645052	Fitting screw
37	6	645055	Spring
38	2	675109	Screw
39	1	645050-3	Hose Assembly for Load Safety Devices
40	2	675047	Screw
41	1	645035	Holding Plate
42	2	613782	Srew
43	2	645059	Washer
44	1	645038-1	Bolt

5.3.3.2 Drawing 645003-6 Hydraulic Assembly Elevator - BV Type

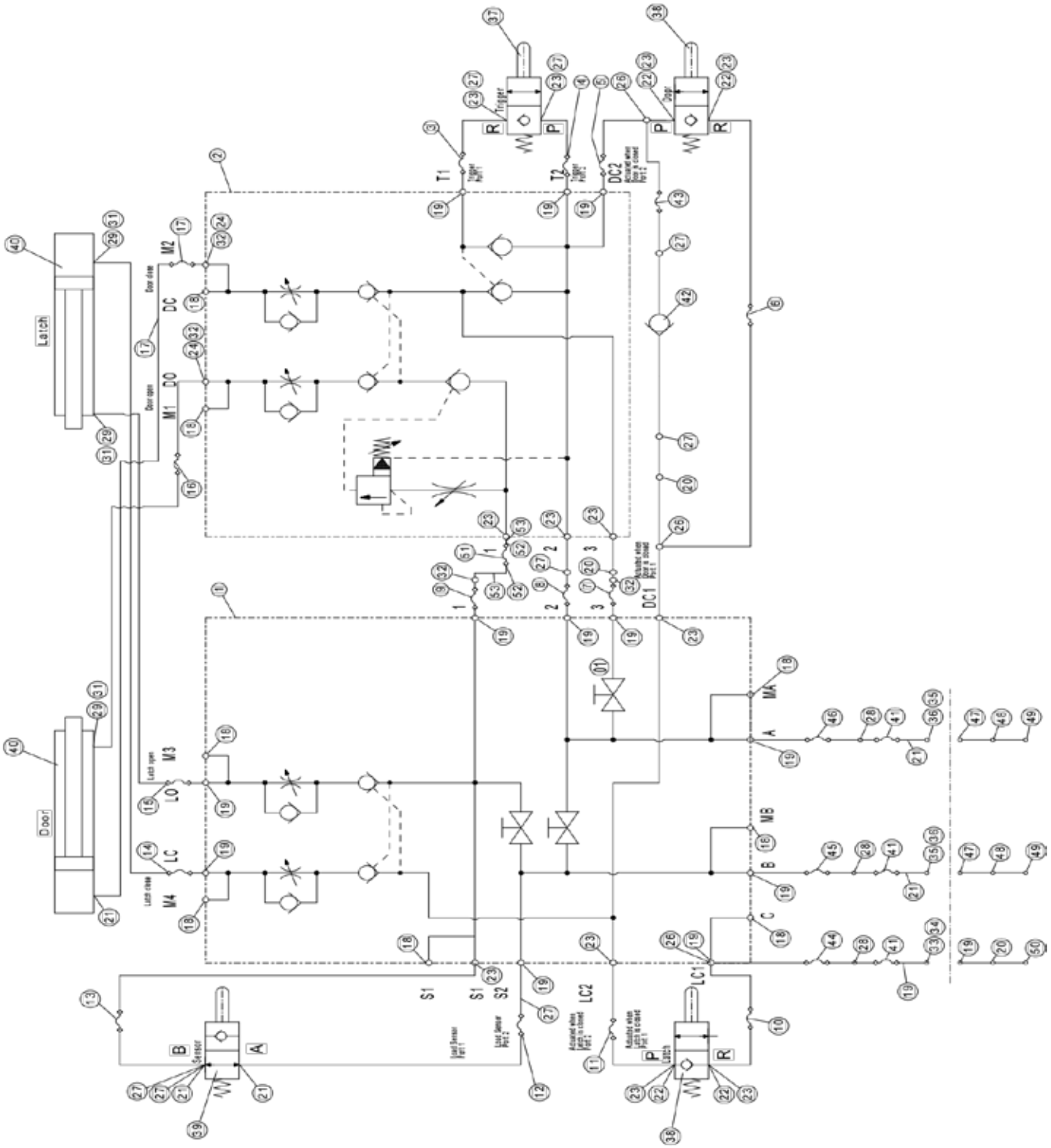


Fig. 85: 645003-6 Hydraulic Assembly Elevator

Part list 645003-6 Hydraulic Assembly Elevator

No.	Qty.	Part No.	Description
1	1	645295-1	Left hydraulic block assembly for SD elevator
2	1	645295-2	Right hydraulic block assembly for SD elevator
3	1	645142-T1	Hose Assembly
4	1	645142-T2	Hose Assembly
5	1	645142-DC2	Hose Assembly
6	1	645142-DC1	Hose Assembly
7	1	645142-3	Hose Assembly
8	1	645142-2	Hose Assembly
9	1	645142-1	Hose Assembly
10	1	645142-LC1	Hose Assembly
11	1	645142-LC2	Hose Assembly
12	1	645142-S2	Hose Assembly
13	1	645142-S1	Hose Assembly
14	1	645142-LC	Hose Assembly
15	1	645142-LO	Hose Assembly
16	1	645142-M1	Hose Assembly
17	1	645142-M2	Hose Assembly
18	8	612929	Blind screw
19	14	612944	Straight Connection 8L-1/4''
20	3	612945	Straight Connection 8L-8L
21	5	613943	Fitting
22	4	613944	Reducing Nippel G 1/4 A G 1/4 I
23	12	613945	Swivelling Screw Fitting
24	2	613946	Straight Connection
	-	-	-
26	3	645095	T-connection
27	8	645096	L-Adapter
28	3	645106	Connection
29	3	755365	Banjo Coupling
30	-	-	-
31	3	755372	Standpipe Reducer
32	4	755738	90 degree Fitting, 8L
33	1	612965	Quick connect coupling 1/4 male
34	1	612966	Quick connect coupling 1/4 female
35	2	612937	Quick connect coupling 3/8 female
36	2	612936	Quick connect coupling 3/8 male
37	1	615914	Feedback valve
38	2	643779	2/2 Way Valve
39	1	645118	Valve
40	2	645297	Hydraulic Cylinder for SD 500fr1
41	3	645248-ABC	Hose Assembly
42	1	645110	Check valve
43	1	646308-11	Hose assembly
44	1	645142-LC1-C	Hose assembly
45	1	645142-B-B	Hose assembly
46	1	645142-A-A	Hose assembly
47	2	755373	Straight male stud coupling
48	2	755364	swivel reducer
49	2	645116	Direct pipe fitting
50	1	645117	Direct pipe fitting
51	1	645093	Hydraulic pipe
52	2	790206	Nut
53	2	790206-1	Cutting ring

5.3.3.3 Drawing 646308 Hydraulic Assembly Elevator - VC Type

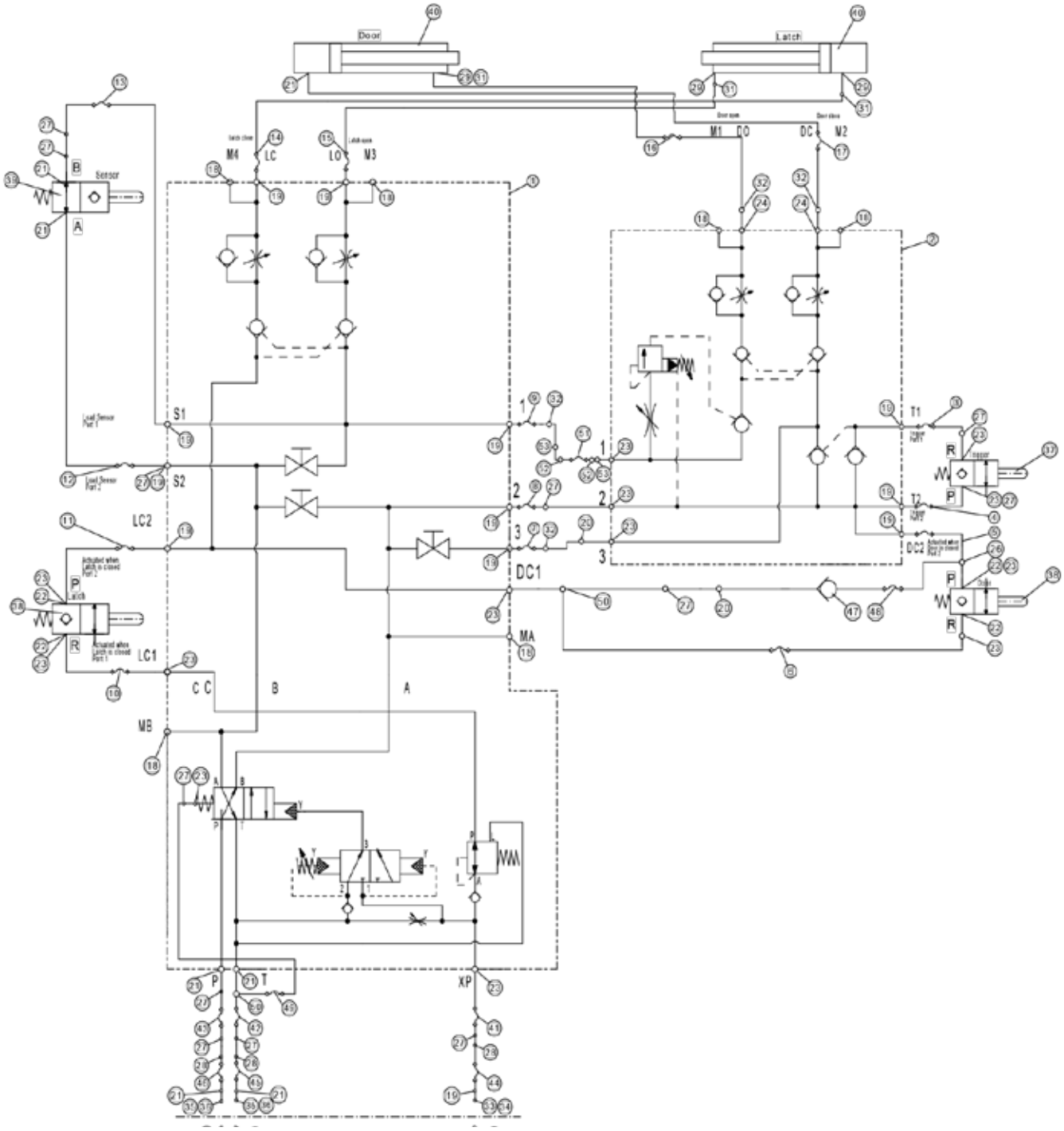


Fig. 86: 646308 Hydraulic Assembly Elevator

Part list 645003-6 Hydraulic Assembly Elevator

No.	Qty.	Part No.	Description
1	1	645307	Left hydraulic block assembly for SD elevator
2	1	645295-2	Right hydraulic block assembly for SD elevator
3	1	645142-T1	Hose Assembly
4	1	645142-T2	Hose Assembly
5	1	645142-DC2	Hose Assembly
6	1	646308-4	Hose Assembly
7	1	646308-14	Hose Assembly
8	1	646308-15	Hose Assembly
9	1	645142-1	Hose Assembly
10	1	646308-5	Hose Assembly
11	1	646308-6	Hose Assembly
12	1	646308-13	Hose Assembly
13	1	646308-16	Hose Assembly
14	1	645142-LC	Hose Assembly
15	1	646308-7	Hose Assembly
16	1	645142-M1	Hose Assembly
17	1	646308-17	Hose Assembly
18	6	612929	Blind screw
19	13	612944	Straight Connection 8L-1/4''
20	3	612945	Straight Connection 8L-8L
21	7	613943	Fitting
22	4	613944	Reducing Nippel G 1/4 A G 1/4 I
23	13	613945	Swivelling Screw Fitting
24	2	613946	Straight Connection
26	1	645095	T-Adapter
27	12	645096	L-Adapter
28	3	645106	Connection
29	3	755365	Banjo Coupling
31	3	755372	Standpipe Reducer
32	4	755738	90 degree Fitting, 8L
33	1	612965	Quick connect coupling 1/4 male
34	1	612966	Quick connect coupling 1/4 female
35	2	612937	Quick connect coupling 3/8 female
36	2	612936	Quick connect coupling 3/8 male
37	1	615914	Feedback valve
38	2	643779	2/2 Way Valve
39	1	645118	Valve
40	2	645297	Hydraulic Cylinder for SD 500fr1
41	1	646308-8	Hose Assembly
42	1	646308-9	Hose Assembly
43	1	646308-10	Hose assembly
44	1	676000-3	Hose assembly
45	1	676000-2	Hose assembly
46	1	676000-1	Hose assembly
47	1	645110	Check valve
48	1	646308-11	Hose assembly
49	1	646308-12	Hose assembly
50	2	645104	T-connection
51	1	645093	Hydraulic pipe
52	2	790206	Nut
53	2	790206-1	Cutting ring
54	2	755373	Straight Male Stud Coupling
55	2	755364	Swivel Reducer
56	2	645116	Direct Pipe Fitting
57	1	645117	Direct Pipe Fitting

5.3.4 Drawing and Parts List VES SD 500-2

5.3.4.1 Drawing 646200-Y Elevator SD 500 Frame II

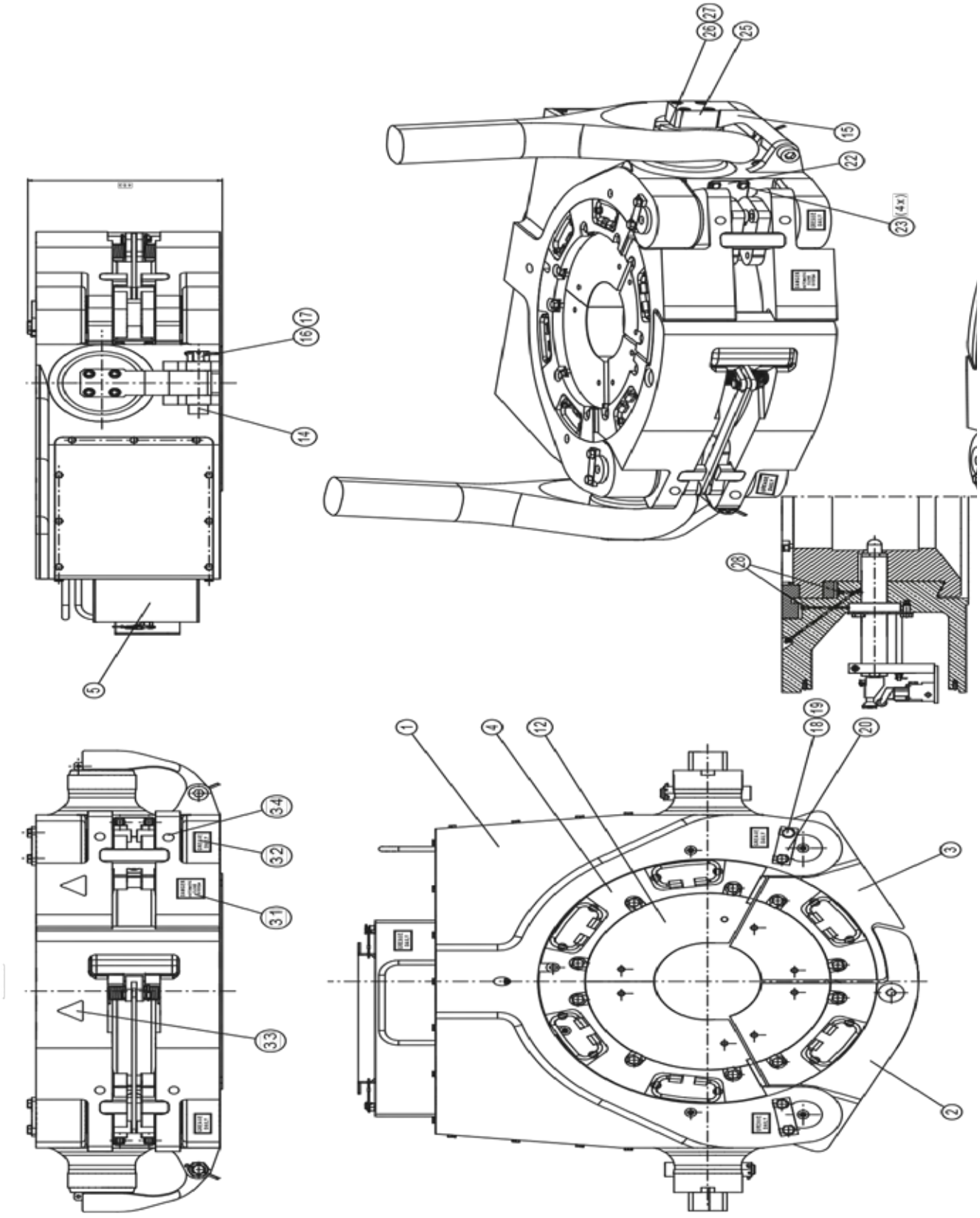


Fig. 87: 646200-Y Elevator SD 500 Frame II

Part list 646200-Y Elevator SD 500 Frame II

No.	Qty.	Part No.	Description
1	1	645205	Body VES-SD 500-2
2	1	645215	Door assembly, left
3	1	645211	Door assembly, right
4	1	645208	Cover assembly for bushing
5	1	646220	Rear Door and Cover Assembly
6	1	646210-1	Cover plate
7	1	646210-2	Cover plate
8	1	646260-1	Door opening assembly, left
9	1	645250	Load safety device
10	1	646240	Trigger assembly
11	1	645203-2	Hydraulic assembly
12	1	645200-BC	Bushing assembly
13	1	646260-2	Door opening assembly, right
14	2	645018	Cylinder head screw
15	2	645185-2	Link block assembly for VES SD500
16	2	645019	Castle nut
17	2	735404	Cotter pin
18	4	617519	Hexagon screw
19	4	617520	Washer
20	2	615009	Securing plate for latch pin
21	2	645038	Bolt
22	2	645233	Cover disk
23	40	725461	Hexagon screw
24	-	-	
25	2	645696	Adapter
26	4	645620	Countersunk head screw
27	4	645697	Securing ring
28	2	645220	Blind screw
29	1	646003-6	Hydraulic Assembly
30	1	671638	Warning Sign “FORUM Handling Tools ”
31	1	671639	Warning Sign “Automatic”
32	4	671642	Warning Sign “Grease”
33	2	671641	Warning Sign “Squeeze danger”
34	4	671524	Warning Sign “Don’t Touch”

5.3.4.2 Drawing 646003-6 Hydraulic Assembly Elevator- BV Type

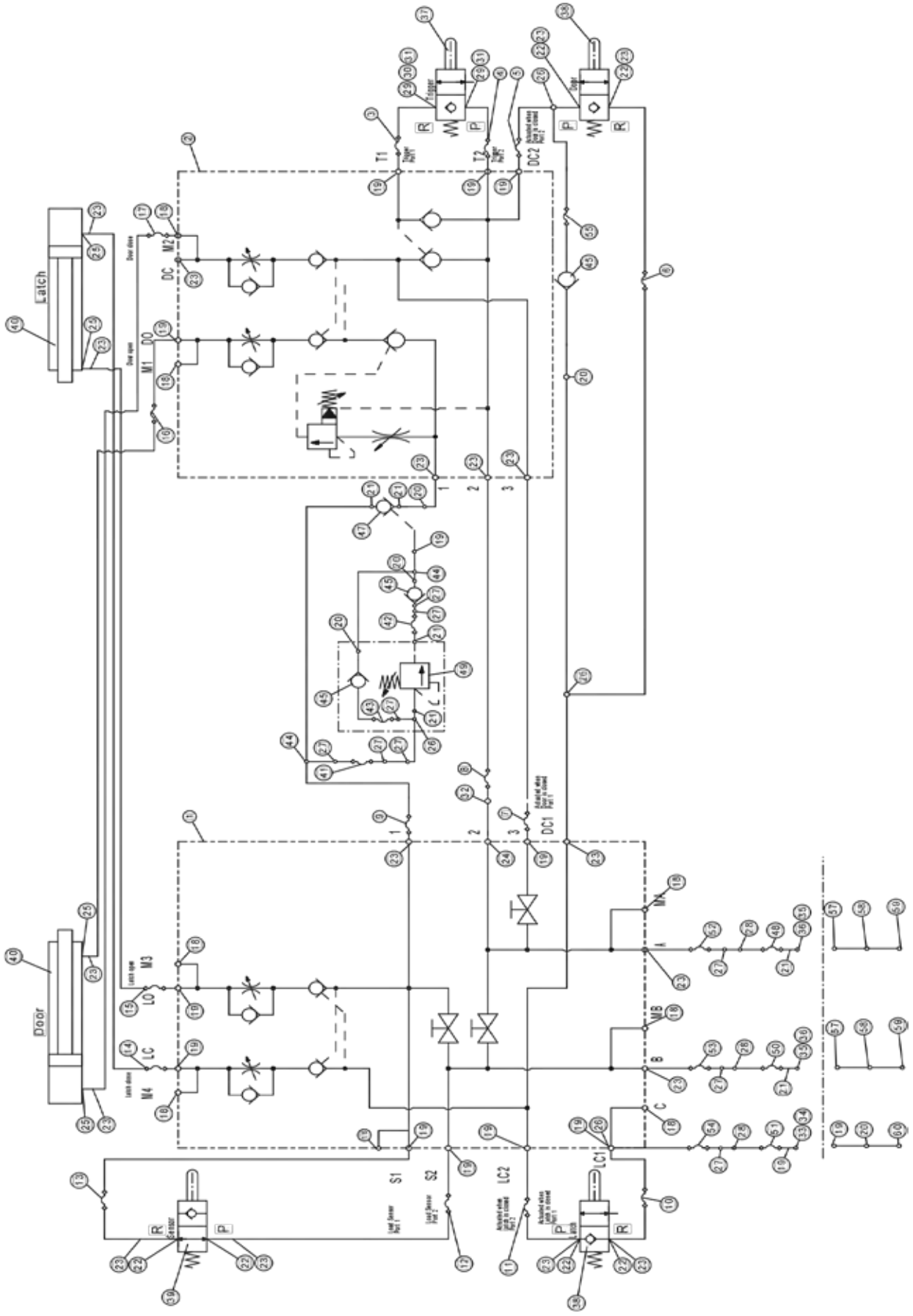


Fig. 88: 645003-6 Hydraulic Assembly Elevator

Part list 646003-6 Hydraulic Assembly Elevator

No.	Qty.	Part No.	Description
1	1	645295-1	Left hydraulic block assembly for SD elevator
2	1	645295-2	Right hydraulic block assembly for SD elevator
3	1	646200-13	Hose Assembly for connection "T2"
4	1	646200-14	Hose Assembly for connection "T1"
5	1	646200-10	Hose Assembly for connection "DC2"
6	1	646200-29	Hose Assembly for connection "DC1"
7	1	646200-6	Hose Assembly for connection "3"
8	1	646200-5	Hose Assembly for connection "2"
9	1	646200-37	Hose Assembly for connection "1"
10	1	646200-7	Hose Assembly for connection "LC1"
11	1	646200-38	Hose Assembly for connection "LC2"
12	1	646200-12	Hose Assembly for connection "S2"
13	1	646200-11	Hose Assembly for connection "S1"
14	1	646200-21	Hose Assembly for connection "LC"
15	1	646200-15	Hose Assembly for connection "LO"
16	1	646200-16	Hose Assembly for connection "D0"
17	1	646200-17	Hose Assembly for connection "M2"
18	8	612929	Blind screw
19	14	612944	Straight Connection 8L-1/4''
20	5	612945	Straight Connection 8L-8L
21	6	613943	Fitting
22	6	613944	Reducing Nippel G 1/4 A G 1/4 I
23	18	613945	Swivelling Screw Fitting
24	1	613946	Straight Connection
25	4	645636-1	Reduction
26	4	645095	T-Connection
27	9	645096	L-Adapter
28	3	645106	Connection
29	2	755365	Banjo Coupling
30	1	755367	Adjustable Stud Elbow
31	2	755372	Standpipe Reducer
32	1	755738	90 degree Fitting, 8L
33	1	612965	Quick connect coupling 1/4 male
34	1	612966	Quick connect coupling 1/4 female
35	2	612937	Quick connect coupling 3/8 female
36	2	612936	Quick connect coupling 3/8 male
37	1	615914	Feedback Valve
38	2	643779	2/2 Way Valve
39	1	615656	Valve
40	2	645661	Hydraulic Cylinder for SD 500fr1
41	1	646200-19	Hose Assembly for connection "V1"
42	1	646200-20	Hose Assembly for connection "C1"
43	1	646200-18	Hose Assembly for connection "Z"
44	2	645104	T-Connection
45	3	645110	Check Valve
46	-	-	-
47	1	726303	Check Valve
48	1	646200-1	Hose Assembly for connection "A"
49	1	755375	Valve
50	1	646200-2	Hose Assembly for connection "B"
51	1	646200-3	Hose Assembly for connection "C"
52	1	646200-22	Hose Assembly for connection "A1"
53	1	646200-23	Hose Assembly for connection "B1"
54	1	646200-24	Hose Assembly for connection "C1"
55	1	646200-35	Hose Assembly for "B-DC1"
56	-	-	-
57	2	755373	Straight Male Stud Coupling
58	2	755364	Swivel Reducer
59	2	645116	Direct Pipe Fitting
60	1	645117	Direct Pipe Fitting

5.3.4.3 Drawing 646004 Hydraulic Assembly Elevator- VC Type

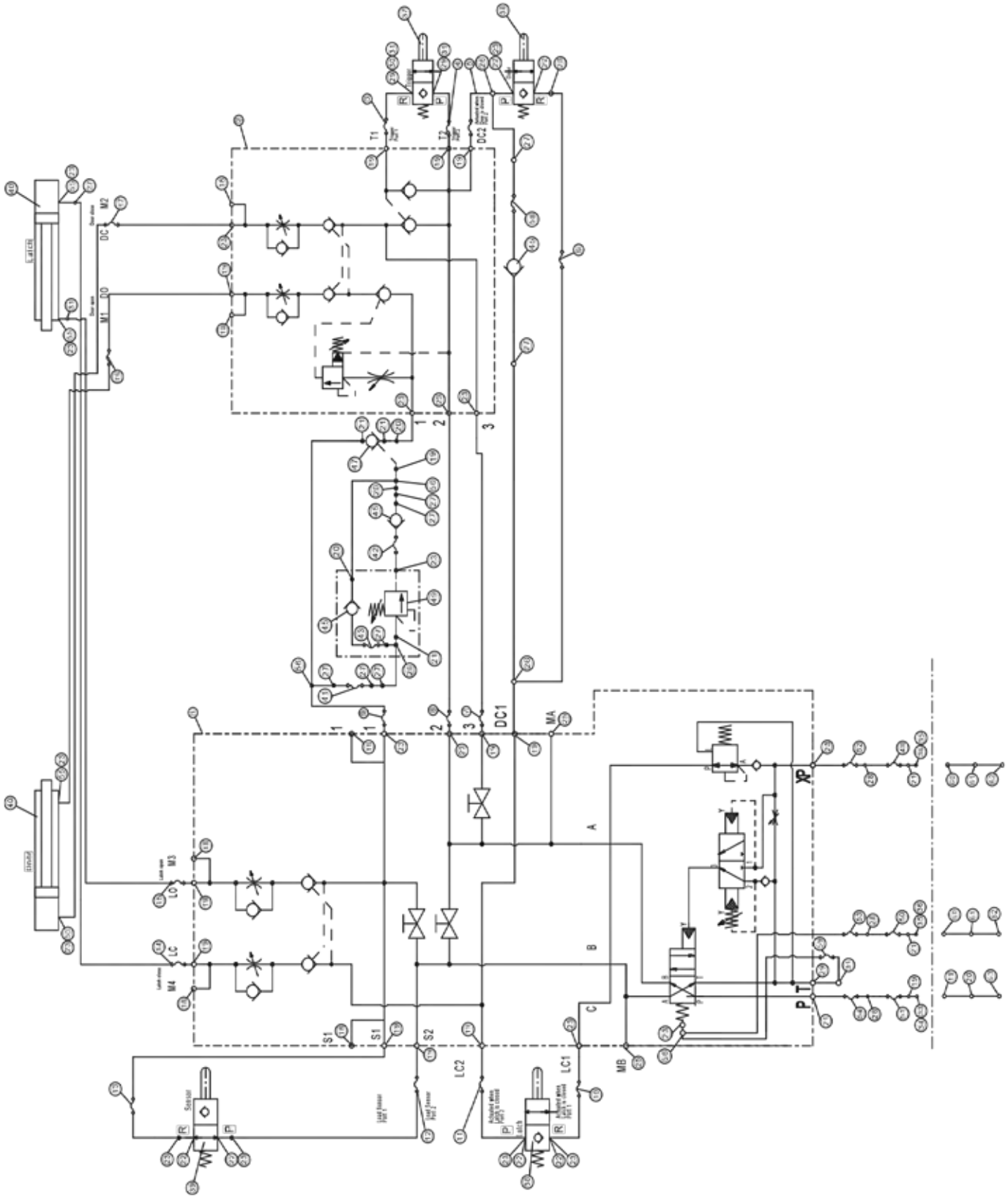


Fig. 89: 646004 Hydraulic Assembly Elevatorr

Part list 646004 Hydraulic Assembly Elevator

No.	Qty.	Part No.	Description
Pos.	Quantity	Part-no.	Description
1	1	645307	Left hydraulic block assembly for SD elevator
2	1	645295-2	Right hydraulic block assembly for SD elevator
3	1	646200-13	Hose Assembly for connection “T2”
4	1	646200-14	Hose Assembly for connection “T1”
5	1	646200-10	Hose Assembly for connection “DC2”
6	1	646200-9	Hose Assembly for connection “DC1”
7	1	646200-6	Hose Assembly for connection “3”
8	1	646200-5	Hose Assembly for connection “2”
9	1	646200-4	Hose Assembly for connection “1”
10	1	646200-29	Hose Assembly for connection “LC1”
11	1	646200-8	Hose Assembly for connection “LC2”
12	1	646200-12	Hose Assembly for connection “S2”
13	1	646200-11	Hose Assembly for connection “S1”
14	1	646200-21	Hose Assembly for connection “LC”
15	1	646200-15	Hose Assembly for connection “LO”
16	1	646200-16	Hose Assembly for connection “D0”
17	1	646200-17	Hose Assembly for connection “M2”
18	6	612929	Blind screw
19	13	612944	Straight Connection 8L-1/4’’
20	4	612945	Straight Connection 8L-8L
21	4	613943	Fitting
22	6	613944	Reducing Nippel G 1/4 A G 1/4 I
23	20	613945	Swivelling Screw Fitting
25	2	645092	Blind Screw
26	3	645095	T-connection
27	9	645096	L-Adapter
28	3	645106	Connection
29	3	755365	Banjo Coupling
30	1	755367	Adjustable Stud Elbow
31	4	755372	Standpipe Reducer
33	1	612965	Quick connect coupling 1/4 male
34	1	612966	Quick connect coupling 1/4 female
35	2	612937	Quick connect coupling 3/8 female
36	2	612936	Quick connect coupling 3/8 male
37	1	615914	Feedback Valve
38	2	643779	2/2 Way Valve
39	1	645656	Valve
40	2	645661	Hydraulic Cylinder for SD 500fr1
41	1	646200-28	Hose Assembly for connection “V1”
42	1	646200-27	Hose Assembly for connection “C1”
43	1	646200-26	Hose Assembly for connection “Z”
45	3	645110	Check Valve
47	1	726303	Pilot operated operated check valve
48	1	646200-25	Hose assembly for connection "XP"
49	2	755375	Valve
50	1	646200-30	Hose assembly for connection "T"
51	1	646200-31	Hose assembly for connection "P"
52	1	646200-32	Hose assembly for connection "XP1"
53	1	646200-33	Hose assembly for connection "T1"
54	1	646200-34	Hose assembly for connection "P1"
55	4	645636-1	Reducing
56	3	645104	T-connection
57	1	755737	Egual Tee
58	1	646200-35	Hose assembly for connection "B-DC1"
59	1	646200-36	Hose assembly for connection "TK"
60	2	755373	Straight Male Stud Coupling
61	2	755364	Swivel Reducer
62	2	645116	Direkt Pipe Fitting
63	1	645117	Direkt Pipe Fitting

5.3.5 Drawing and Parts List VES SD 500-3

5.3.5.1 Drawing 646600-Y Elevator SD 500 Frame III

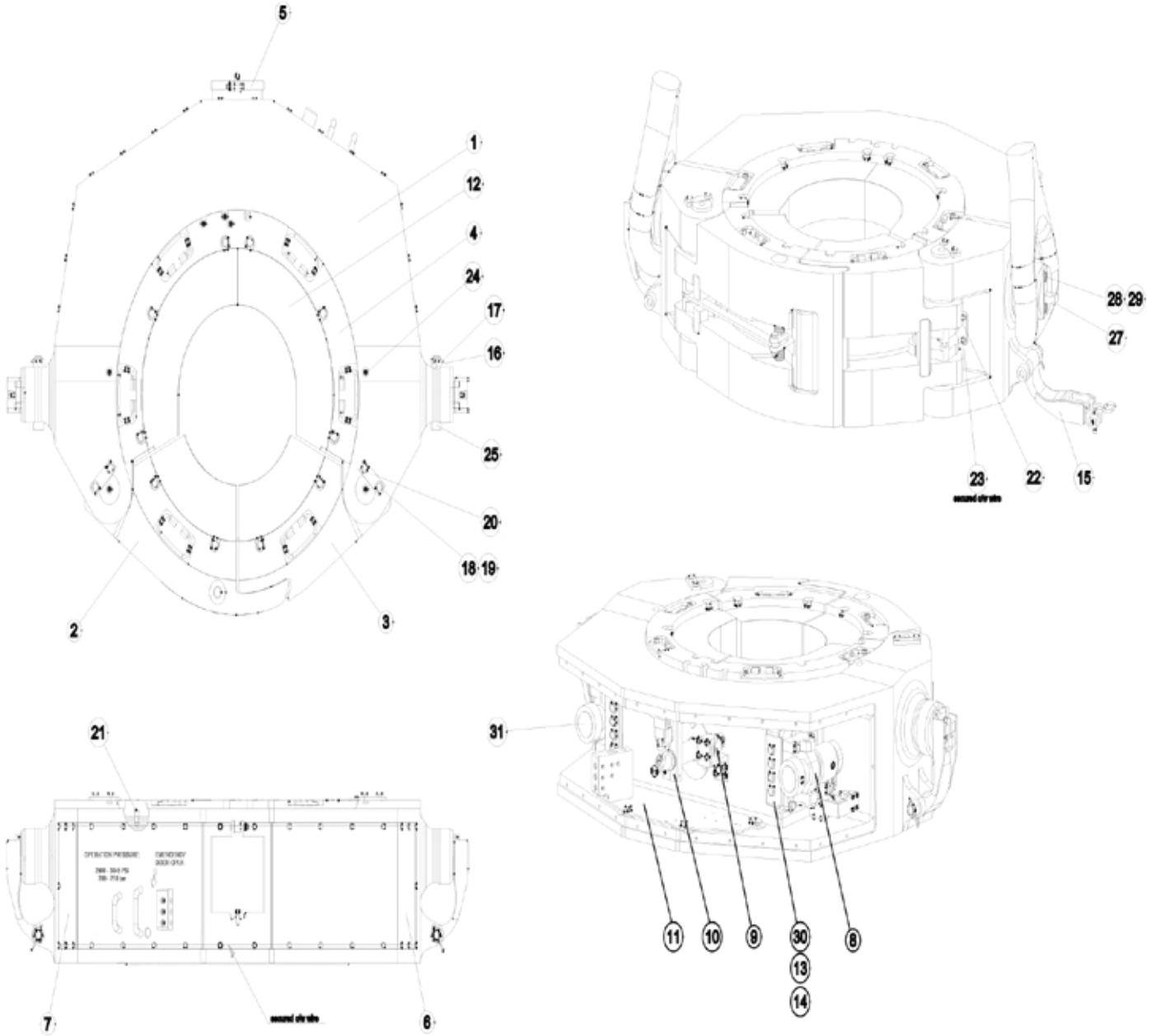


Fig. 90: 645600-Y Elevator SD 500 Frame III

Part list 646600-Y Elevator SD 500 Frame III

No.	Qty.	Part No.	Description
1	1	645605	Body VES-SD 500-3
2	1	645615	Door Assembly Left
3	1	645611	Door Assembly Right
4	1	645630	Cover Assembly for Bushing
5	1	645609	Cover Hydraulic Room
6	1	645610	Cover Plate
7	1	645610	Cover Plate
8	1	645660-1	Door Opening Assembly Left
9	1	645650	Load Safety Device VES-SD-500 Frame 3
10	1	645640	Trigger Assembly
11	1	646603-6	Hydraulic Plan;Elevator SD 500-3
13	8	710541	Screw
14	8	645658	Washer with external tap
15	2	645185-2	Link Block Assembly for SD 350 / 500 new
16	2	645019	Castle Nut
17	2	735404	Split Pin
18	4	617519	Screw
19	4	617520	Washer with tap
20	2	615009	Securing Plate for Latch Pin
21	2	645038	Bolt;use in door assembly;for all FORUM Handling Tools typ
22	2	645637	Cover Plate
23	8	725461	Screw
25	2	645018	Screw
30	2	645629	Clip Holder
31	1	645660-2	Door Opening Assembly Right

5.3.5.2 Drawing 646603-6 Hydraulic plan for Elevator VES-SD 500-3

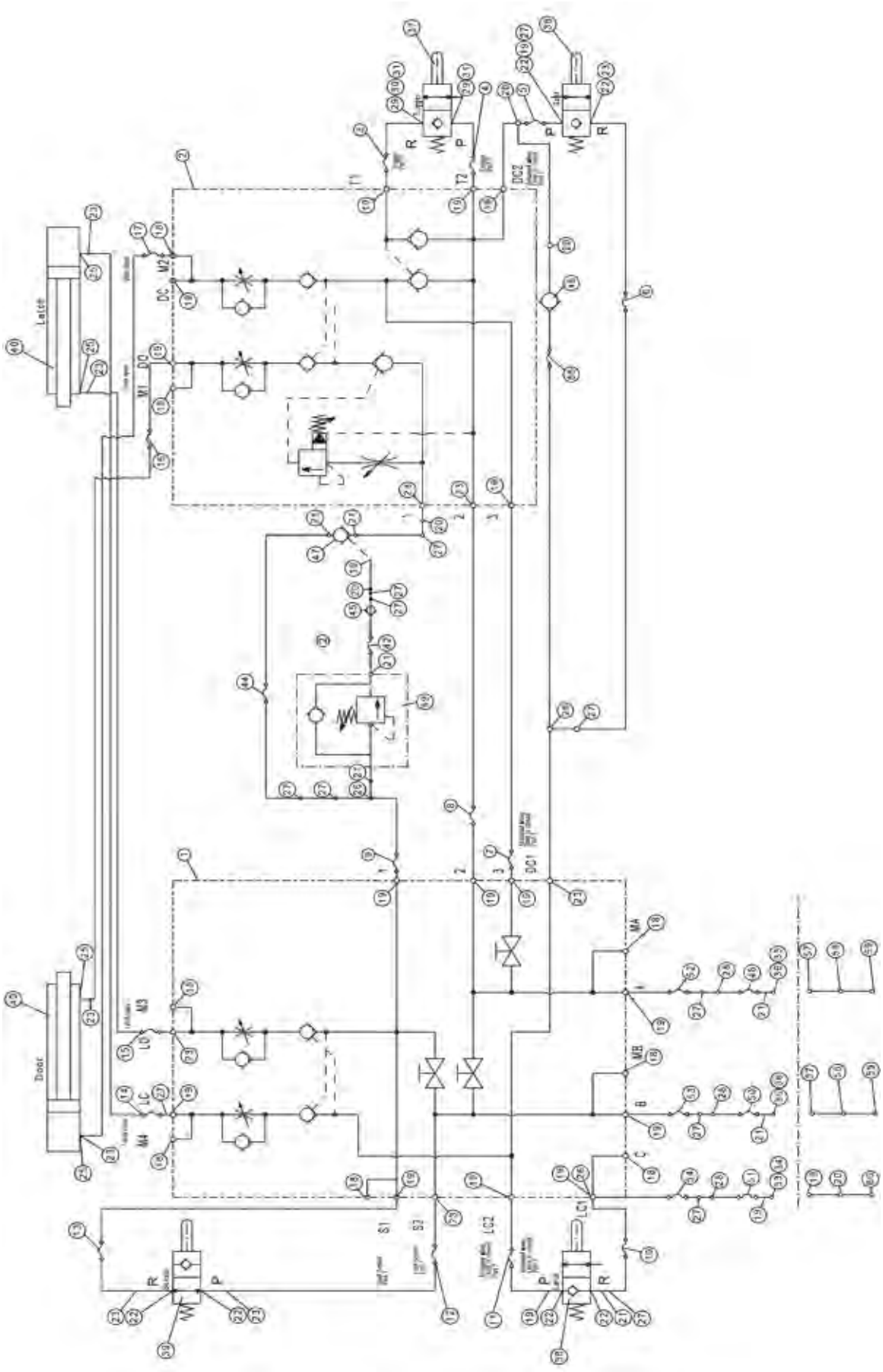


Fig. 91: 645603-6 Hydraulic connections for elevator

Part list 646603-6 Hydraulic plan for Elevator

No.	Qty.	Part No.	Description
1	1	645295-1	Left hydraulic block assembly for SD elev
2	1	645295-2	right hydraulic block assembly for SD ele
18	8	612929	Locking screw
19	20	612944	Straight Connection 8L-1/4"
20	4	612945	Straight Connection 8L-8L
21	7	613943	Straight Male Stud Coupling
22	6	613944	Reducing Nipple
23	12	613945	Swivelling Screw Fitting 90°;(replaces 61
25	4	645636-1	Reducing
26	5	645095	Adjustable Stud Barrel Tee
27	12	645096	L-Adapter
28	3	645106	Connection
29	2	755365	Banjo Coupling
30	1	755367	Adjustable Stud Elbow
31	2	755372	Standpipe Reducer
33	1	612965	Coupling, Flat Face, male;(replaces 61296
34	1	612966	Coupling, Flat Face, female;(replaces 612
35	2	612937	Coupling, Flat Face, female;(replaces 612
36	2	612936	Coupling, Flat Face, male;(replaces 61293
37	1	615914	Feedback Valve
38	2	643779	2/2 Way Valve
39	1	645656	2-Way-Valve
40	2	645661	Hydraulic Cylinder;for VES-SD-500 Frame 2
44	1	645104	T-Connection
45	2	645110	Check Valve
47	1	726303	Pilot operated check valve
49	1	755375	Sequence valve OIL Control
50	1	646600-40	Hydraulic Hose Assembly for;SD- 500 Frame
57	2	755373	Straight Male Stud Coupling
58	2	755364	Swivel Reducer
59	2	645116	Direct Pipe Fitting
60	1	645117	Direct Pipe Fitting

5.3.6 Drawing and Parts List VES SD 750 / 1000

5.3.6.1 Drawing 676000-Y Elevator VES-SD 750 / 1000

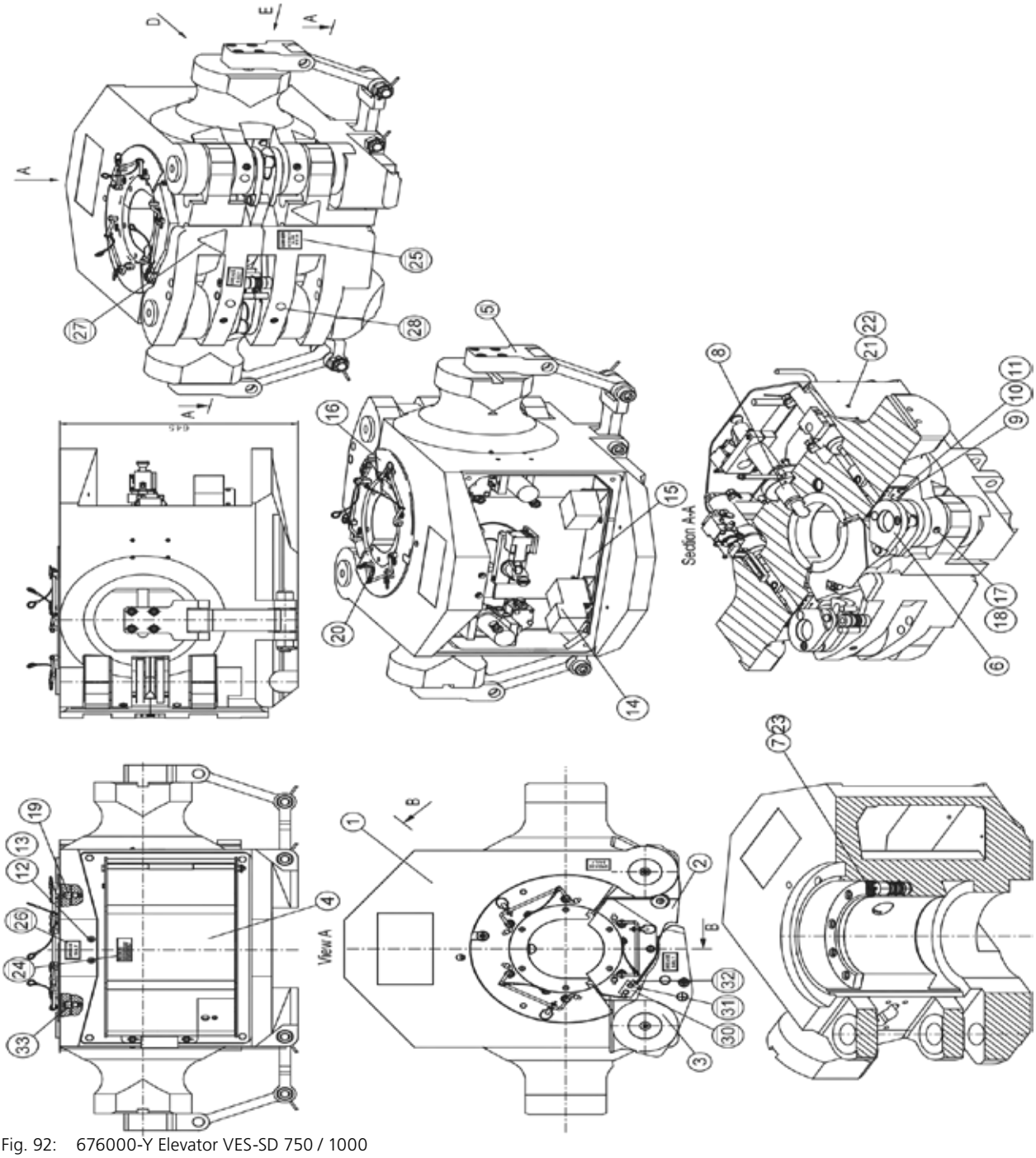


Fig. 92: 676000-Y Elevator VES-SD 750 / 1000

Part list 676000-Y Elevator VES-SD 750 / 1000

No.	Qty.	Part No.	Description
1	1	675005	Elevator Body
2	1	676011	Door Assy RH
3	1	676015	Door Assy LH
4	1	676005	Cover Assy
5	1	676017	Link Retainer SD 750-1000 Manual
6	1	676060	Door Opening Assy
7	1	675050	Load Safety Device
8	1	676040	Trigger Assy
9	2	645079	Cover Plate
10	8	613825	Safety Plate
11	8	671051	Screw
12	3	70064	Grease Nipple
13	3	612518	Cap for Grease Nipple
14	1	676004	Hydraulic Assy
15	1	676053-1	Hydraulic Plate Assembly
16	1	675033	Bushing Retainer Plate
17	4	645027	Screw
18	4	645026	Securing Ring
19	1	645038	Bolt
20	5	735324	Screw
21	4	645159	Screw
22	4	735854	Washer
23	1	675050-1	Load Ring (Door)
24	1	671638	Warning Sign Blohm+Voss
25	1	671639	Warning Sign “Automatic”
26	4	671642	Warning Sign “Grease”
27	2	671641	Warning sign “squeeze danger”
28	4	611524	Sticker “don`t touch”
29	1	675005-1	Bushing
30	1	646035	Holding Plate
31	2	613782	Screw
32	2	645059	Washer
33	1	645038-1	Bolt
34	1	645295-11	Lever for ball valve

5.3.6.2 Drawing 676000-Y-VC Elevator VES-SD 750 / 1000

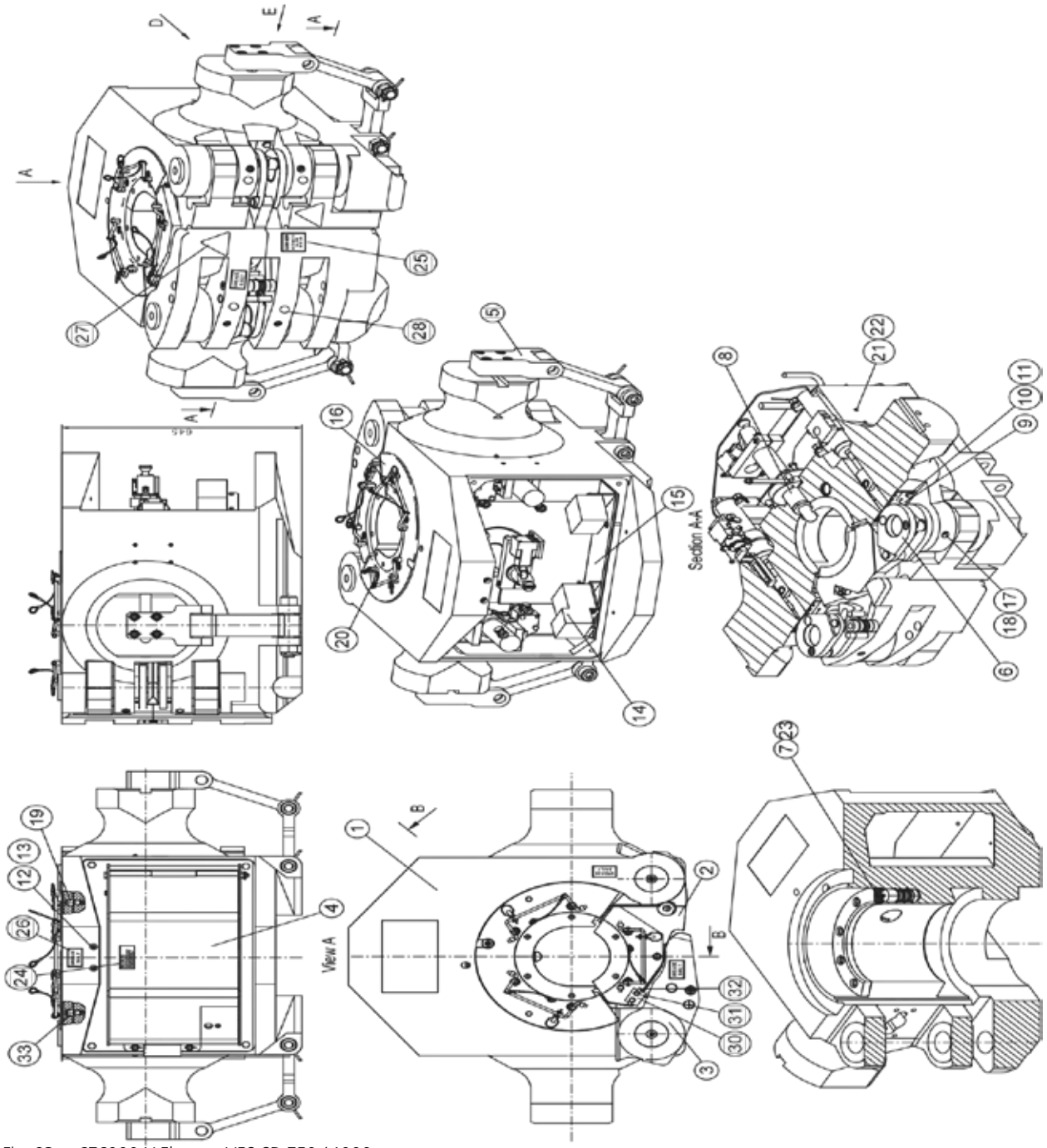


Fig. 93: 676000-Y Elevator VES-SD 750 / 1000

Part list 676000-Y-VC Elevator VES-SD 750 / 1000

No.	Qty.	Part No.	Description
1	1	675005	Elevator Body
2	1	676011	Door Assy RH
3	1	676015	Door Assy LH
4	1	676005	Cover Assy
5	1	676017	Link Retainer SD 750-1000 Manual
6	1	676060	Door Opening Assy
7	1	675050	Load Safety Device
8	1	676040	Trigger Assy
9	2	645079	Cover Plate
10	8	613825	Safety Plate
11	8	671051	Screw
12	3	70064	Grease Nipple
13	3	612518	Cap for Grease Nipple
14	1	676004	Hydraulic Assy
15	1	676053-1	Hydraulic Plate Assembly
16	1	675033	Bushing Retainer Plate
17	4	645027	Screw
18	4	645026	Securing Ring
19	1	645038	Bolt
20	5	735324	Screw
21	4	645159	Screw
22	4	735854	Washer
23	1	675050-1	Load Ring (Door)
24	1	671638	Warning Sign Blohm+Voss
25	1	671639	Warning Sign “Automatic”
26	4	671642	Warning Sign “Grease”
27	2	671641	Warning sign “squeeze danger”
28	4	611524	Sticker “don`t touch”
29	1	675005-1	Bushing
30	1	646035	Holding Plate
31	2	613782	Screw
32	2	645059	Washer
33	1	645038-1	Bolt
34	1	645295-11	Lever for ball valve

5.3.6.3 Drawing 676003-6 Hydraulic Connection for Elevator VES-SD 750 / 1000

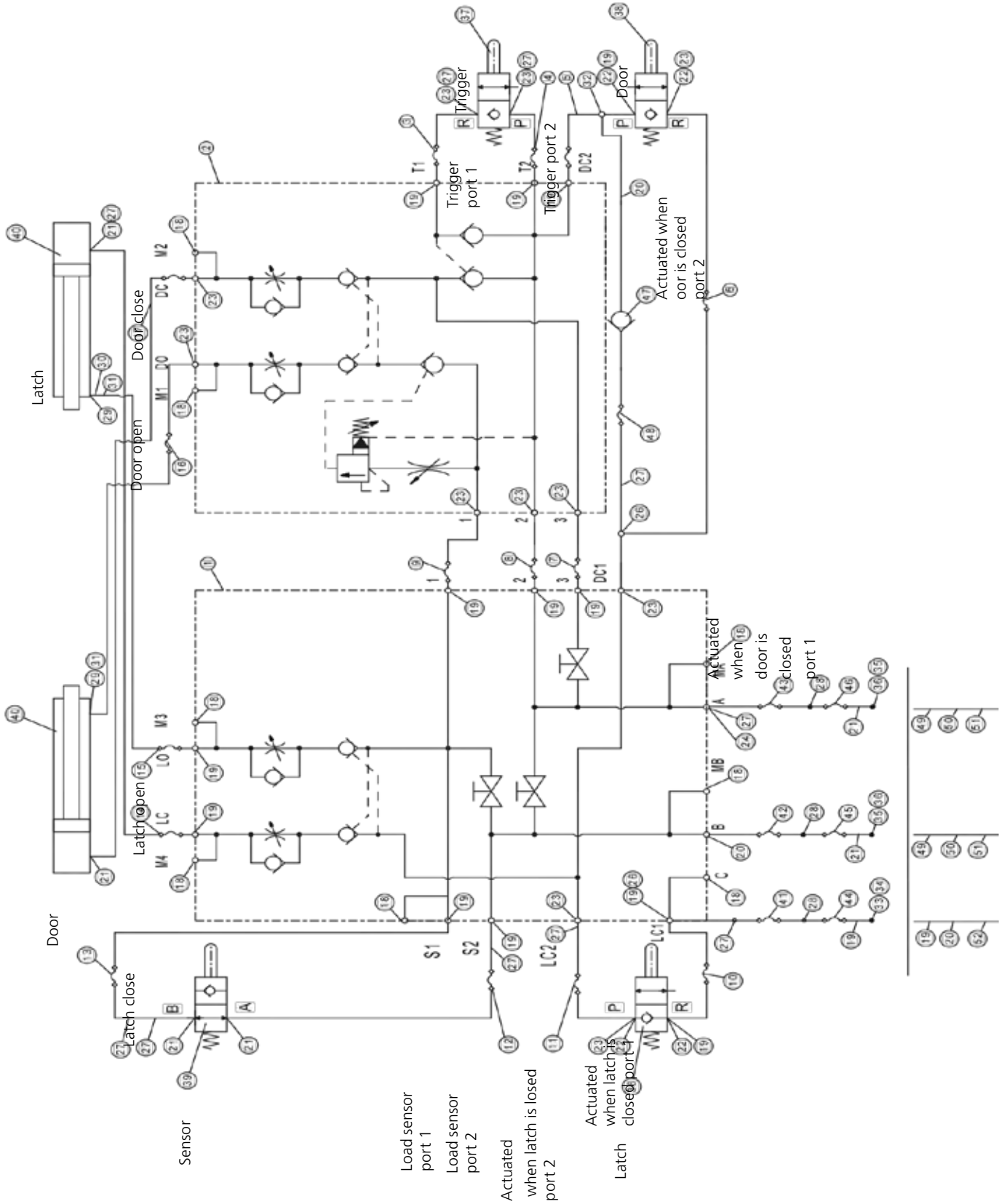


Fig. 94: 676003-6 Hydraulic Connection for Elevator VES-SD 750 / 1000

Part list 676003-6 Hydraulic Connection for Elevator VES-SD 750 / 1000

No.	Qty.	Part No.	Description
1	1	645295-1	Left hydraulic block assembly for SD elevator
2	1	645295-2	Right hydraulic block assembly for SD elevator
3	1	676000-16	Hydraulic Hose Assembly for Connection ''T1''
4	1	676000-17	Hydraulic Hose Assembly for Connection ''T2''
5	1	676000-13	Hydraulic Hose Assembly for Connection ''DC2''
6	1	676000-12	Hydraulic Hose Assembly for Connection ''DC1''
7	1	676000-9	Hydraulic Hose Assembly for Connection ''3''
8	1	676000-8	Hydraulic Hose Assembly for Connection ''2''
9	1	676000-7	Hydraulic Hose Assembly for Connection ''1''
10	1	676000-10	Hydraulic Hose Assembly for Connection ''LC1''
11	1	676000-11	Hydraulic Hose Assembly for Connection ''LC2''
12	1	676000-15	Hydraulic Hose Assembly for Connection ''S2''
13	1	676000-14	Hydraulic Hose Assembly for Connection ''S1''
14	1	676000-21	Hydraulic Hose Assembly for Connection ''LC''
15	1	676000-19	Hydraulic Hose Assembly for Connection ''LO''
16	1	676000-18	Hydraulic Hose Assembly for Connection ''DO''
17	1	676000-20	Hydraulic Hose Assembly for Connection ''M2''
18	8	612929	Blind screw
19	14	612944	Straight Connection 8L-1/4''
20	3	612945	Straight Connection 8L-8L
21	6	613943	Fitting
22	4	613944	Reducing Nippel G 1/4 A G 1/4 I
23	11	613945	Swivelling Screw Fitting
24	1	613946	Straight Connection
25	-	-	-
26	2	645095	L-Adapter
27	10	645096	L-Adapter
28	3	645106	Connection
29	2	755365	Banjo Coupling
30	1	755367	Adjustable Stud Elbow
31	2	755372	Standpipe Reducer
32	1	645104	T-Connection
33	1	612965	Quick connect coupling 1/4 male
34	1	612965	Quick connect coupling 1/4 female
35	2	612937	Quick connect coupling 3/8 female
36	2	612936	Quick connect coupling 3/8 male
37	1	615914	Feedback Valve
38	2	643779	2/2 Way Valve
39	1	645118	Valve
40	2	645297	Hydraulic Cylinder for SD Elevator 500 frame 1, 750
41	1	676000-6	Hydraulic Hose Assembly for Connection ''C1''
42	1	676000-5	Hydraulic Hose Assembly for Connection ''B1''
43	1	676000-4	Hydraulic Hose Assembly for Connection ''A1''
44	1	676000-3	Hydraulic Hose Assembly for Connection ''C''
45	1	676000-2	Hydraulic Hose Assembly for Connection ''B''
46	1	676000-1	Hydraulic Hose Assembly for Connection ''A''
47	1	645110	Check valve
48	1	676004-B-DC1	Hydraulic hose A "B-DC1"
49	2	755373	Male Stud Coupling
50	2	755364	Swivel Reducer
51	2	645116	Direct Pipe Fitting
52	1	645117	Direct Pipe Fitting

5.3.6.4 Drawing 676004 Hydraulic Connection for Elevator VC Type VES-SD 750 / 1000

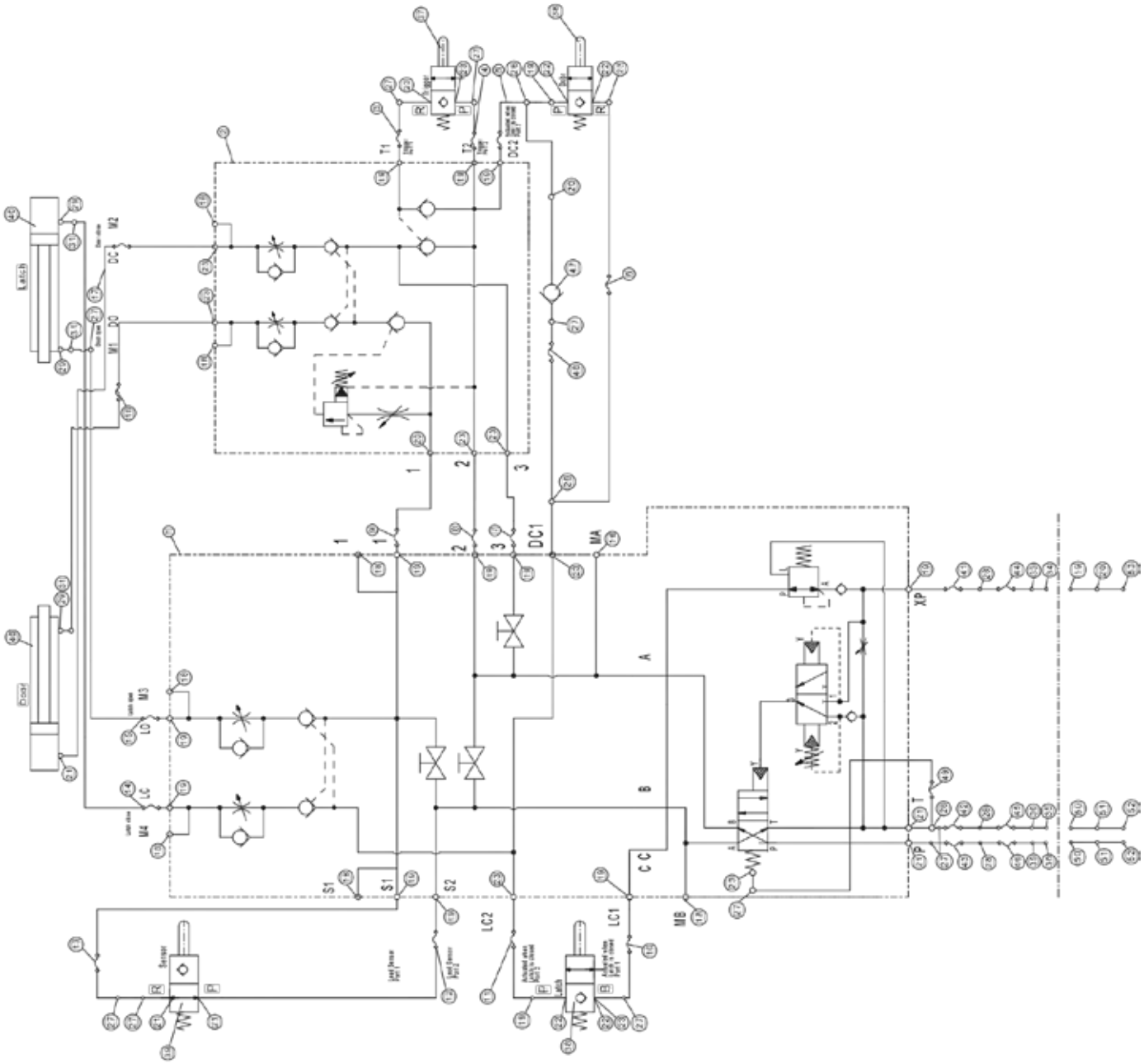


Fig. 95: 676004 Hydraulic Connection for Elevator VC Type VES-SD 750 / 1000

Part list 676004 Hydraulic Connection for Elevator VC Type VES-SD 750 / 1000

No.	Qty.	Part No.	Description
1	1	645307	Left hydraulic block assembly for SD elevator
2	1	645295-2	Right hydraulic block assembly for SD elevator
3	1	676000-16	Hydraulic Hose Assembly for Connection ''T1''
4	1	676000-17	Hydraulic Hose Assembly for Connection ''T2''
5	1	676000-13	Hydraulic Hose Assembly for Connection ''DC2''
6	1	676004-DC1	Hydraulic Hose Assembly for Connection ''DC1''
7	1	676004-3	Hydraulic Hose Assembly for Connection ''3''
8	1	676004-2	Hydraulic Hose Assembly for Connection ''2''
9	1	676000-7	Hydraulic Hose Assembly for Connection ''1''
10	1	676000-10	Hydraulic Hose Assembly for Connection ''LC1''
11	1	676000-11	Hydraulic Hose Assembly for Connection ''LC2''
12	1	676004-S2	Hydraulic Hose Assembly for Connection ''S2''
13	1	676000-14	Hydraulic Hose Assembly for Connection ''S1''
14	1	676000-21	Hydraulic Hose Assembly for Connection ''LC''
15	1	676000-19	Hydraulic Hose Assembly for Connection ''LO''
16	1	676000-18	Hydraulic Hose Assembly for Connection ''DO''
17	1	676000-20	Hydraulic Hose Assembly for Connection ''DC''
18	8	612929	Blind screw
19	14	612944	Straight Connection 8L-1/4''
20	2	612945	Straight Connection 8L-8L
21	5	613943	Fitting
22	4	613944	Reducing Nippel G 1/4 A G 1/4 I
23	12	613945	Swivelling Screw Fitting
24	-	-	-
25	-	-	-
26	3	645095	T-connection
27	10	645096	L-Adapter
28	3	645106	Connection
29	3	755365	Banjo Coupling
30	-	-	-
31	3	755372	Standpipe Reducer
32	-	-	-
33	1	612965	Quick connect coupling 1/4 male
34	1	612966	Quick connect coupling 1/4 female
35	2	612937	Quick connect coupling 3/8 female
36	2	612936	Quick connect coupling 3/8 male
37	1	615914	Feedback Valve
38	2	643779	2/2 Way Valve
39	1	645118	Valve
40	2	645297	Hydraulic Cylinder for SD Elevator 500 frame 1, 750
41	1	676004-P	Hydraulic Hose Assembly for Connection ''P''
42	1	676004-T	Hydraulic Hose Assembly for Connection ''T''
43	1	676004-XP	Hydraulic Hose Assembly for Connection ''XP''
44	1	676000-3	Hydraulic Hose Assembly for Connection ''C''
45	1	676000-2	Hydraulic Hose Assembly for Connection ''B''
46	1	676000-1	Hydraulic Hose Assembly for Connection ''A''
47	1	645110	Check valve
48	1	676004-B-DC1	Hydraulic hose A "B-DC1"
49	1	676004-4	Hydraulic hose A "4"
50	2	755373	Male Stud Coupling
51	2	755364	Swivel Reducer
52	2	645116	Direct Pipe Fitting
53	1	645117	Direct Pipe Fitting

5.3.7 Type Series part list

5.3.7.1 Drawing 645050 Load safety device VES-SD 350 / 500-1

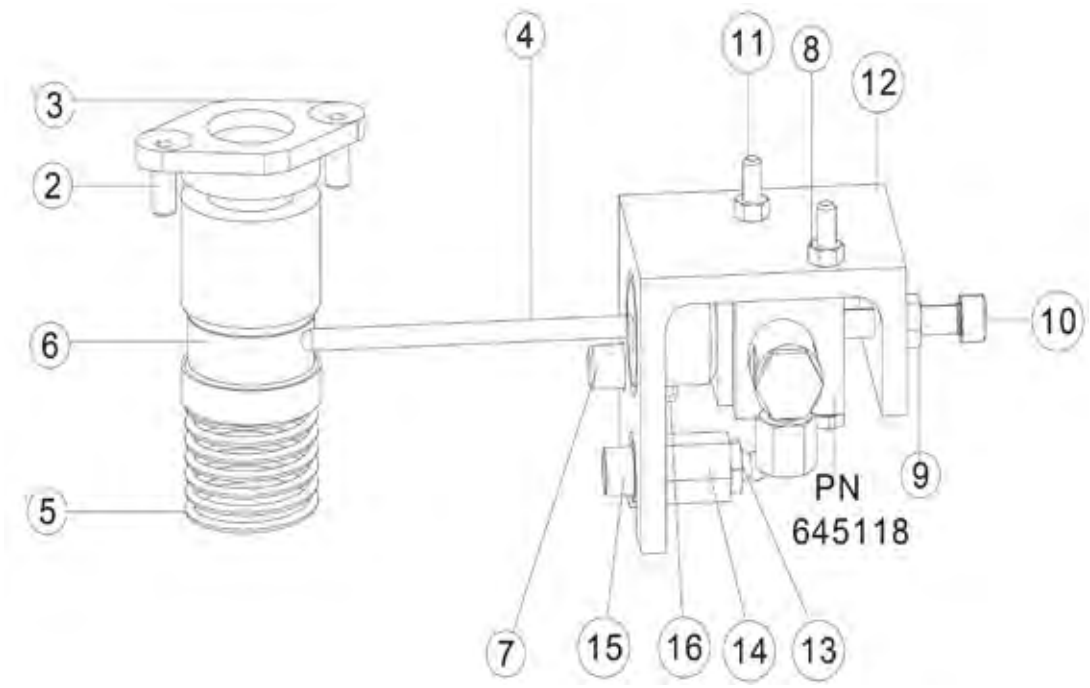


Fig. 96: 645050 Load safety device

Part list 645050 Load safety device

No.	Qty.	Part No.	Description
2	2	645054	Screw
3	1	645130	Cover
4	1	645131	Plunger for SD 500-1
5	1	645135	Pressure spring
6	1	645132	Detect
7	1	645137	Screw
8	2	660414-2	Nut
9	1	613633	Nut
10	1	756725	Screw
11	2	645136	Screw
12	1	645133	Holding plate
13	1	612515	Grease nipple
14	1	612663	Socket
15	1	612957	Adapter
16	1	792104	Washer

5.3.7.2 Drawing 645250 Load safety device VES-SD 500-2

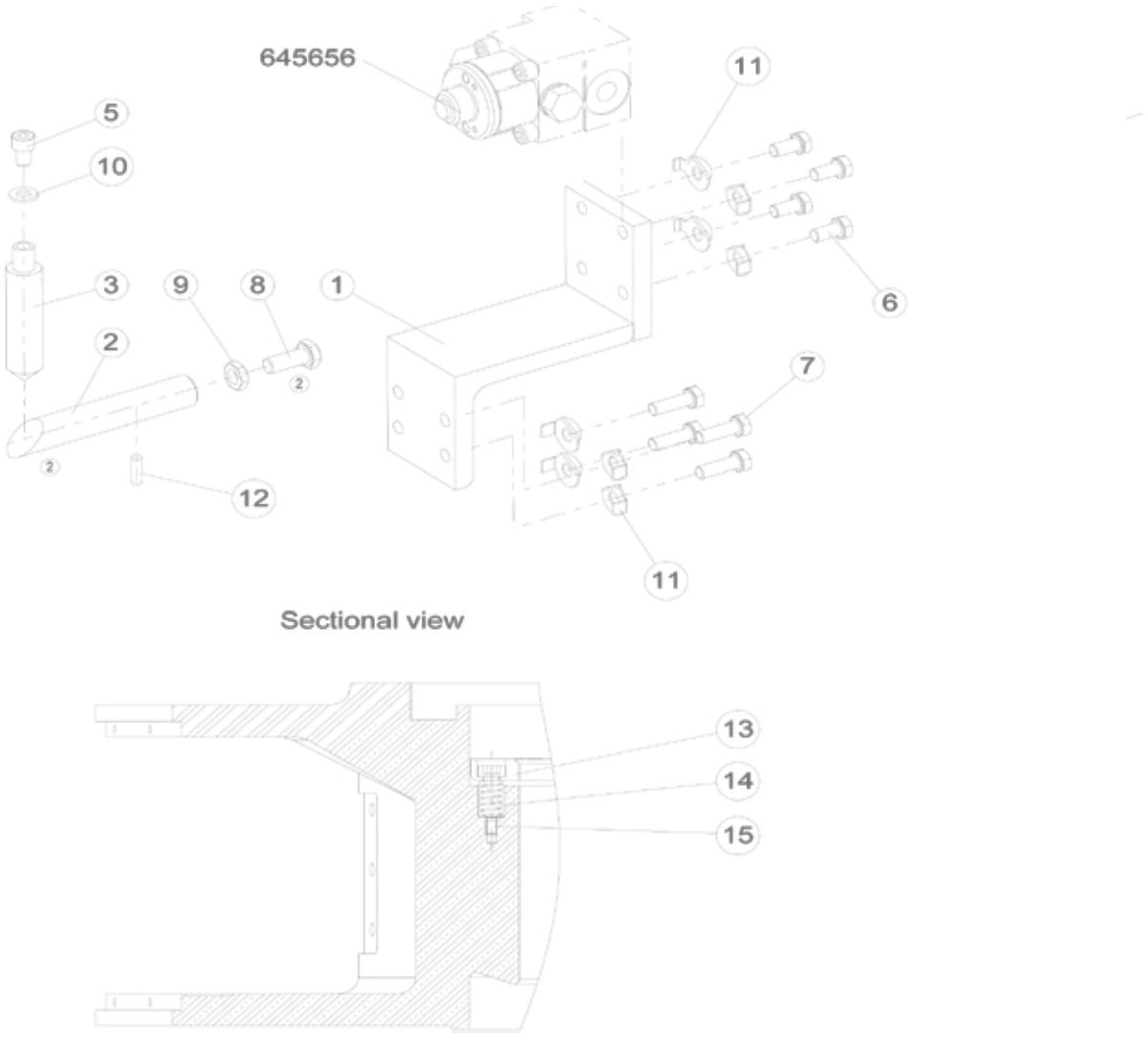


Fig. 97: 645250 Load safety device

Part list 645250 Load safety device

No.	Qty.	Part No.	Description
1	1	645651	Welding console
2	1	645252	Bolt 1
3	1	645653	Bolt 2
4	-	-	-
5	1	755081-1	Cylinder head screw
6	4	643779-1	Hexagon screw
7	4	735852	Hexagon screw
8	1	613715	Hexagon screw
9	1	89125	Nut
10	1	645683	Washer
11	8	645059	Washer
12	1	645686	Cylinder pin
13	1	645254	Load ring
14	8	645655	Pressure spring
15	8	645665	Shouldered screw

5.3.7.3 Drawing 645650 Load safety device VES-SD 500-3

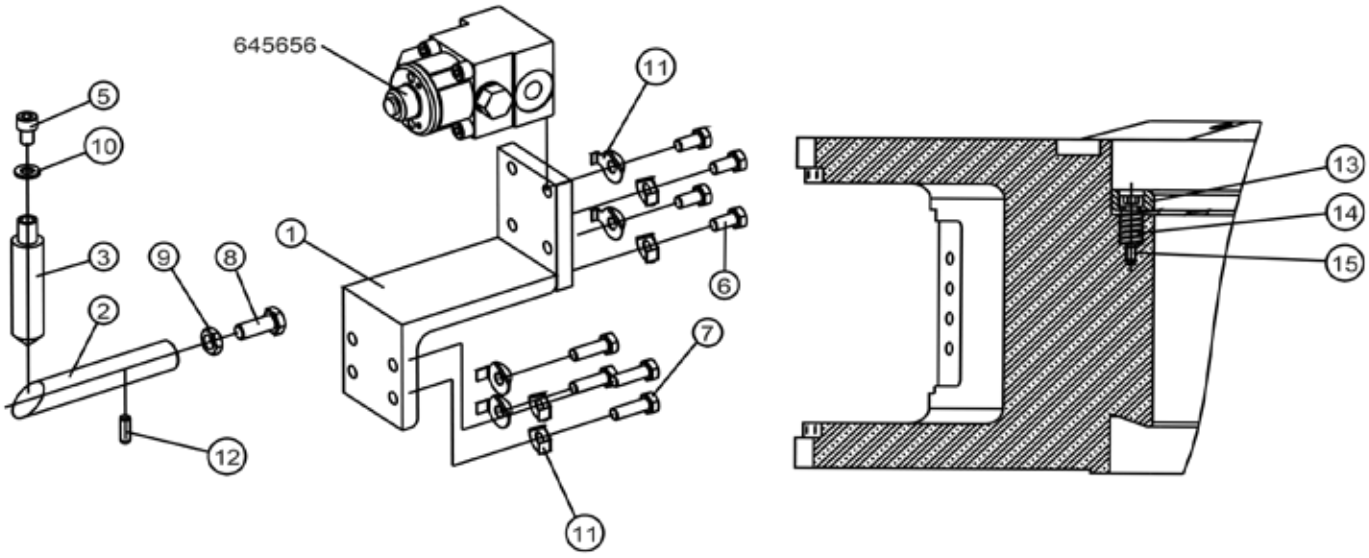


Fig. 98: 645650 Load safety device

Part list 645650 Load safety device

No.	Qty.	Part No.	Description
1	1	645651	Welding console
2	1	645252	Bolt 1
3	1	645653	Bolt 2
4	-	-	-
5	1	755081-1	Cylinder head screw
6	4	643779-1	Hexagon screw
7	4	735852	Hexagon screw
8	1	613715	Hexagon screw
9	1	89125	Nut
10	1	645683	Washer
11	8	645059	Washer
12	1	645686	Cylinder pin
13	1	645254	Load ring
14	8	645655	Pressure spring
15	8	645665	Shouldered screw

5.3.7.4 Drawing 675050 Load safety device VES-SD 750 / 1000

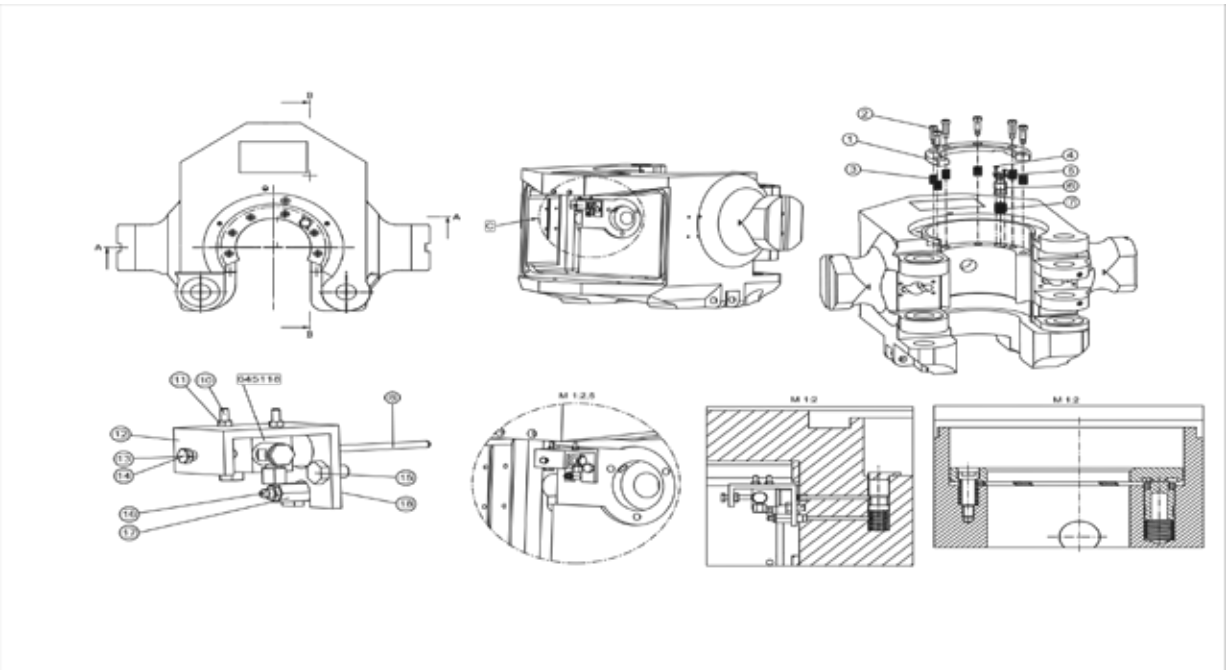


Fig. 99: 675050 Load safety device

Part list 675050 Load safety device

No.	Qty.	Part No.	Description
1	1	675024	Load ring
2	6	645052	Shouldered screw
3	6	645055	Pressure spring
4	2	645054	Countersunk screw
5	1	645130	Cover for valve
6	1	645132-1	Detand
7	1	645135	Helix
8	1	645131	Plunger
9	-	-	-
10	2	645136	Screw
11	2	755251	Nut
12	1	645133	Holding Plate
13	1	645138	Screw
14	1	613633	Nut
15	1	645137	Screw
16	1	612662	Double Socket
17	1	612663	Socket
18	1	612957	Adapter

5.3.7.5 Drawing 645033 Bushing retaining plate VES-SD 350 / 500-1

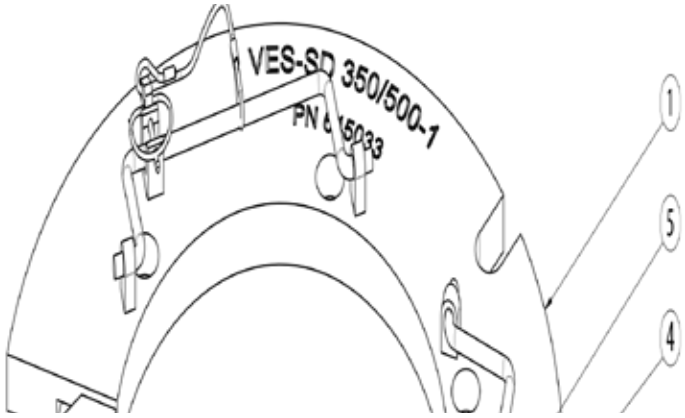


Fig. 100: 645033 Bushing retaining plate

Part list 645033 Bushing retaining plate VES-SD 350 / 500-1

No.	Qty.	Part No.	Description
1	1	645033-1	Plate for Body
2	1	645038-2	Plate for Door
3	3	645035	Link Pin
4	3	643801	Wire line
5	6	643801-1	Rope Clamp

5.3.7.6 Drawing 675033 Bushing retaining plate VES-SD 750 / 1000

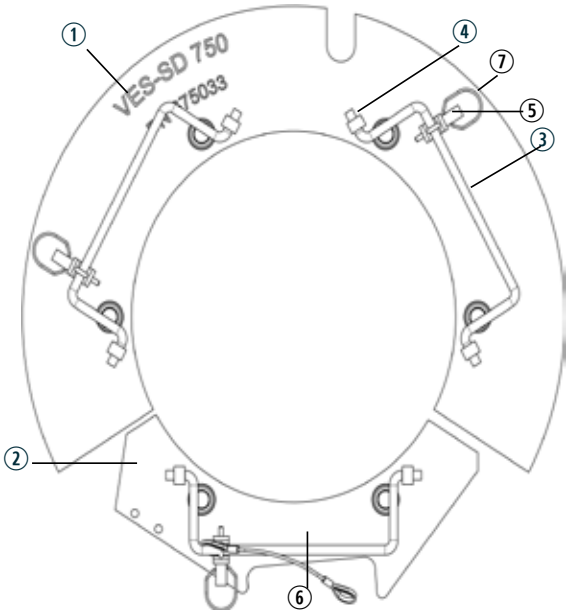


Fig. 101: 675033 Bushing retaining plate

Part list 675033 Bushing retaining plate VES-SD 750 / 1000

No.	Qty.	Part No.	Description
1	1	675033-1	Plate for body
2	1	675033-2	Plate for door
3	3	645033-3	Handle
4	6	645033-4	Hinge for handle
5	3	645033-5	Fixing plate
6	3	645037	Rope
7	3	645035	Link pin

5.3.7.7 Drawing Bushing retaining plate VES-SD 500-2 / VES-SD 500-3

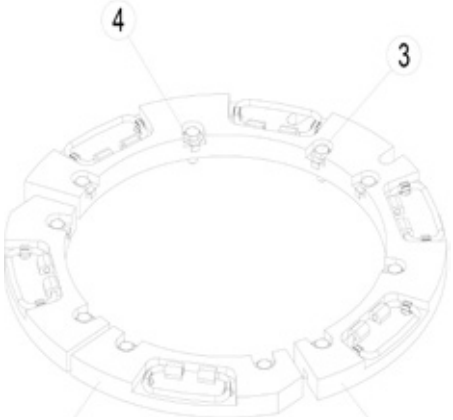


Fig. 102: 645208 Bushing retaining plate

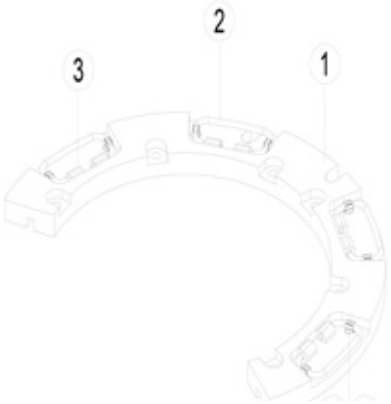


Fig. 103: 645231 Cover ring body

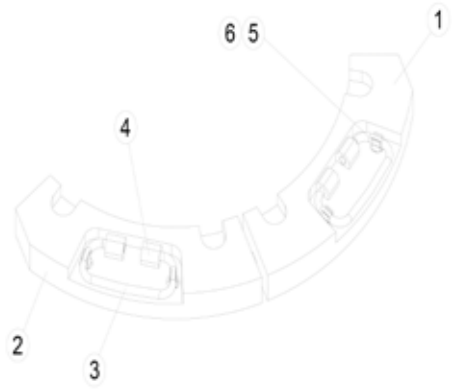


Fig. 104: 645232 Cover ring door

Part list 645208 Bushing retaining plate VES-SD 500-2

No.	Qty.	Part No.	Description
1	1	645231	Cover ring, body
2	1	645232	Cover ring, door
3	10	755314	Hexagon screw
4	10	775068	Washer

Part list 645231 Cover ring body VES-SD 500-2

No.	Qty.	Part No.	Description
1	1	645231-1	Cover ring
2	4	645631-2	Handle
3	8	645631-3	Block
4	8	645631-4	Spring clip
5	8	645631-5	Blind Rivet

Part list 645232 Cover Ring Door VES-SD 500-2

No.	Qty.	Part No.	Description
1	1	645232-1	Cover ring
2	1	645232-2	Cover ring
3	2	645631-2	Handle
4	4	645631-3	Block
5	4	645631-4	Spring clip
6	4	645631-5	Blind Rivet

Part list 645630 Bushing retaining plate VES-SD 500-3

No.	Qty.	Part No.	Description
1	1	645231	Cover ring, body
2	1	645232	Cover ring, door
3	10	755314	Hexagon screw
4	10	775068	Washer

Part list 645631 Cover ring body VES-SD 500-3

No.	Qty.	Part No.	Description
1	1	645631-1	Cover ring
2	4	645631-2	Handle
3	8	645631-3	Block
4	8	645631-4	Spring clip
5	8	645677	Half-round rivet

Part list 645632 Cover Ring Door VES-SD 500-3

No.	Qty.	Part No.	Description
1	1	645632-1	Cover ring
2	1	645632-2	Cover ring
3	2	645631-2	Handle
4	4	645631-3	Block
5	4	645631-4	Spring clip
6	4	645677	Half-round rivet

5.3.7.8 Drawing 645040 Trigger Assembly VES-SD 350 / VES-SD 500-1

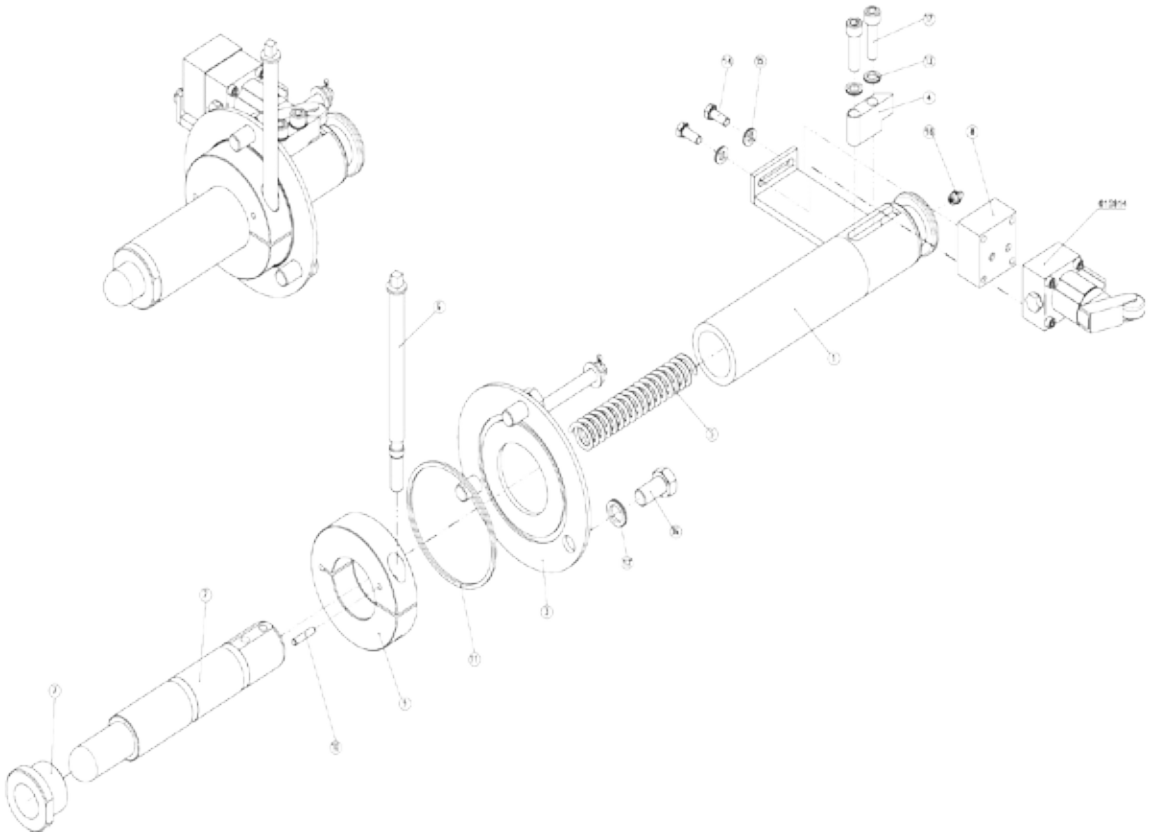


Fig. 105: 645040 Trigger Assembly

Part list 645040 Trigger Assembly

No.	Qty.	Part No.	Description
0	0	615914	Feedback Valve
1	1	645040-1	Tube Assembly;for Trigger
2	1	645041	Pin for trigger assembly;VES-SD 350/ 500
3	1	645056	Cover Plate;for SD 500-1
4	1	645141	Stopper
5	1	645045	Spring for Trigger Assembly;for VES-SD El
6	1	645049	Clamp Screw
7	1	645043	Locking Pin
8	1	646088	Mounting plate
9	1	645048	Clamp
10	1	645048-2	Parallel pin
11	1	645057	Sealing
12	2	752832	Screw
13	2	792103	Washer
14	2	643779-1	Screw
15	2	792112-1	Washer
16	3	617519	Screw
17	3	792106	Washer
18	1	70064	Grease Nipple

5.3.7.9 Drawing 646240 Trigger Assembly VES-SD 500-2

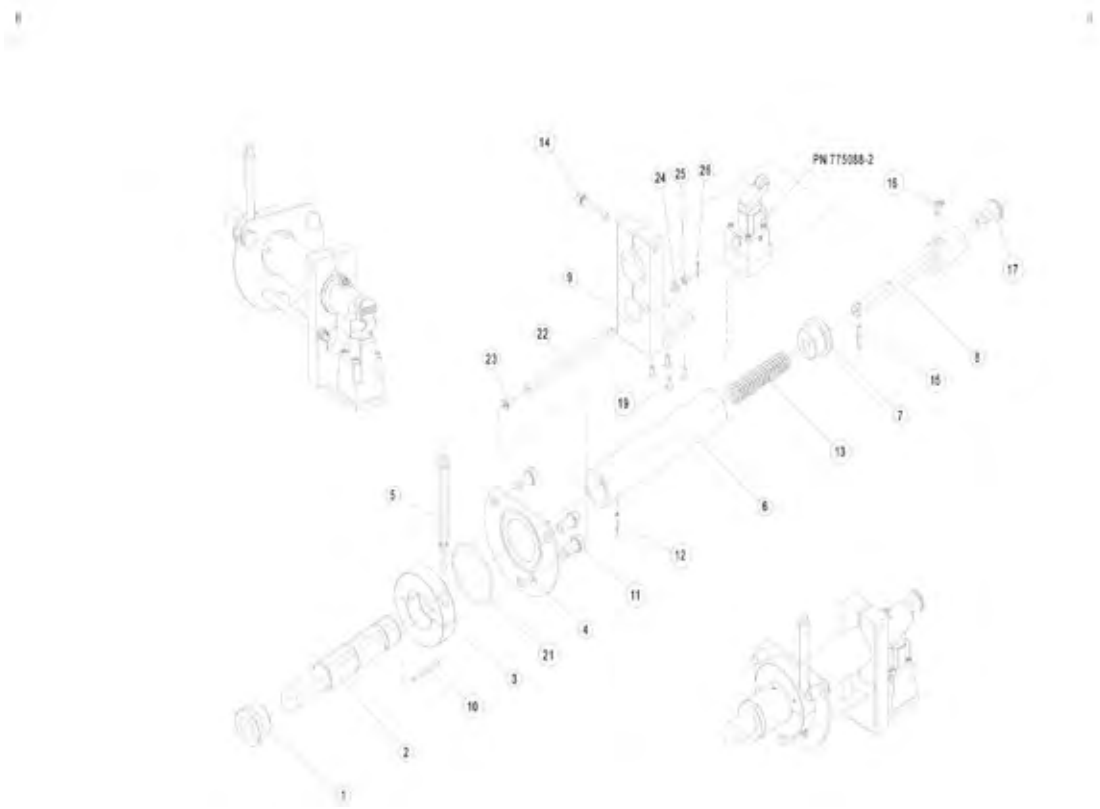


Fig. 106: 646240 Trigger Assembly

Part list 646240 Trigger Assembly

No.	Qty.	Part No.	Description
1	1	645043	Locking pin
2	1	645641	Bilt
3	1	645048	Clamp
4	1	645241	Cover plate
5	1	645249	Clamp screw
6	1	645642	Tube
7	1	645643	Plug
8	1	645644	Plunger
9	1	646646-1	Console
10	1	645048-1	Cylinder pin
11	3	617519	Hexagon screw
12	1	645645	Straight pin with inner thread
13	1	645045	Pressure spring
14	1	645649	Cylinder head screw
15	1	645648	Cylinder pin
16	1	645647	Grease nipple
17	1	645640-1	Handle
19	4	675047	Screw
21	1	645242	O-ring seal
22	1	645243	Bolt
23	1	645054	Screw
24	1	645244	Washer
25	1	613633	Nut
26	1	620609	Cotter Pin

5.3.7.10 Drawing 645640 Trigger Assembly VES-SD 500-3

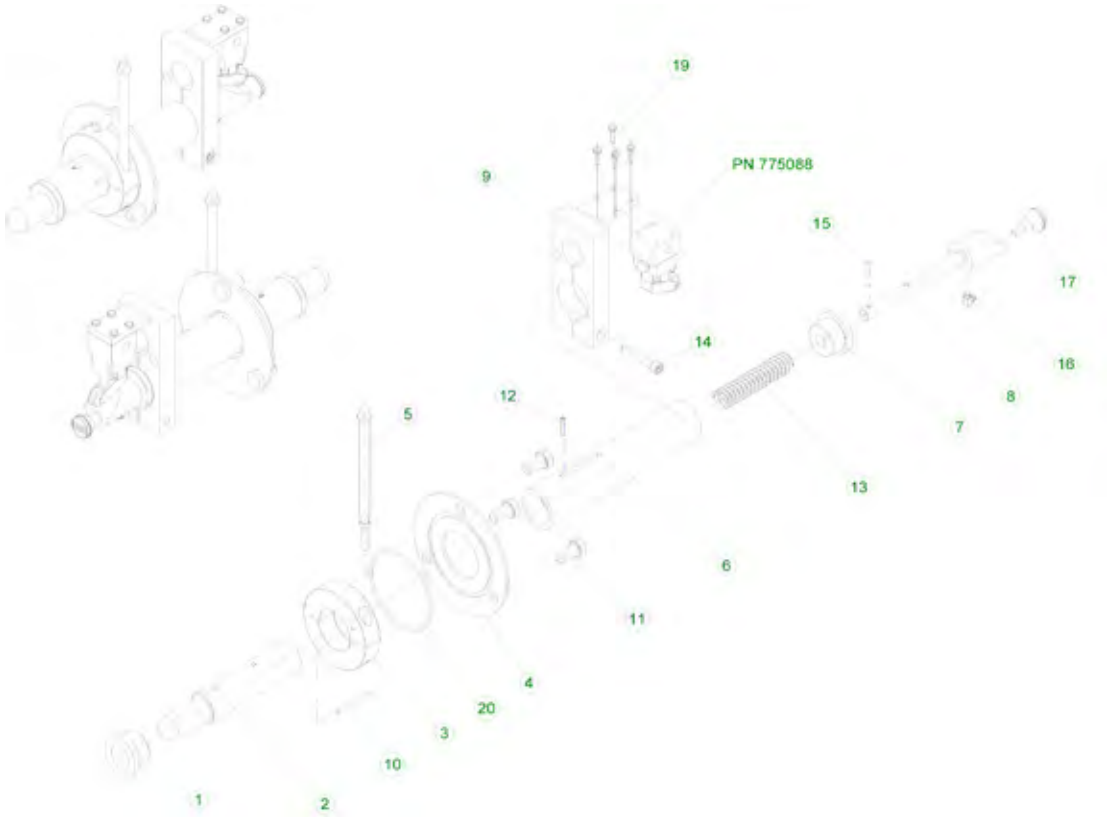


Fig. 107: 645640 Trigger Assembly

Part list 645640 Trigger Assembly

No.	Qty.	Part No.	Description
1	1	645043	Locking pin
2	1	645641	Pin
3	1	645048	Clamp
4	1	645056	Cover plate
5	1	645049	Clamp screw
6	1	645642	Tube
7	1	645643	End pin
8	1	645644	Pestle
9	1	645646-1	Console
10	1	645048-1	Pin
11	3	617519	Hexagon screw
12	1	645645	Pin with inner thread
13	1	645045	Pressure spring
14	1	645649	Screw
15	1	645648	Cylinder pin
16	1	645647	Grease nipple
17	1	645640-1	Handle
18	-	-	-
19	4	775092-1	Hexagon screw
20	1	645057	O-ring

5.3.7.11 Drawing 676040 Trigger Assembly VES-SD 750 / 1000

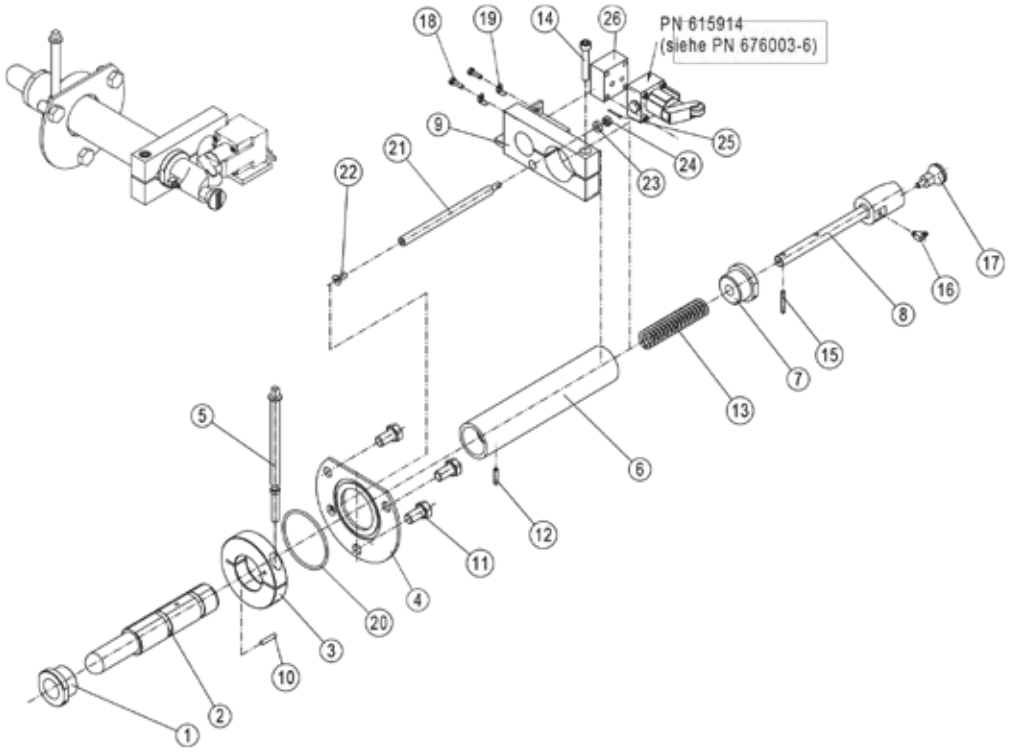


Fig. 108: 676040 Trigger Assembly

Part list 676040 Trigger Assembly

No.	Qty.	Part No.	Description
1	1	645043	Looking pin
2	1	645641	Bolt
3	1	675084	Clamp
4	1	675049	Cover plate
5	1	645049	Clamp screw
6	1	645642	Tube
7	1	645643	Plung
8	1	675061	Plunger
9	1	676646-1	Console
10	1	657049-1	Pin
11	3	617519	Screw
12	1	645645	Pin
13	1	645045	Spring
14	1	645649	Screw
15	1	645648	Pin
16	1	645647	Grease Fitting
17	1	645640-1	Handel
18	2	643779-1	Screw
19	2	645059	Safety sheet
20	1	645242	Sealing
21	1	645243	Bolt
22	1	645054	Screw
23	1	645244	Washer
24	1	613633	Nut
25	1	620609	Cotter pin
26	1	646088	Mounting plate

5.3.7.12 Drawing 645188-1 Door Sensor VES-SD 350 / VES-SD 500-1 /VES-SD 750 / 1000

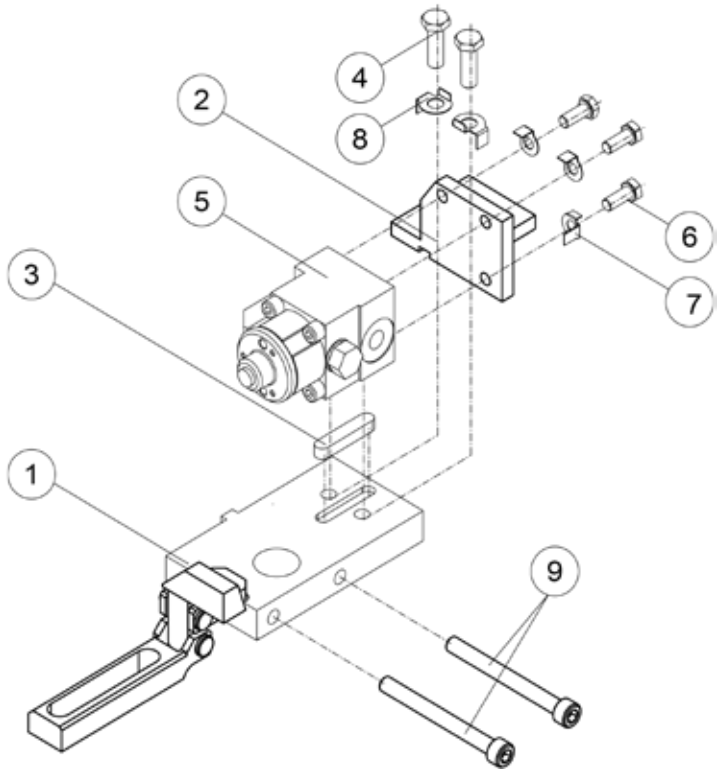


Fig. 109: 645188-1 Door Sensor

Part list 645188-1 Door Sensor

No.	Qty.	Part No.	Description
1	1	645189-1	Cylinder bearing plate for signal valve (For
2	1	645190	Plate for Sensor
3	1	645194	Fitting Key
4	2	645195	Hexagon Screw
5	1	643779	$^{2}/_{2}$ Way Valve
6	3	643779-1	Hexagon Screw
7	3	613722	Washer with 2 taps
8	1	735854	Washer
9	1	612693	Screw

5.3.7.13 Drawing 646288-1 Door Sensor VES-SD 500-2

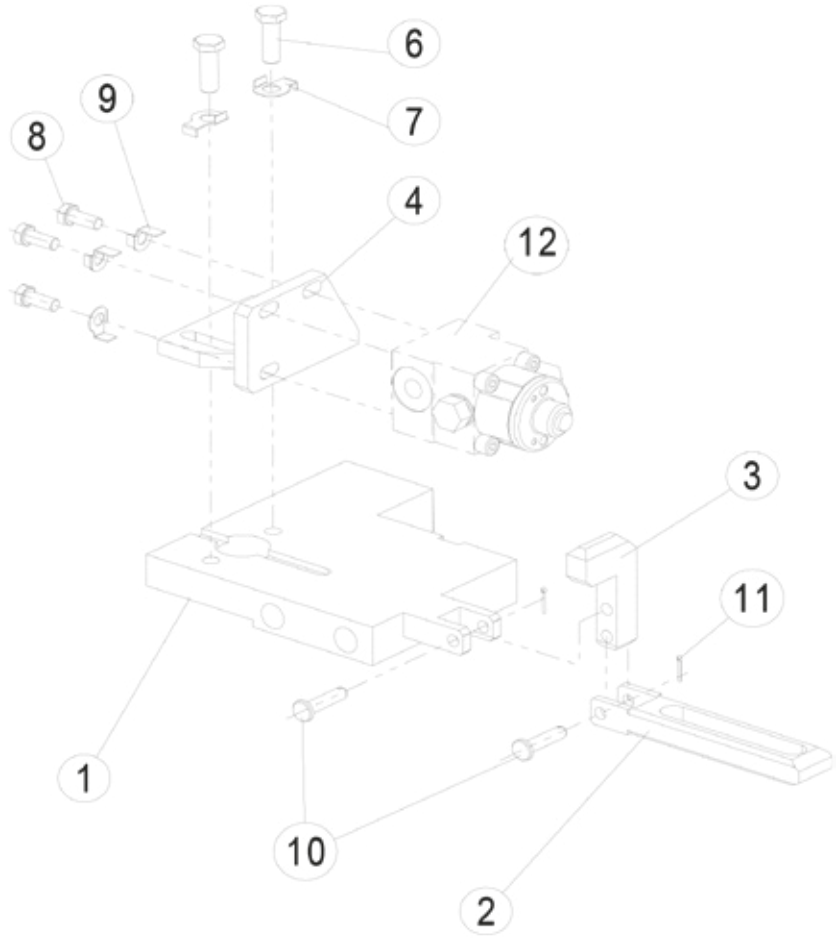


Fig. 110: 646288-1Door Sensor

Part list 646288-1Door Sensor

No.	Qty.	Part No.	Description
1	1	645289	Lateral guide plate 1
2	1	645293	Lever
3	1	645699-2	Rocker lever, right
4	1	646290	Holder for sensor
5	-	-	-
6	2	645195	Hexagon screw
7	2	735854	Washer
8	3	643779-1	Hexagon screw
9	3	645722	Washer
10	2	645618	Set bolt
11	2	645191-4	Cotter pin
12	1	643779	$^{2}/_{2}$ Way Valve

5.3.7.14 Drawing 645688–1 Door sensor, left VES-SD 500-3

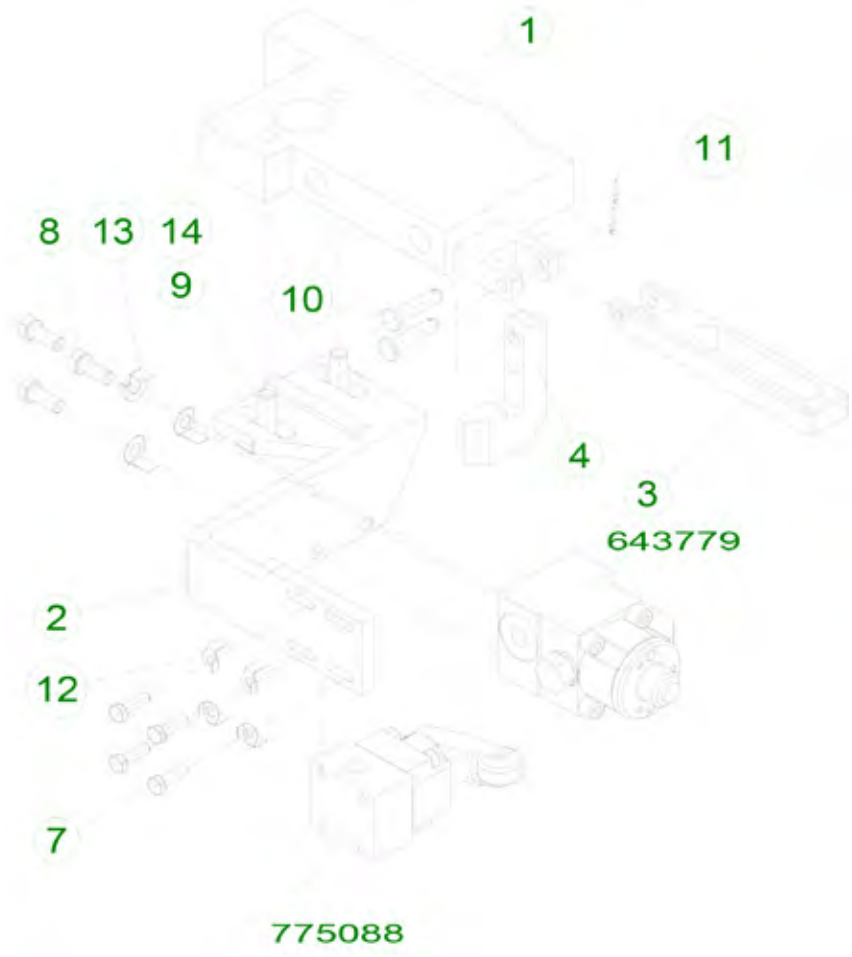


Fig. 111: 645688–1 Door sensor, left

Part list 645688–1 Door sensor, left

No.	Qty.	Part No.	Description
1	1	645689	Plate
2	1	645690-1	Holding angle for sensor
3	1	645698	Lever
4	1	645699-1	Tilting lever, left
5	-	-	-
6	-	-	-
7	4	775092-1	Hexagon screw
8	3	643779-1	Hexagon screw
9	2	645195	Hexagon screw
10	2	645618	Bolt
11	2	645191-4	Cotter pin
12	4	613783	Washer
13	3	613722	Washer
14	2	735854	Washer

5.3.7.15 Drawing 645688–2 Door sensor, right VES-SD 500-3

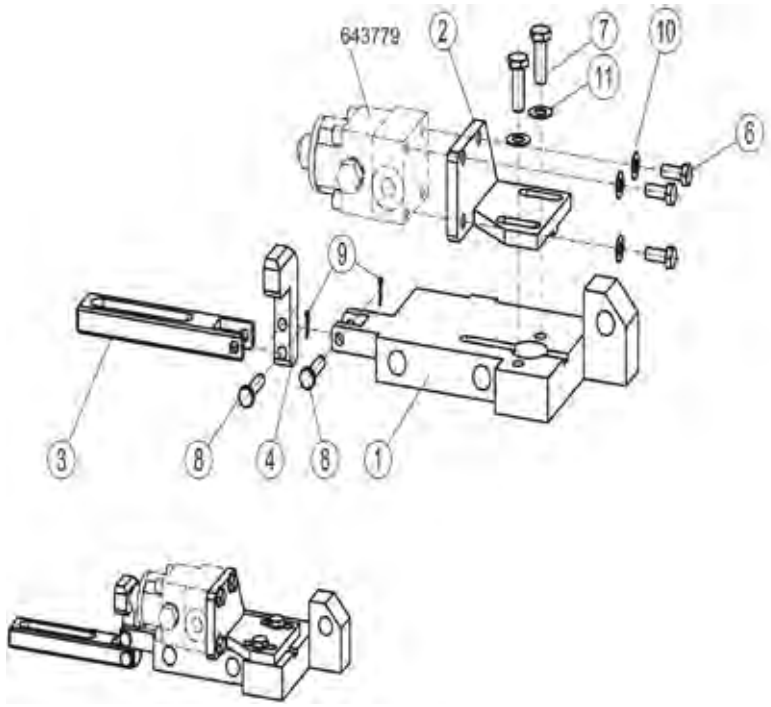


Fig. 112: 645688–2 Door sensor, right

Part list 645688–2 Door sensor, right

No.	Qty.	Part No.	Description
1	1	645689	Lateral Guide Plate
2	1	645690	Holder for Sensor
3	1	645698	Lever
4	1	645699-2	Rocker Lever Right
6	3	643779-1	Screw
7	2	645195	Screw
8	2	645618	Clevis pin with head
9	2	645191-4	Split Pin
10	3	792112	Washer
11	2	792103-1	Washer

5.3.7.16645298 Drawing Door Opening Assembly VES-SD 350 / VES-SD 500-1

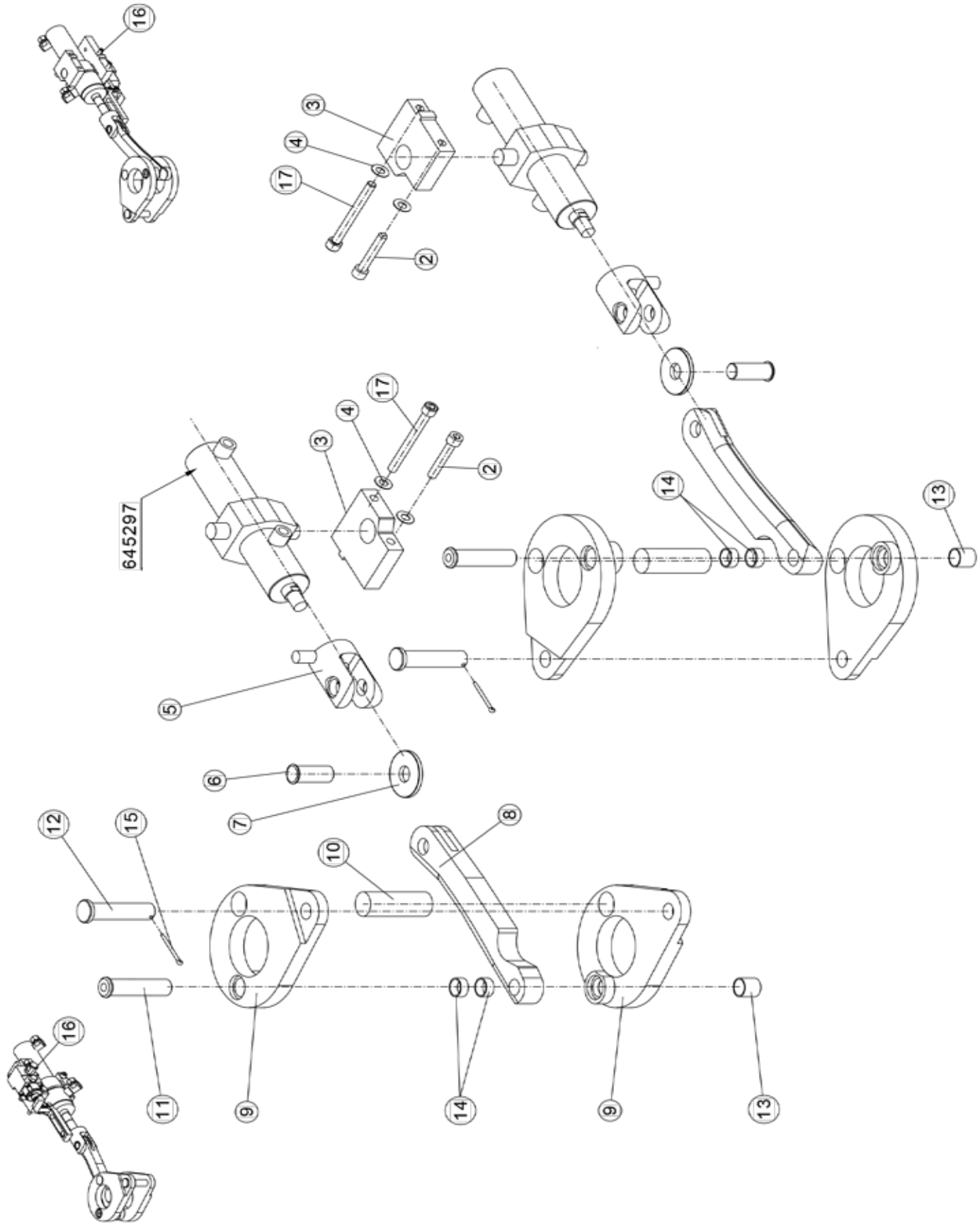


Fig. 113: 645298 Door Opening Assembly

Part list 645298 Door Opening Assembly

No.	Qty.	Part No.	Description
1	2	645297	Hydraulic Cylinder
2	2	612592-1	Screw
3	2	645070-1	Cylinder bearing plate
4	4	735854	Washer
5	2	645062-1	Yoke for Cylinder
6	2	645066	Bolt for Cylinder
7	2	645064	Roller
8	2	645153	Crank Lever
9	4	645150	Excentric plate
10	2	645068	Distance Pin
11	2	645067	Bolt
12	2	645299	Bolt
13	2	643914	Bushing
14	4	612594	Bushing
15	2	752339	Cotter Pin
16	2	645188-1	Door Sensor
19	2	645674	Screw

5.3.7.17 Drawing 646260-1 Door opening assembly left VES-SD 500-2

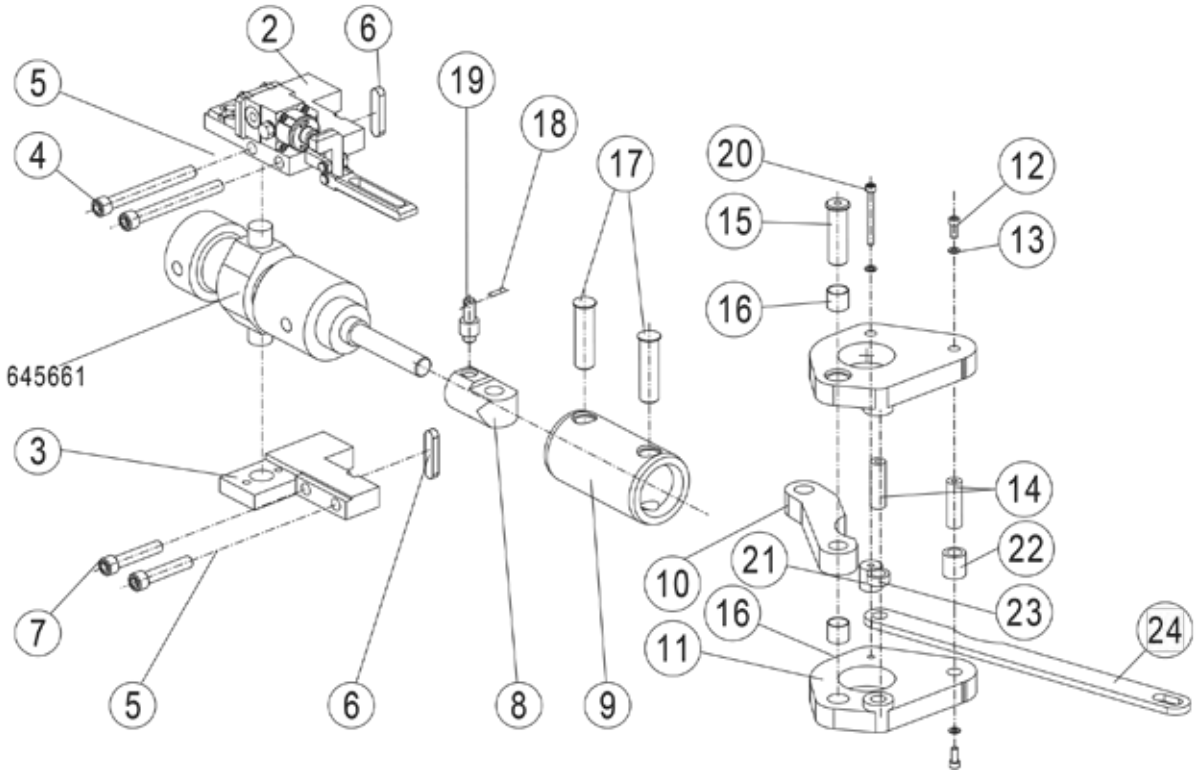


Fig. 114: 646260-1 Door opening assembly left

Part list 646260-1 Door opening assembly left

No.	Qty.	Part No.	Description
1	-	-	-
2	1	646288-1	Door sensor, 1
3	1	646292	Plain
4	2	755156	Screw
5	-	-	-
6	2	621439	Parallel Key
7	2	755826	Screw
8	1	645664	Clevis
9	1	645266	Piston
10	1	645268	Conrod
11	1	645270	Eccenter
12	2	755085-1	Screw
13	3	645685	Retaining ring
14	2	645069	Axle for lever
15	1	645669	Conrod bolt
16	2	645635	Sleeve bearing
17	2	645667	Piston bolt
18	1	645666-1	Cotter pin
19	1	645294	Bolt
20	1	645670-6	Screw
21	1	645670-3	Bushing
22	1	645670-4	Bushing
23	1	645670-5	Bushing
24	1	645226	Plate

5.3.7.18 Drawing 646260-2 Door opening assembly right VES-SD 500-2

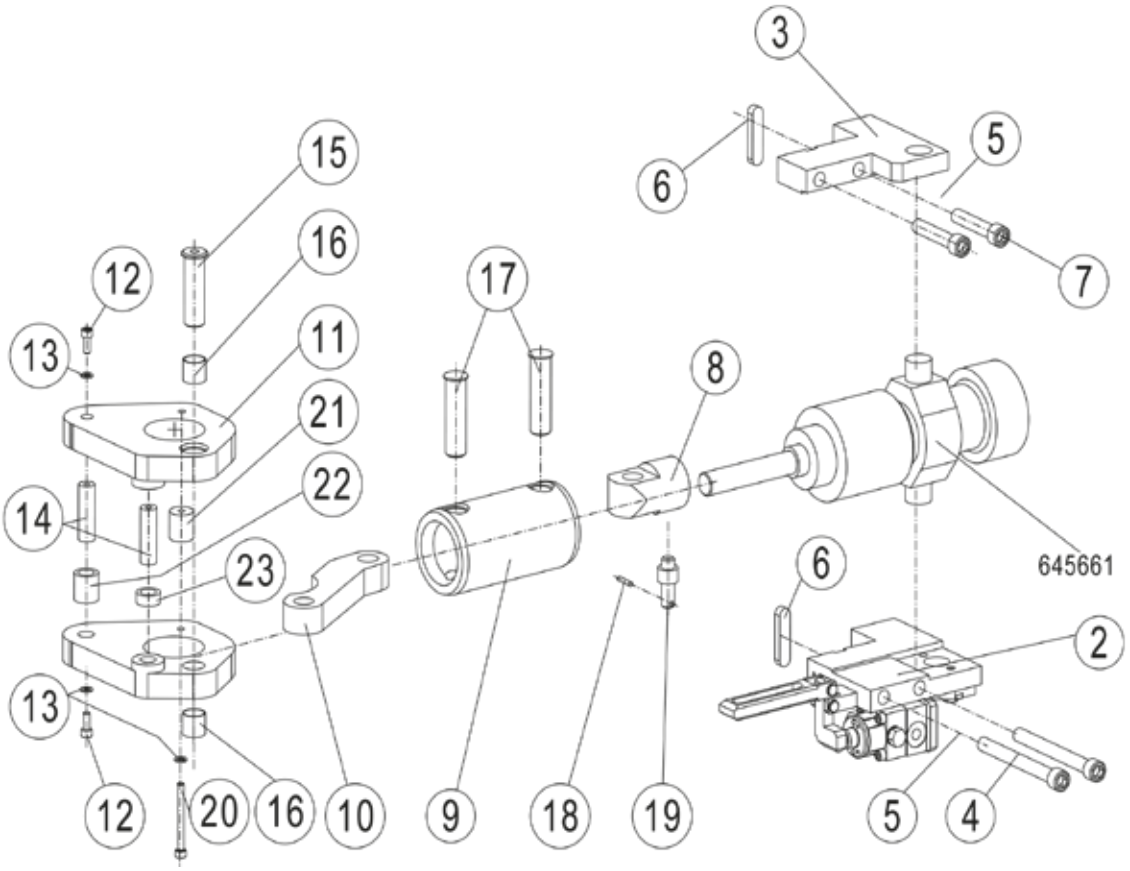


Fig. 115: 646260-2 Door opening assembly right

Part list 646260-2 Door opening assembly right

No.	Qty.	Part No.	Description
1	-	-	-
2	1	646288-1	Door sensor, 1
3	1	646291	Bearing support
4	2	755156	Screw
5	-	-	-
6	2	621439	Parallel Key
7	2	755826	Screw
8	1	645664	Clevis
9	1	645266	Piston
10	1	645268	Conrod
11	1	645270	Eccenter
12	2	755085-1	Cylinder head screw
13	2	645685	Retaining ring
14	2	645069	Axle for lever
15	1	645669	Conrod bolt
16	2	645635	Sleeve bearing
17	2	645667	Piston bolt
18	1	645666-1	Cotter pin
19	1	645294	Bolt
20	1	645670-6	Screw
21	1	645670-3	Bushing
22	1	645670-4	Bushing
23	1	645670-5	Bushing

5.3.7.19 Drawing 645660–1 Door opening assembly left VES-SD 500-3

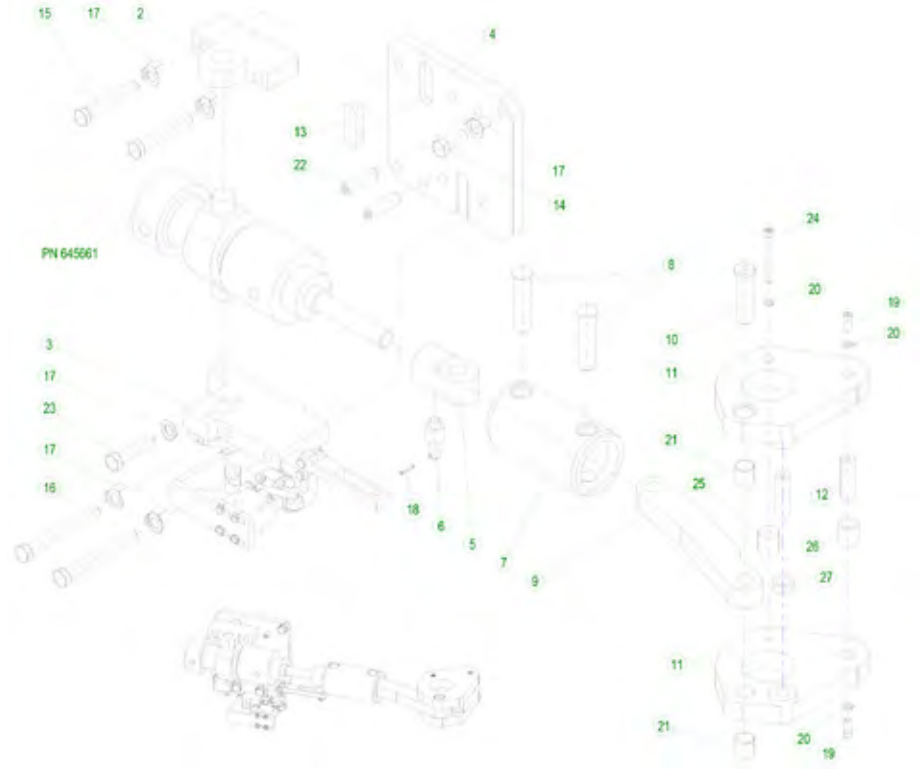


Fig. 116: 645660–1 Door opening assembly left

Part list 645660–1 Door opening assembly left

No.	Qty.	Part No.	Description
2	1	645662	Cylinder support
3	1	645688-1	Door sensor, left
4	1	645663	Cylinder base plate
5	1	645664	Swing eye
6	1	645687	Pin
7	1	645266	Piston
8	2	645667	Gudgeon pin
9	1	645668	Crank lever
10	1	645669	Crank lever pin
11	1	645670	Eccenter
12	2	645069	Pin
13	1	645678	Parallel key
14	1	645673	Hexagon screw
15	2	645680	Hexagon screw
16	2	645681	Hexagon screw
17	6	617520	Washer
18	1	645666-1	Pin
19	2	755085-1	Cylinder screw
20	3	645685	Spring ring
21	2	645635	Permaglide bushing
22	2	645608-1	Pin
23	1	645682	Hexagon screw
24	1	645670-6	Screw
25	1	645670-3	Bushing
26	1	645670-4	Bushing
27	1	645670-5	Bushing

5.3.7.20 Drawing 645660–2 Door opening assembly right VES-SD 500-3

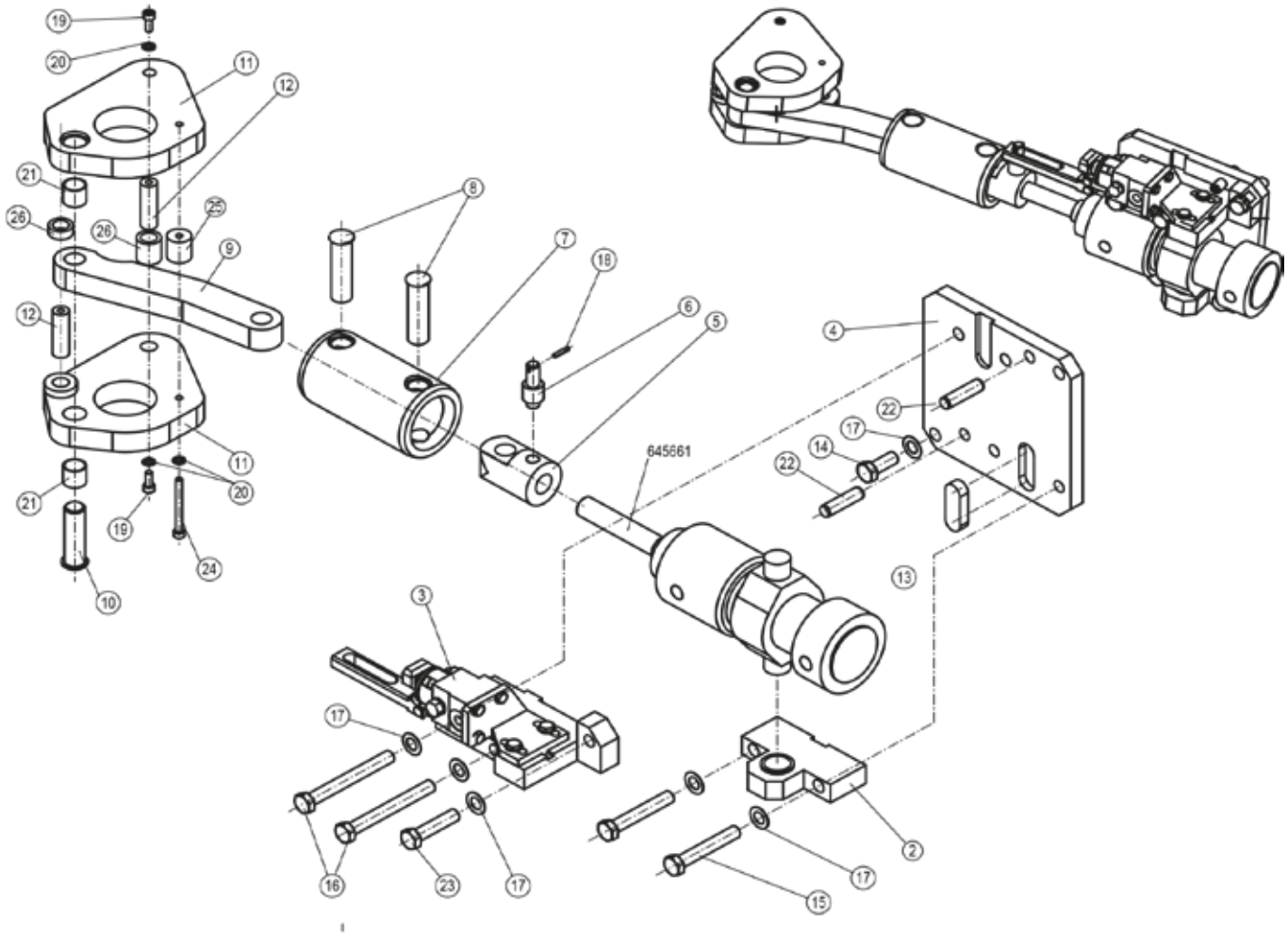


Fig. 117: 645660–2 Door opening assembly right

Part list 645660–2 Door opening assembly right

No.	Qty.	Part No.	Description
2	1	645662	Cylinder support
3	1	645688-2	Door sensor, right
4	1	645663	Cylinder base plate
5	1	645664	Swing eye
6	1	645687	Bolt
7	1	645266	Piston
8	2	645667	Gudgeon pin
9	1	645668	Crank lever
10	1	645669	Crank lever pin
11	1	645670	Eccenter
12	2	645069	Pin
13	1	645678	Parallel key
14	1	645673	Hexagon screw
15	2	645680	Hexagon screw
16	2	645681	Hexagon screw
17	6	792106	Washer
18	1	645666-1	Pin
19	2	755085-1	Cylinder screw
20	3	645685	Spring ring
21	2	645635	Permaglide bushing
22	2	645608-1	Pin
23	1	645682	Hexagon screw
24	1	645670-6	Screw
25	1	645670-3	Bushing
26	1	645670-4	Bushing
27	1	645670-5	Bushing

5.3.7.21 Drawing 676060 Door Opening Assembly VES-SD 750 / 1000

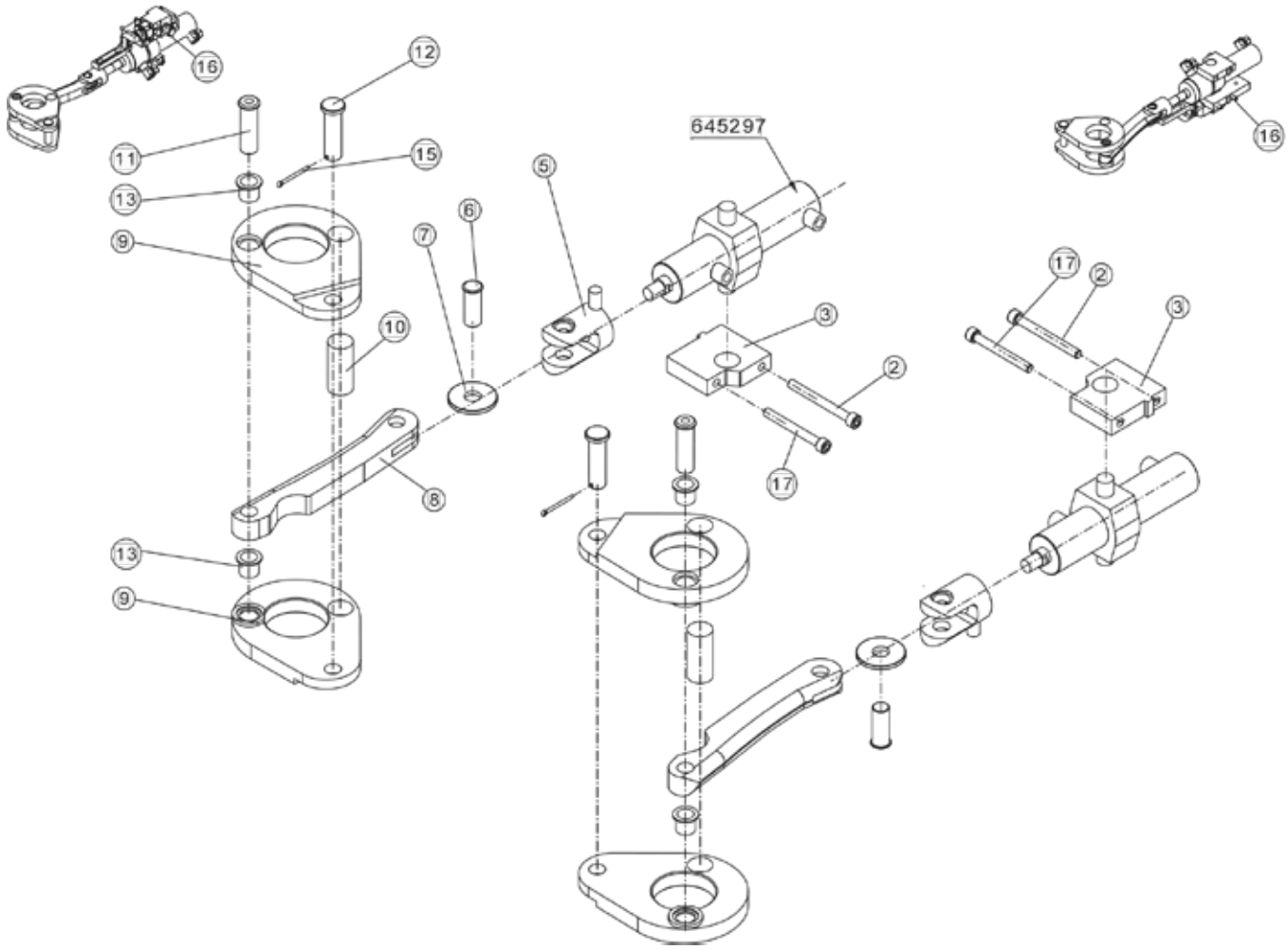


Fig. 118: 676060 Door Opening Assembly

Part list 676060 Door Opening Assembly

No.	Qty.	Part No.	Description
1	2	645297	Hydraulic Cylinder
2	2	612592-1	Screw
3	2	645070-1	Cylinder bearing plate
4	-	-	-
5	2	645062-1	Yoke for Cylinder
6	2	645066	Bolt for Cylinder
7	2	645064	Roller
8	2	645153	Crank Lever
9	4	676065	Excentric plate
10	2	676068	Distance Pin
11	2	676067	Bolt
12	2	676299	Bolt
13	4	612599	Bushing
14	-	-	-
15	2	70653	Cotter Pin
16	2	645188-1	Door Sensor
17	2	645674	Screw

5.3.7.22 Drawing 645305 Door Assembly Left VES-SD 350 / VES-SD 500-1

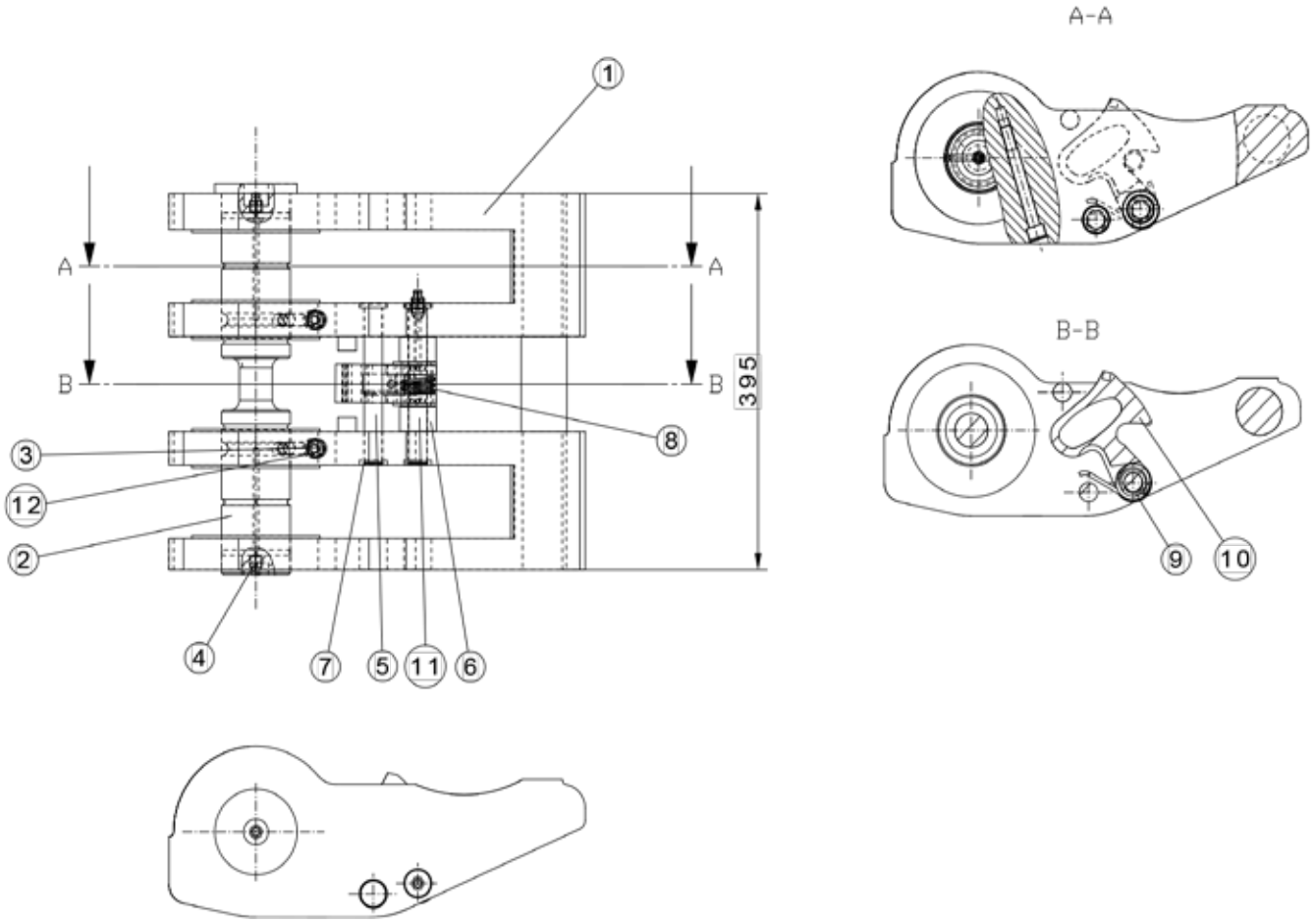


Fig. 119: 645305 Door Assembly Left

Part list 645305 Door Assembly Left

No.	Qty.	Part No.	Description
1	1	645016	Door Body Left Side
2	1	645119	Door Pin
3	2	645027	Screw
4	3	612515	Grease Nipple
5	1	645022	Hinge Pin for Hook
6	2	645025	Distance Bushing
7	2	645026	Securing Ring
8	1	645024	Spring
9	1	645023	Bushing for Spring
10	1	645021	Securing Hook
11	1	645022-1	Hinge Pin for Latch-Lock
12	2	620608	Securing ring

5.3.7.23 Drawing 635306 Door Assembly Right VES-SD 350 / VES-SD 500-1

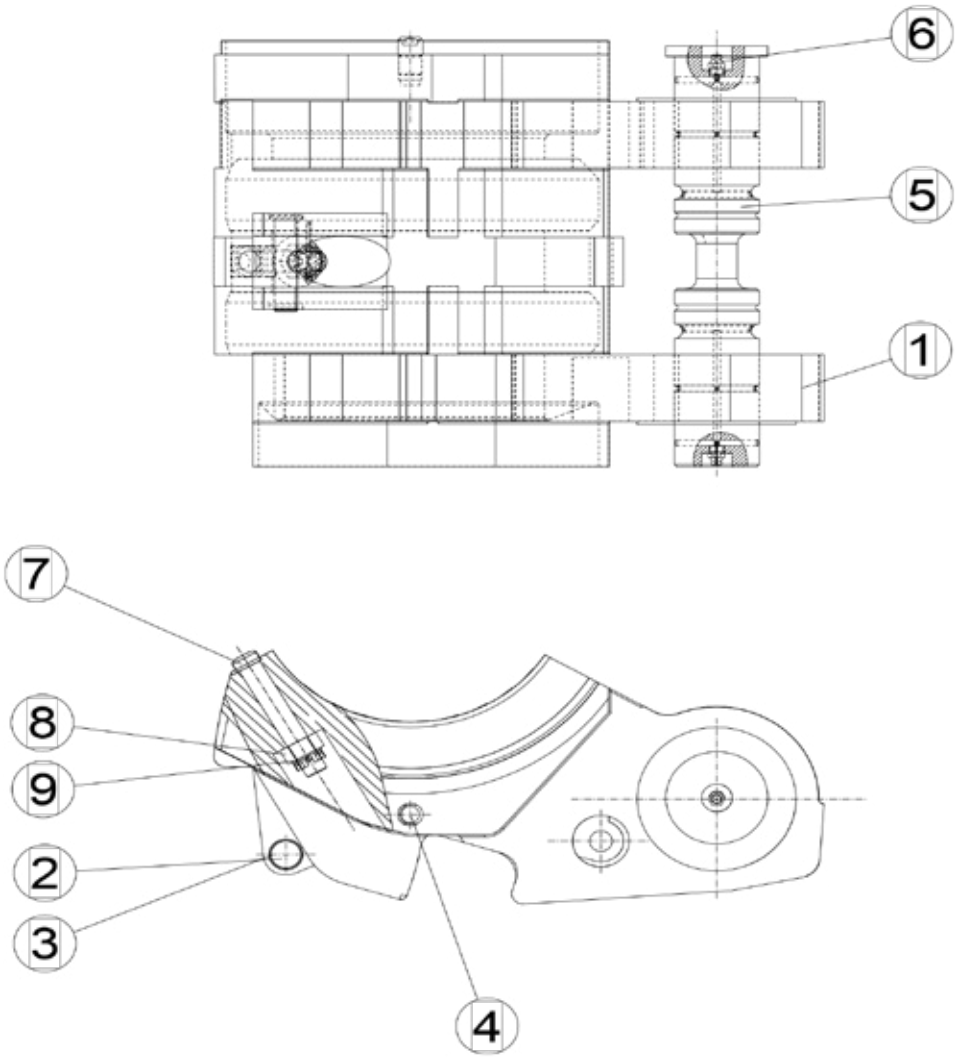


Fig. 120: 635306 Door Assembly Right

Part list 635306 Door Assembly Right

No.	Qty.	Part No.	Description
1	1	635012	Door Body Right Side
2	1	645013	Locking Pin for Hook
3	1	620608	Securing Ring
4	2	645039	Bolt for Door Retainer Plate
5	1	645119	Door Pin
6	2	612515	Grease Nipple
7	1	645014	Bolt
8	1	613623	Nut
9	1	755334	Cotter Pin

5.3.7.24 Drawing 676011 Door Assembly Right VES-SD 500-2

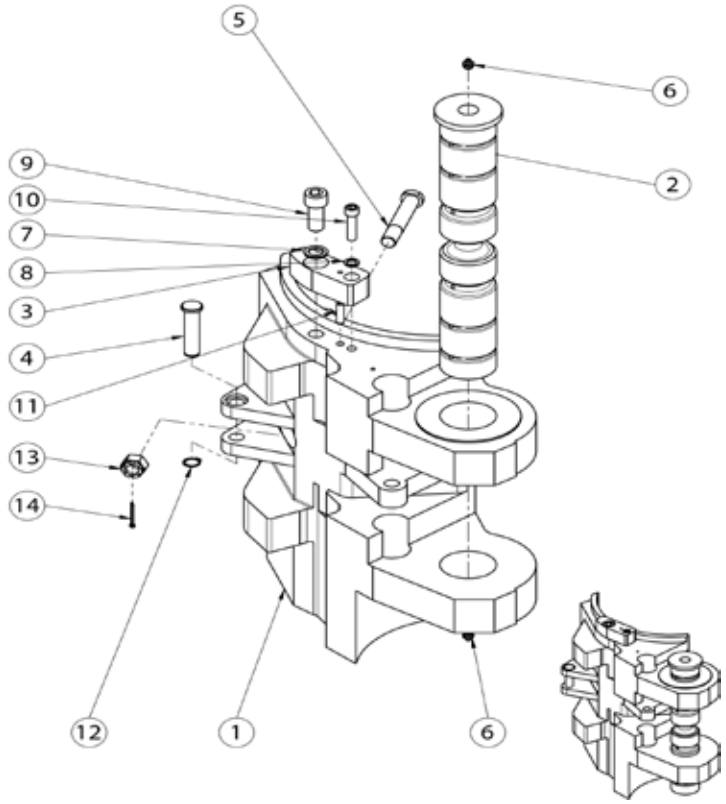


Fig. 121: 676011 Door Assembly Right

Part list 676011 Door Assembly Right

No.	Qty.	Part No.	Description
1	1	-	Right Door
2	1	-	VES-SD 750 Door
3	1	676010	Door Pin; for VES-SD-750
4	1	675037	distortion lock SD750
5	1	645013	Bolt for hook
6	1	675020	Bolt;for Door Assembly VES-SD-750
7	2	612515	Lubricating nipple
8	1	792108	Washer
9	1	792104	Washer
10	1	792168	Screw
11	1	671056	Screw
12	1	621109	Spring-type straight pin
13	1	613720	Retaining ring
14	1	752338	Castle Nut
15	1	725274	Split Pin

5.3.7.25 Drawing 645215 Door assembly, left VES-SD 500-2

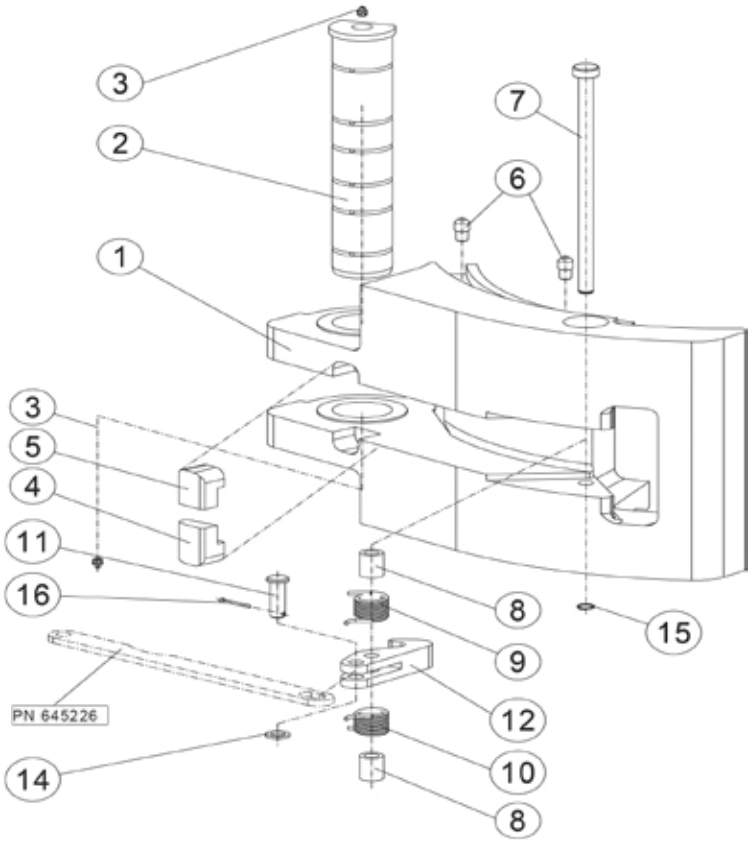


Fig. 122: 645215 Door assembly, left

Part list 645215 Door assembly, left

No.	Qty.	Part No.	Description
1	1	645216	Left door
2	1	645217	Door pin
3	2	612515	Grease nipple
4	1	645219-1	Cam
5	1	645219-2	Cam
6	2	645038	Bolt
7	1	645621	Hinge pin for hook
8	2	645622	Bushing for spring
9	1	645623-1	Spring
10	1	645623-2	Spring
11	1	645624	Bolt
12	1	645625	Securing hook
13	-	-	-
14	1	645679	Washer
15	1	613720	Retaining ring
16	1	752322	Cotter pin

5.3.7.26 Drawing 645211 Door Assembly Right VES-SD 500-2

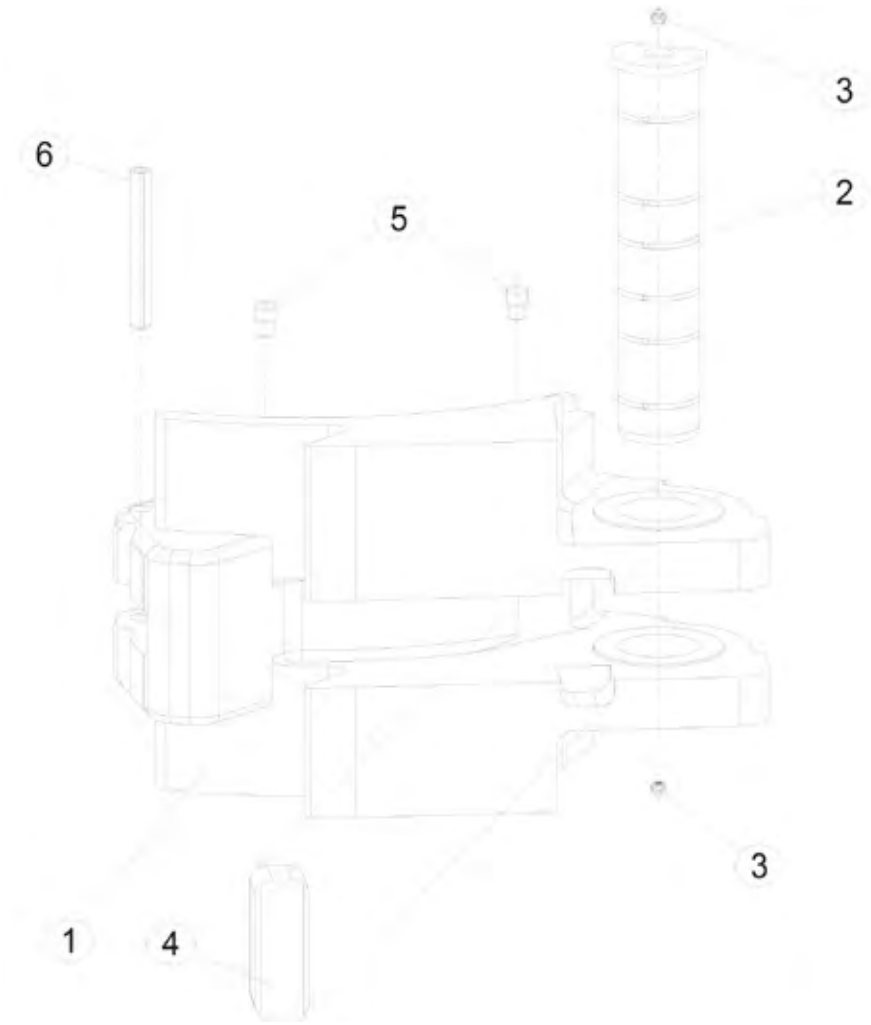


Fig. 123: 645211 Door Assembly Right

Part list 645211 Door Assembly Right

No.	Qty.	Part No.	Description
1	1	645212	Right door
2	1	645217	Door pin
3	2	612515	Grease nipple
4	1	645213	Cam
5	2	645038	Bolt
6	1	645269	Cotter pin

5.3.7.27 Drawing 645615 Door assembly, left VES-SD 500-3

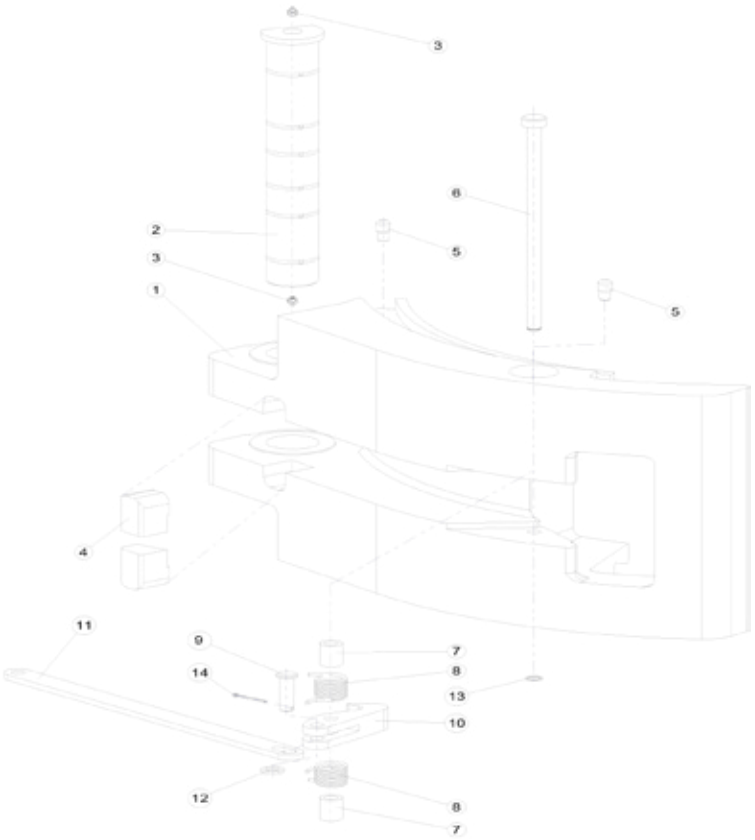


Fig. 124: 645615 Door assembly, left

Part list 645615 Door assembly, left

No.	Qty.	Part No.	Description
1	1	645616	Left door
2	1	645617	Door pin
3	2	612515	Grease nipple
4	2	645619	Cam
5	2	645038	Bolt
6	1	645621	Hinge pin
7	2	645622	Bushing
8	2	645623	Spring
9	1	645624	Bolt
10	1	645625	Securing hook
11	1	645626	Plate
12	1	645679	Washer
13	1	613720	Safety ring
14	1	752322	Cotter pin

5.3.7.28 Drawing 645611 Door Assembly Right VES-SD 500-3

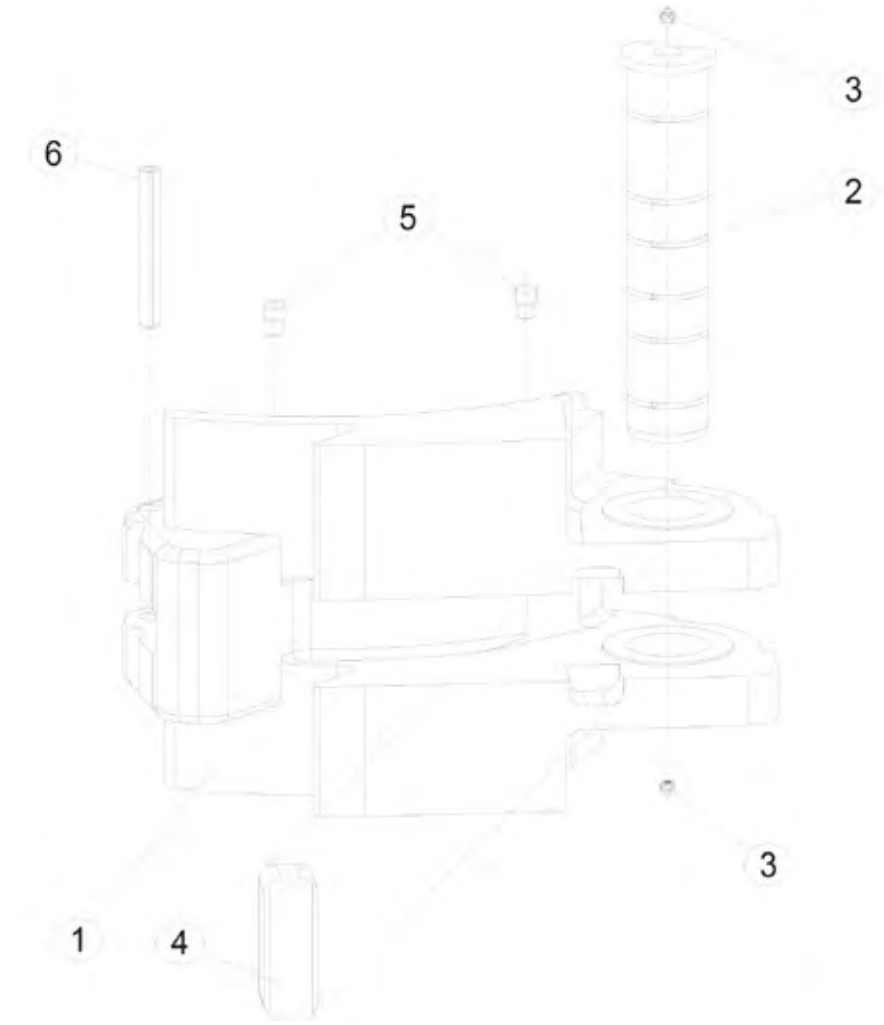


Fig. 125: 645611 Door Assembly Right

Part list 645611 Door Assembly Right

No.	Qty.	Part No.	Description
1	1	645212	Right door
2	1	645217	Door pin
3	2	612515	Grease nipple
4	1	645213	Cam
5	2	645038	Bolt
6	1	645269	Cotter pin

5.3.7.29 Drawing 676015 Door Assembly Left VES-SD 750 / 1000

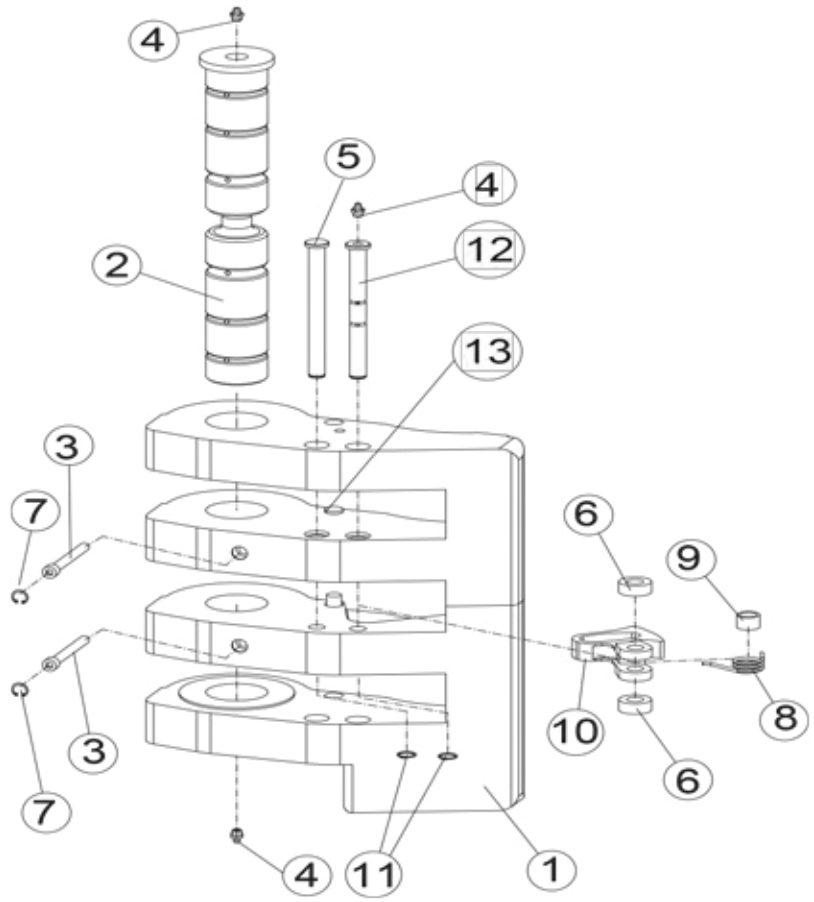


Fig. 126: 676015 Door Assembly Leftt

Part list 6676015 Door Assembly Left

No.	Qty.	Part No.	Description
1	1	675016	Door left
2	1	676010	Door pin
3	2	645027	Screw
4	3	612515	Grease nipple
5	1	675022	Hinge pin for hook
6	2	675025	Distance bushing for hook
7	2	645026	Securing ring
8	1	645024	Spring for hook
9	1	645023	Bushing for spring
10	1	645021	Securing hook
11	2	613720	Securing ring
12	1	676022	Bolt
13	1	675016-1	Bolt

5.3.7.30 Drawing 6645079-1 Rear Door and Cover Assembly VES- SD350 / VES-SD 500-1

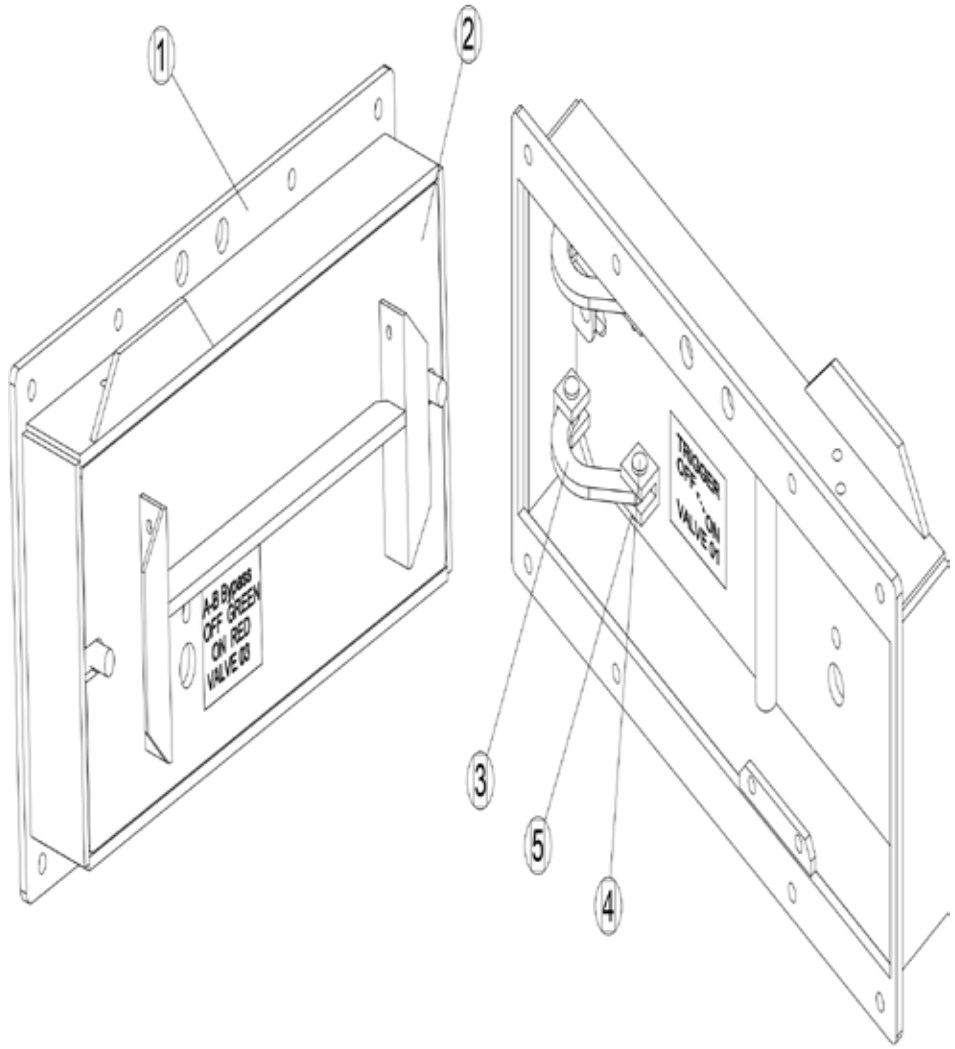


Fig. 127: 645079-1 Rear Door and Cover Assembly

Part list 645079-1 Rear Door and Cover Assembly

No.	Qty.	Part No.	Description
1	1	645079-12	Basis rear cover welding plan
2	1	645079-2	Rear door
3	2	645079-22	Hinge link no.2
4	4	645079-24	Bolt
5	4	645196	Cotter pin

5.3.7.31 Drawing 646220 Rear Door and Cover Assembly VES-SD 500-2

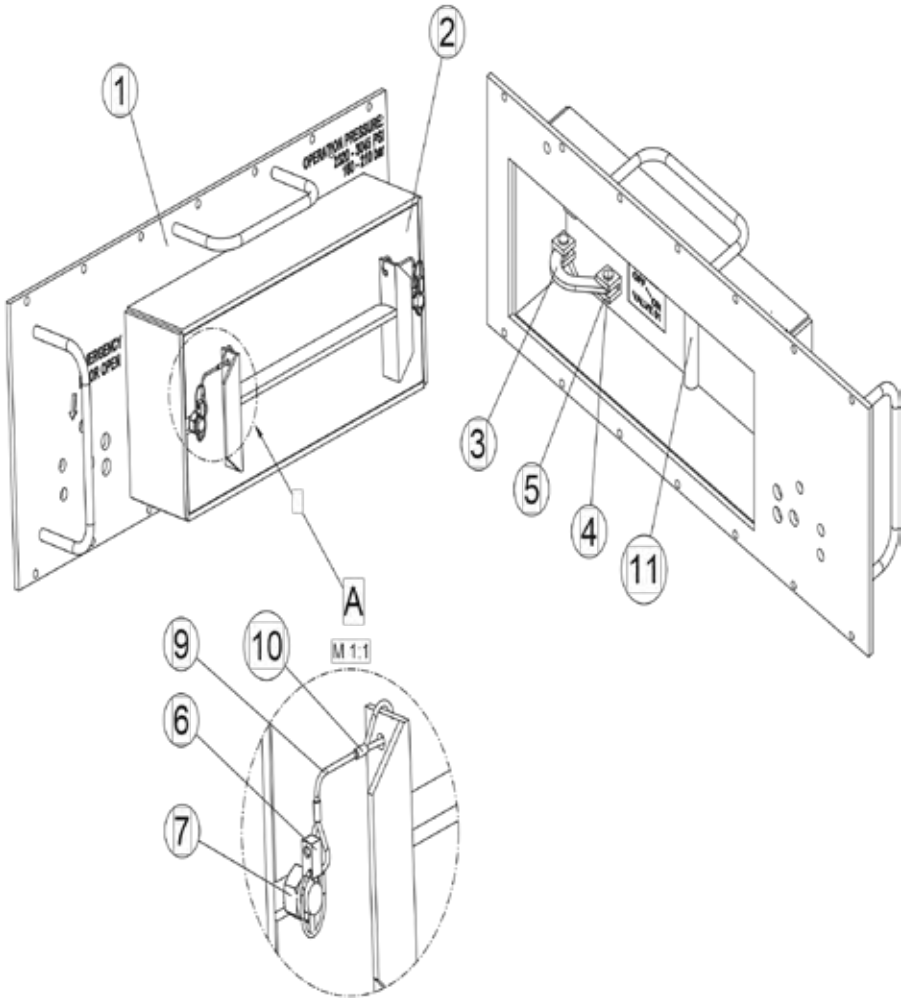


Fig. 128: 646220 Rear Door and Cover Assembly

Part list 646220 Rear Door and Cover Assembly

No.	Qty.	Part No.	Description
1	1	646220-1	Basis rear cover welding plan
2	1	646220-3	Rear door
3	2	645079-22	Hinge link 2
4	4	645079-24	Bolt
5	4	645196	Cotter pin
6	2	645035	Link Pin
7	2	755137	Nut
8	-	-	-
9	2	643801	Rope ø3mm
10	4	643801-1	Rope clamp ø3mm
11	1	775813	Square Box Wrench, SW 9

5.3.7.32 Drawing 645609 Hydraulic Cover Assembly VES-SD 500-3

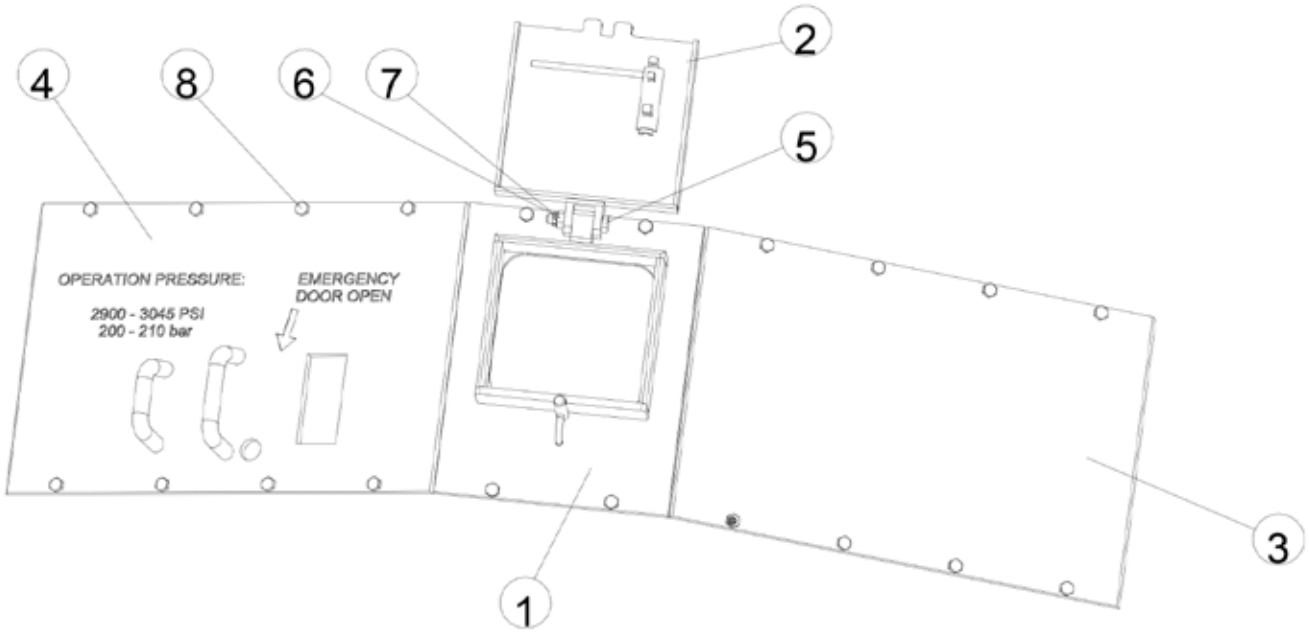


Fig. 129: 645609 Hydraulic Cover Assembly

Part list 645609 Hydraulic Cover Assembly

No.	Qty.	Part No.	Description
1	1	645609-1	Cover plate
2	1	645609-3	Lid
3	1	645609-2	Side plate 1
4	1	645609-5	Side plate 2
5	1	645029	Hexagon screw
6	1	613728	Nut
7	1	80340-1	Cotter pin
8	20	725461	Hexagon screw

5.3.7.33 Drawing 676005 Rear Door and Cover Assembly VES-SD 750 / 1000

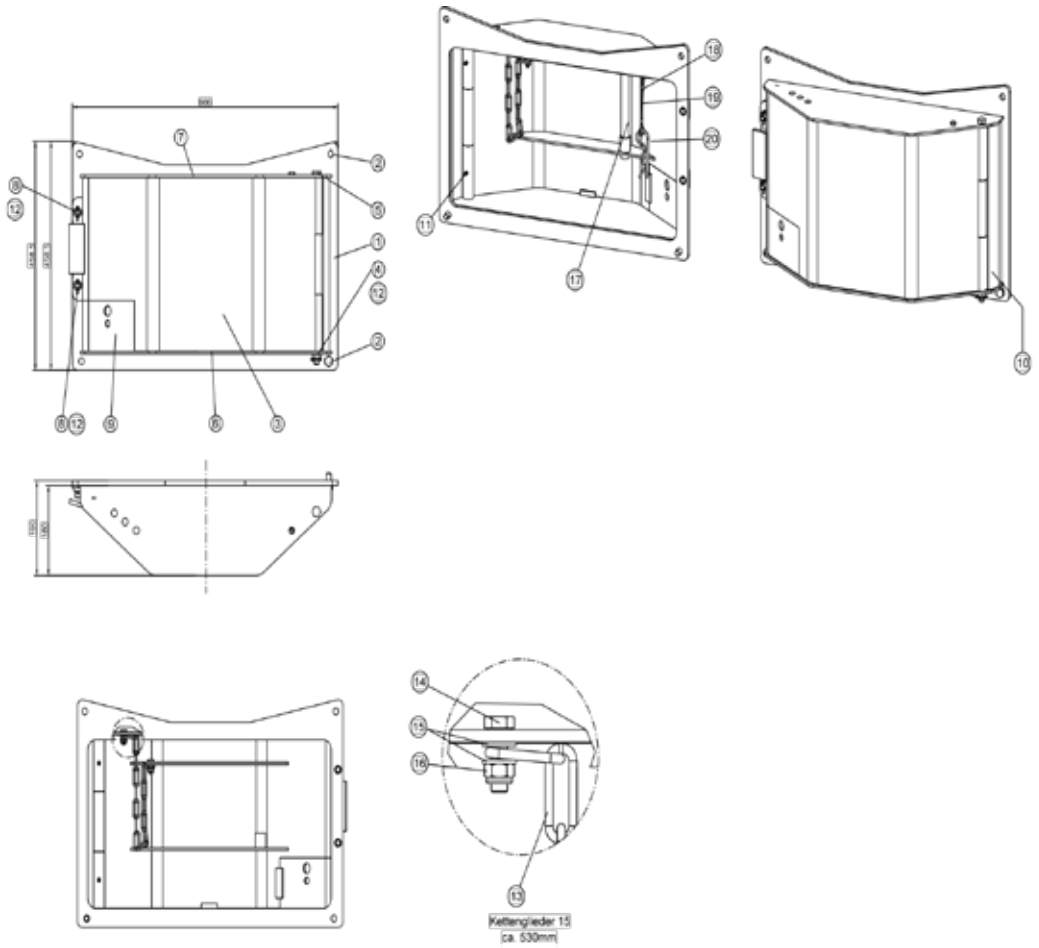


Fig. 130: 676005 Rear Door and Cover Assembly

Part list 676005 Rear Door and Cover Assembly

No.	Qty.	Part No.	Description
1	1	676009	back plate
2	4	645009-15	Screw
3	1	676006	rear door
4	1	613728	castle nut
5	1	676008	screw
6	1	676013	rear lower plate
7	1	676012	rear upper plate
8	2	612690	nuts
9	1	676016	rear low side plate
10	1	676007	rear side plate
11	2	756790	Grease Fitting
12	4	80340-1	Cotter Pin
13	1	752306	5-Link Chain 530mm
14	2	752123	Screw
15	4	645683	Washer
16	2	675057	Nut
17	1	775813	Square Box Wrech,SW9
18	2	643801-1	Rope clamp ø3mm
19	1	643801	Rope ø3mm
20	1	99638	Spring Cotter

5.3.7.34 Drawing 645185-2 Link block assembly

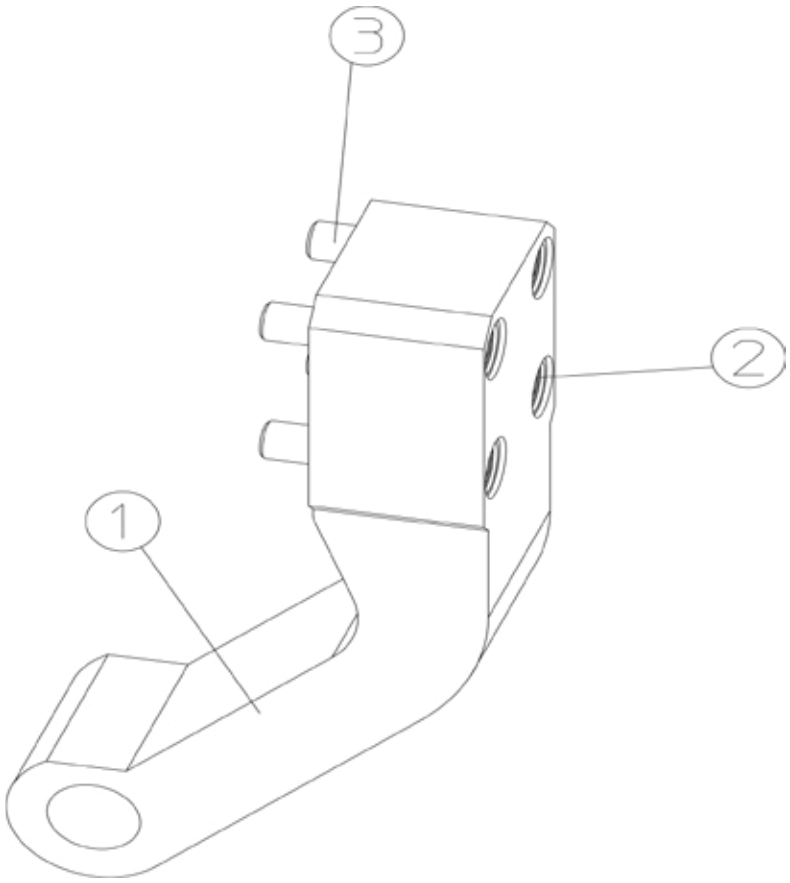


Fig. 131: 645185-2 Link block assemblyt

Part list 635306 Door Assembly Right

No.	Qty.	Part No.	Description
1	1	-	Plate
2	4	645185-3	Securing ring
3	4	725466	Screw

5.3.7.35 Drawing 645691 Link block assembly

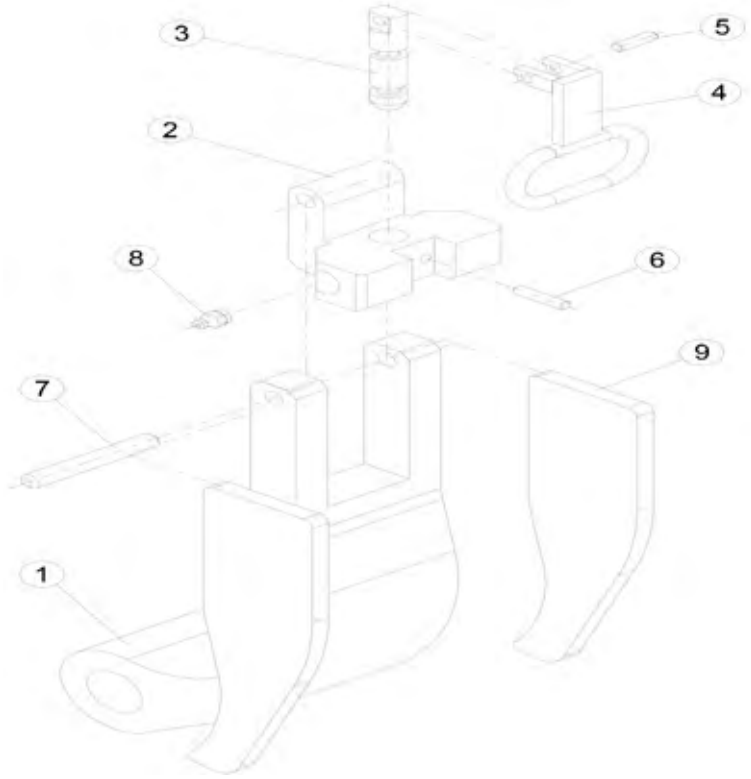


Fig. 132: 645691 Link block assembly

Part list 645691 Link block assembly

No.	Qty.	Part No.	Description
1	1	645692	Clamp
2	1	645693	Square
3	1	645695	Bolt
4	1	645694	Handle
5	1	645686	Pin
6	1	621438	Safety pin
7	1	645638	Pin
8	1	70064	Grease nipple
9	2	645692-1	Shroud

5.3.7.36 Drawing 676017 Link Retainer VES-SD 750 / 1000

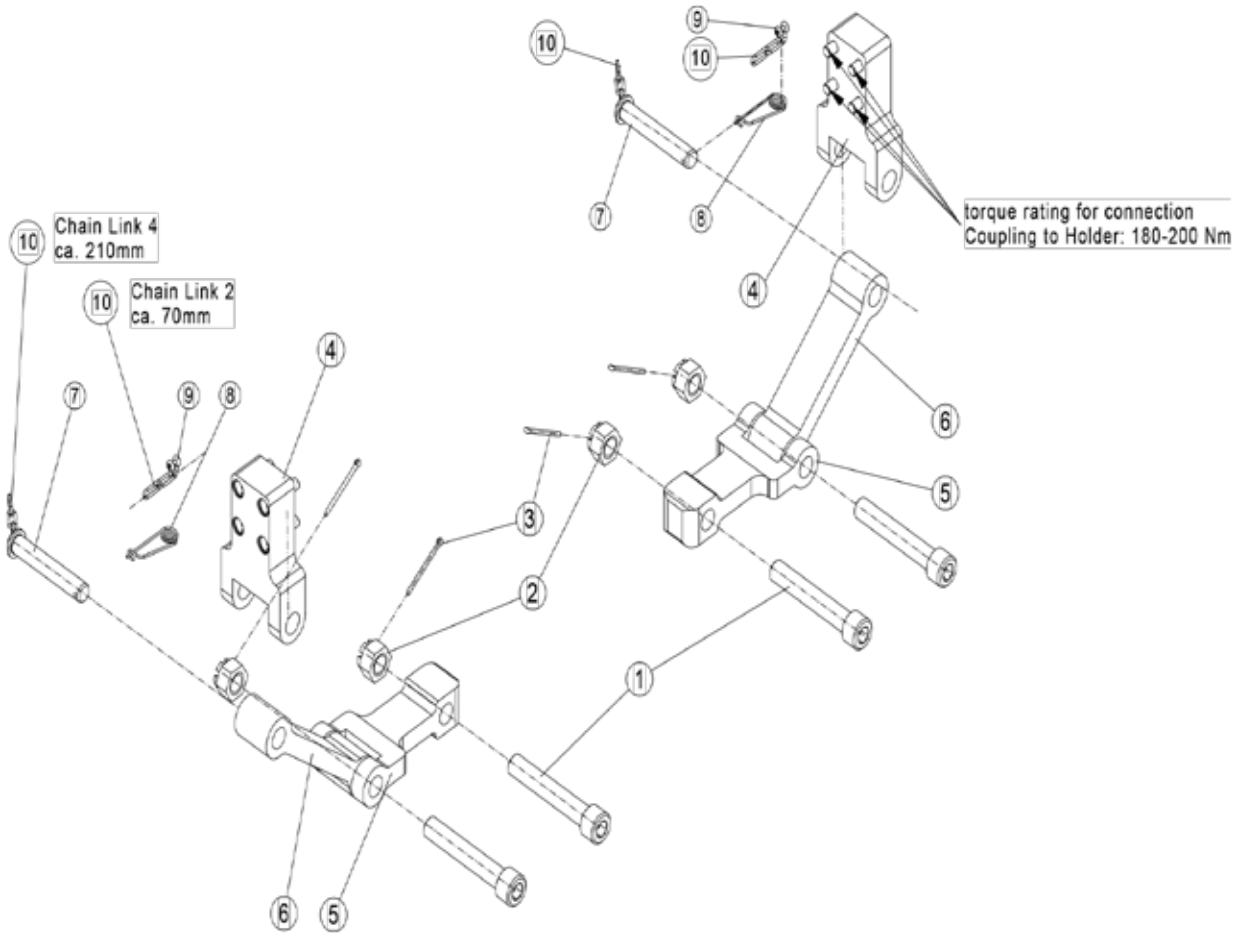


Fig. 133: 676017 Link Retainer 750-1000t

Part list 676017 Link Retainer 750-1000

No.	Qty.	Part No.	Description
1	4	645018	Screw
2	4	645019	Castle Nut
3	4	735404	Cotter Pin
4	2	645861	Link Retainer 750-1000
5	2	645822	Link Retainer Frame 1+2
6	2	645832	Link Retainer 750-1000
7	2	645809	Bolt
8	2	675159	Spring Cotter Pin
9	2	645037-2	Shackle
10	1	752306	5-Link Chain 0,56cm

5.3.7.37 Drawing 645295-1 Hydraulic Block Left (BV Type)

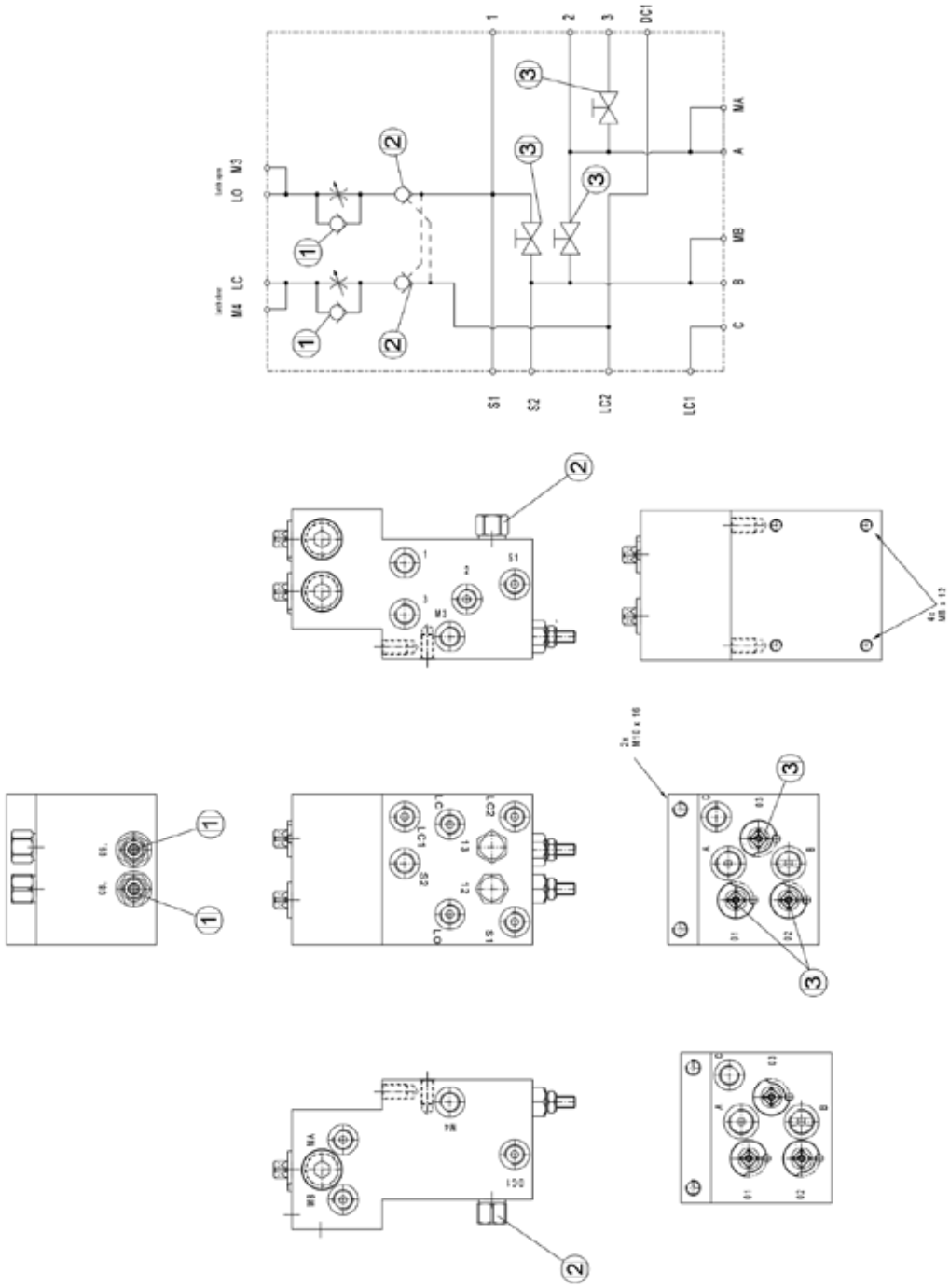


Fig. 134: 645295-1 Hydraulic Block Left

Part list 645295-1 Hydraulic Block Left

No.	Qty.	Part No.	Description
1	2	2000	Adjustable check valve cartridge
2	2	2001	Check valve cartridge
3	3	2006-1	Fitting kit for 3-way ball valve
4	1	-	Control block

5.3.7.38 Drawing 645307 Hydraulic Block Left (VC Type)

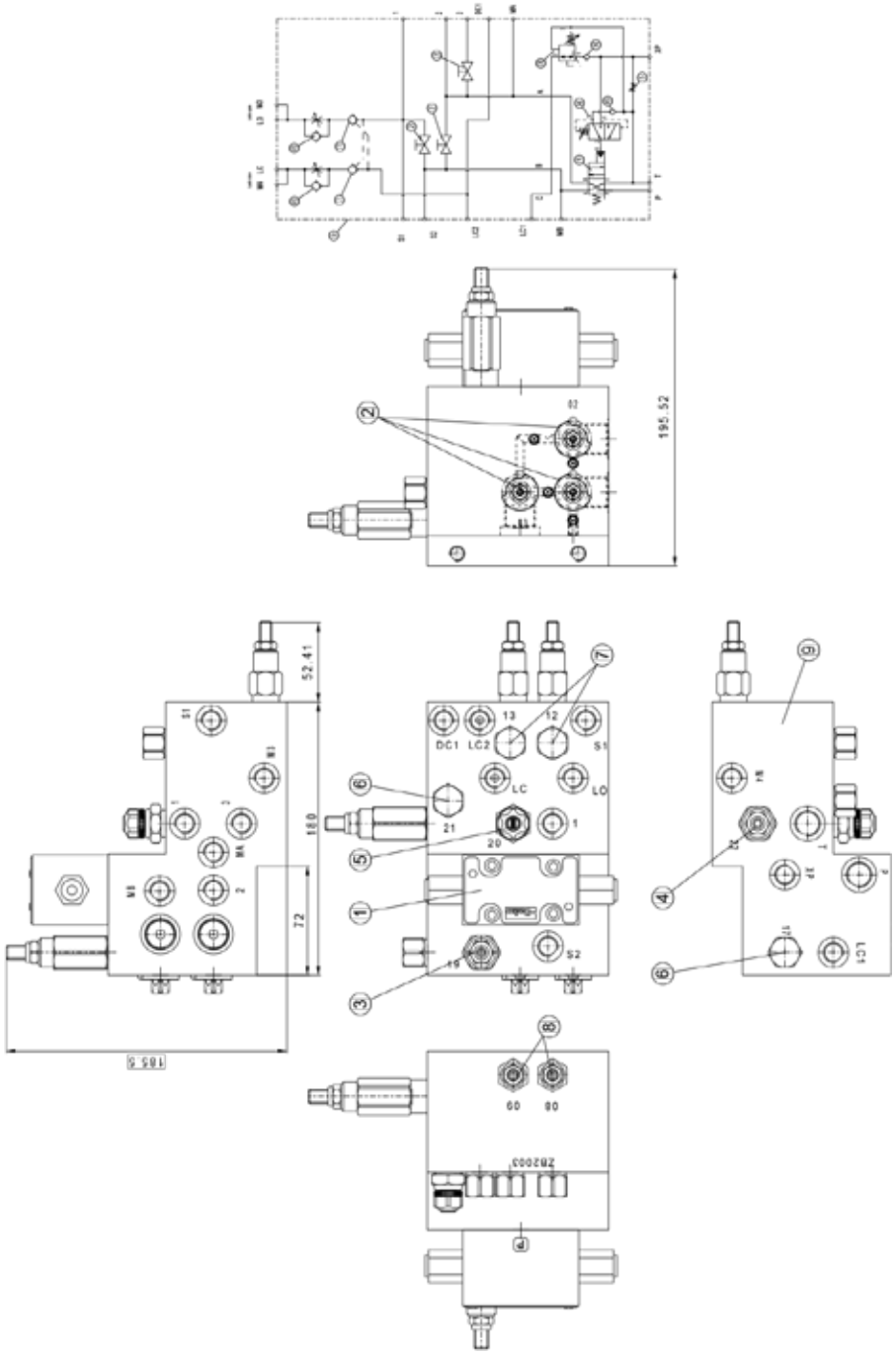


Fig. 135: 645307 Hydraulic Block Left (VC Type)

Part list 645307 Hydraulic Block Left (VC Type)

No.	Qty.	Part No.	Description
1	1	2013	$^4/_2$ way valve
2	3	2006	Assembly kit 3 way ball valve
3	1	2017	3 way pressure control valve
4	1	2038	$^3/_2$ way change valve
5	1	2005	Check valve cartridge
6	2	612952-T	Check valve cartridge
7	2	2001	Adjustable check valve cartridge
8	2	2000	Check valve cartridge
9	1	645307-1	Control block

5.3.7.39 Drawing 645295-2 Hydraulic Block Right

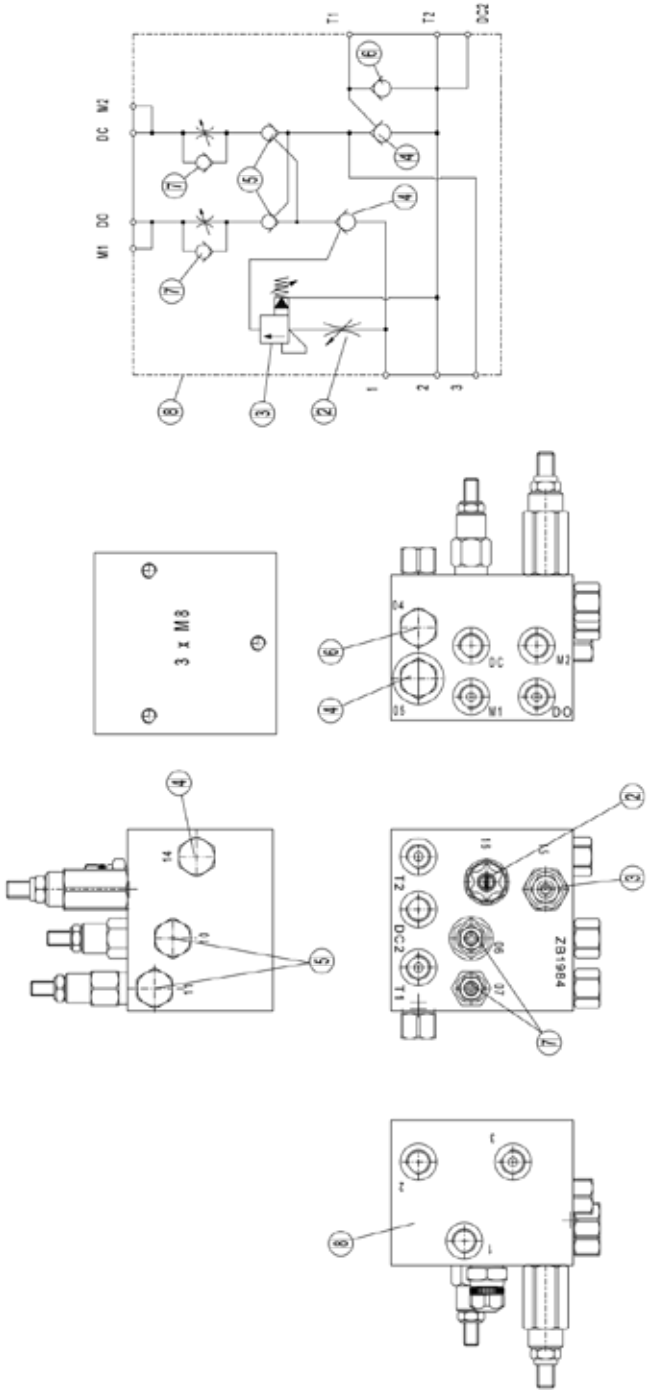


Fig. 136: 645295-2 Hydraulic Block Right

Part list 645295-2 Hydraulic Block Right

No.	Qty.	Part No.	Description
1	9	-	M6 x1 Plug
2	1	2005	Check valve cartridge
3	1	2004	Direct piloted check valve
4	2	2002	Check valve cartridge
5	2	2001	Check valve cartridge
6	1	2003	Check valve cartridge
7	2	2000	Adjustable check valve cartridge
8	1	-	Control block

5.3.7.40 Drawing 646203-2 Hydraulic Assembly plate VES-SD 500-2

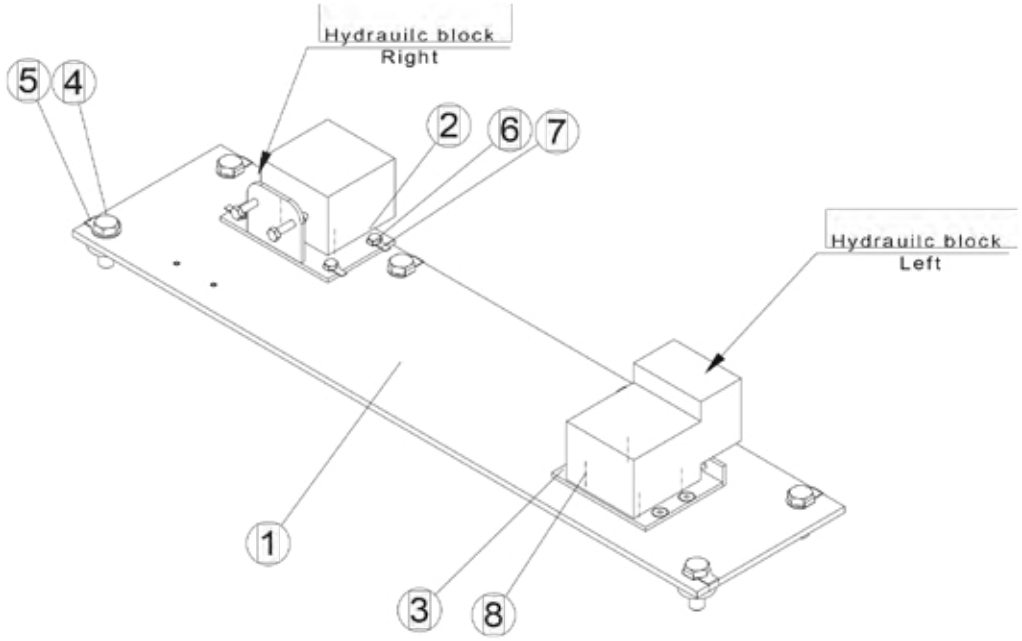


Fig. 137: 646203-2 Hydraulic Assembly plate

Part list 646203-2 Hydraulic Assembly plate

No.	Qty.	Part No.	Description
1	1	645204-1	Plate for Hydraulic
2	1	646205	Plate for Hydraulic Block right
3	1	646206	Plate for Hydraulic Block left
4	6	755314	Hexagon Screw
5	6	617520	Washer
6	4	645028	Screw
7	4	645059	Washer
8	10	645054	Screw
9	2	643775-1	Screw
10	2	675057	Nut

Part list 646203-2-VC Hydraulic Assembly plate

No.	Qty.	Part No.	Description
1	1	645204-1	Plate for Hydraulic
2	1	646205	Plate for Hydraulic Block right
3	1	646206	Plate for Hydraulic Block left
4	6	755314	Hexagon Screw
5	6	617520	Washer
6	4	643779	Screw
7	4	645059	Washer
8	6	645054	Screw
9	2	643775-1	Screw
10	2	675057	Nut
-	2	675109	Screw
-	2	735854	Washer

5.3.7.41 Drawing 645603–3 Hydraulic Assembly plate VES-SD 500-3

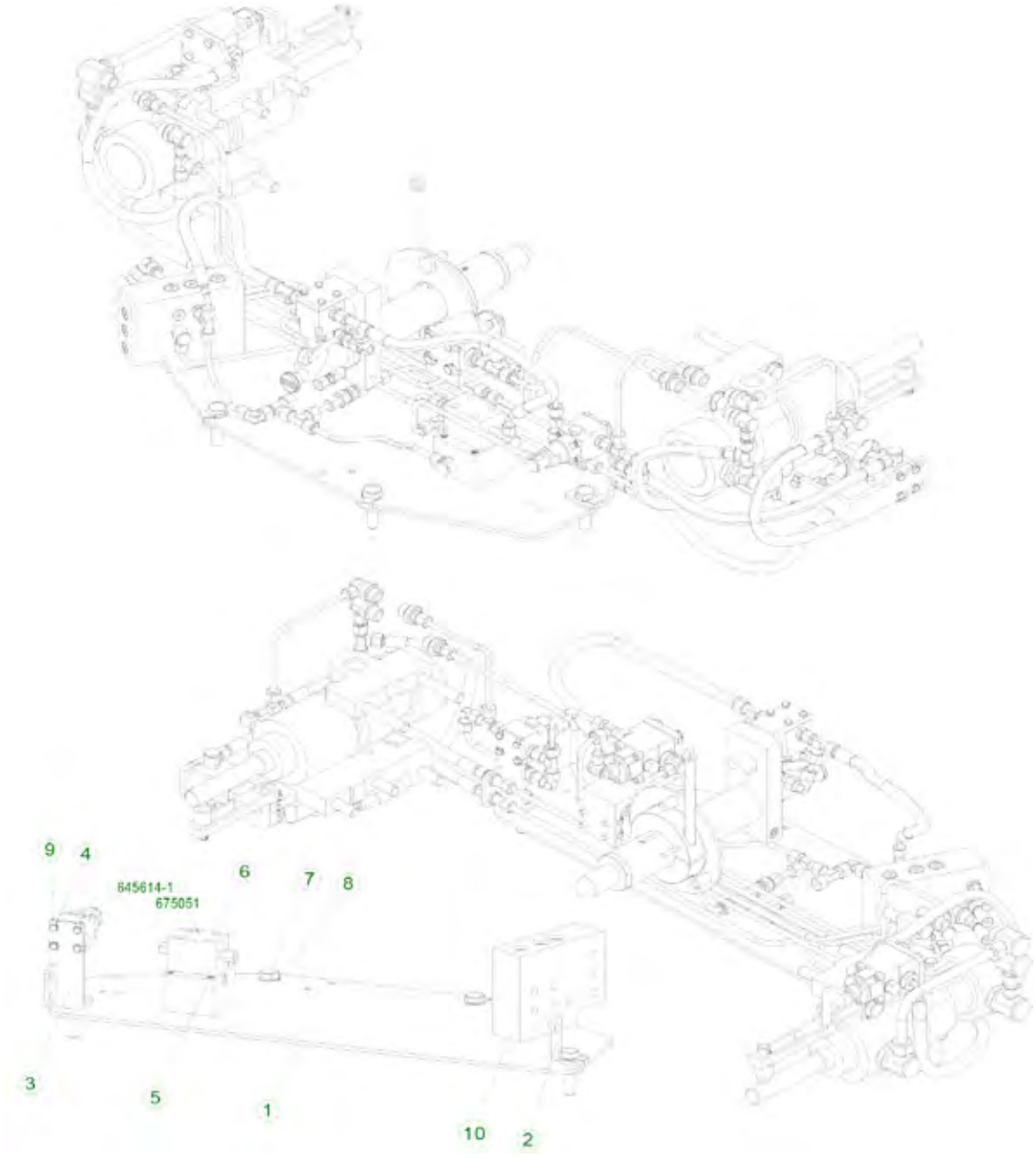


Fig. 138: 645603–3 Hydraulic assembly for elevator

Part list645603–3 Hydraulic assembly for elevator

No.	Qty.	Part No.	Description
1	1	645604	Hydraulic Base Plate
2	1	645603-5	Holder
3	1	645603-4	Holder
4	4	612671	Screw
5	4	675058	Screw
6	4	675059	Screw
7	4	645673-1	Screw
8	4	617520	Washer
9	4	613783	Washer
10	4	612517	Countersunk head screw

5.3.7.42 Drawing 676053-1 Hydraulic Assembly plate VES-SD 750 / 1000

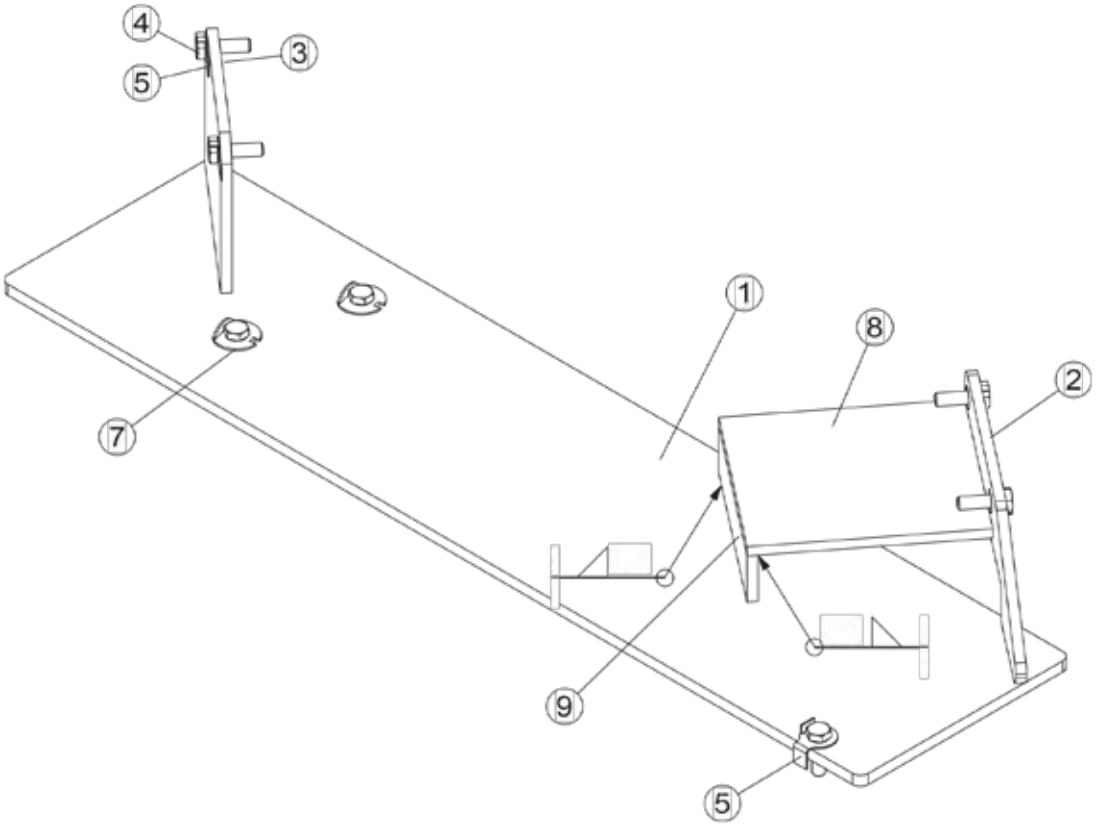


Fig. 139: 676053-1 Hydraulic Assembly

Part list 676053-1 Hydraulic Assemblyplate

No.	Qty.	Part No.	Description
1	1	676053	Hydraulic Plate
2	1		Plate
3	1		Plate
4	7	643779-1	Screw
5	5	645059	Washer
6			
7	2	675045	Washer with external tap
8	1		Plate
9	1		Plate
10	2	675057	Nut

5.3.8 Drawing and Parts List Double Elevator Rotation System

5.3.8.1 Double Elevator Rotation System

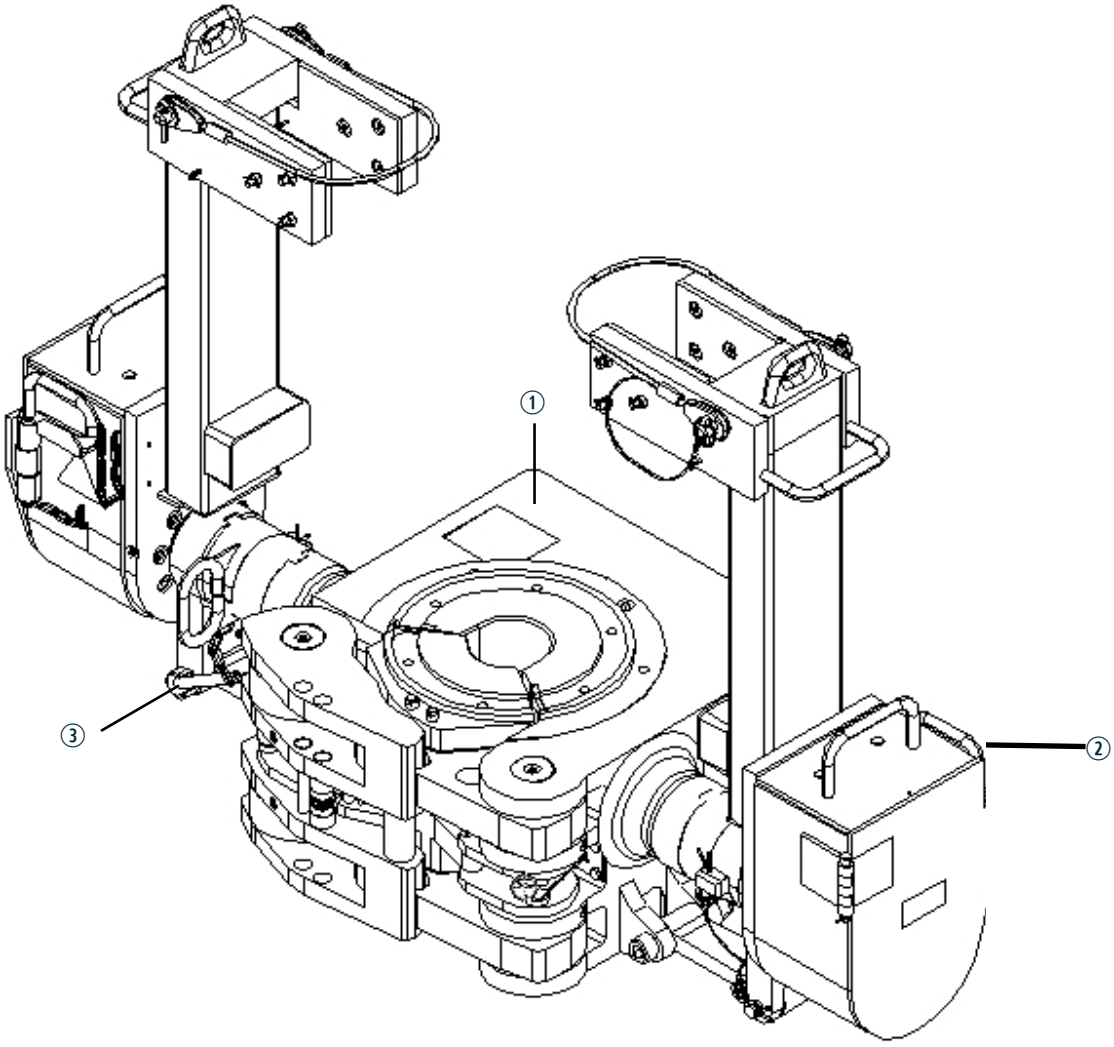


Fig. 140: VES-SD 500-1 incl. adapter kit and Elevator Rotation System

Part list 646000–Y Double Elevator Rotation System

No.	Qty.	Part No.	Description
1	1	646000 Y	Elevator VES SD 500 1
2	1	645800	Rotation System
3	1	645820	Adapter Kit for Elevator Rotation System

5.3.8.2 645800 Rotation System Basic Unit

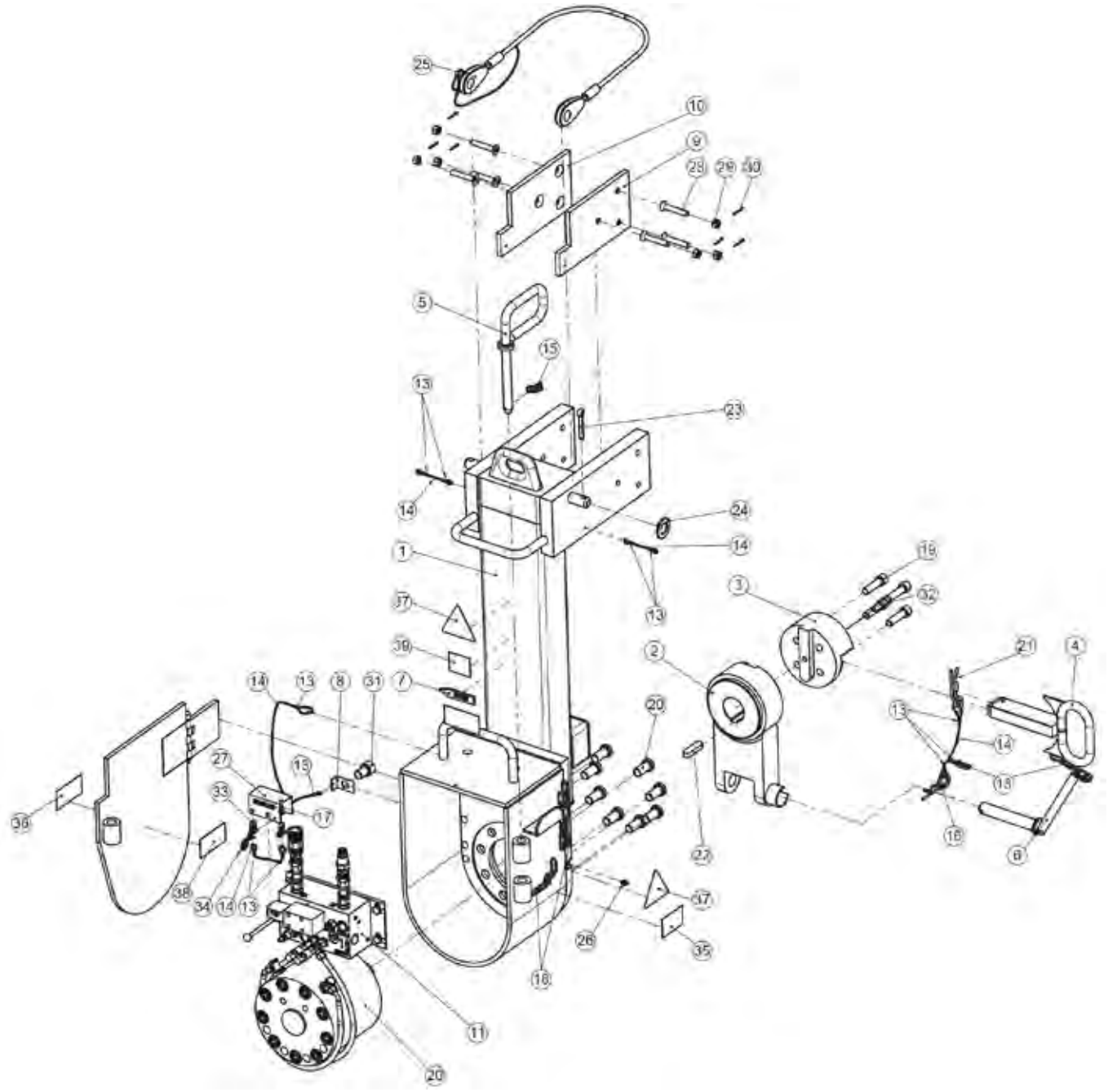


Fig. 141: Drawing 645800 Rotation System Basic Unit

Part list 645800 Rotation System Basic Unit

No.	Qty.	Part No.	Description
1	2	645807	Rotation Frame
2	2	645801	Holder
3	2	645802	Coupling(Basic)
4	2	645806	Locking Pin
5	2	675153	Door Pin
6	2	675150	Bolt
7	2	645823	Anschlag Winkel
8	2	645805 1	Rubber sheet right
9	2	645805	Rubber sheet left
10	2	99638	Spring Cotter Pin
11	2	645603 7	Hydraulic Assembly Rotation System
12	2	645035	Link Pin
13	2	645602 15	Safety Rope
14	2	645813 1	Securing Plate
15	28	643801 1	Rope Clamp
16.1	0,8	643801	wire line
16.2	0,64	643801	wire line
16.3	0,6	643801	wire line
16.4	1,2	643801	wire line
16.5	1,1	643801	wire line
16.6	0,7	643801	wire line
16.7	0,6	643801	wire line
17	14	792108	Washer
18	4	645037 2	Shackle;(replaces P/N 645037 1)
19	12	660414 1	Eye Screw
20	16	645036	Screw
21	16	80340 1	Split Pin;(Replaces 70316)
22	16	613728	Castle Nut
23	2	671056	Screw
24	2	645085 1	Cotter Pin
25	2	645824	Spring Cotter Pin
26	2	675159	Spring Cotter Pin
27	2	645699 3	Parallel key
28	2	70064	Grease Nipple
29	2	645824	Spring Cotter Pin
30	2	643664	Screw
31	8	725467	Screw;Replaces 735323
32	16	645602 10	Screw
33	2	660414 2	Nut
34	2	775018	Washer
35	2	645835	sign (DOOR)
36	2	613129	Sticker Hotline
37	2	645813	Warning Sign
38	2	645814	Danger Sign
39	2	671638	Warning sign FORUM Handling Tools
40	4	671641	Warning sign "squeeze danger"
41	2	671642	Warning sign "GREASE DAILY"
42	2	645815	Hydraulic Block Assembly

5.3.8.3 645820 Adapter Kit VES-SD $^{350}/_{500}$-$^{1}/_{500}$-$^{2}/_{500}$-3

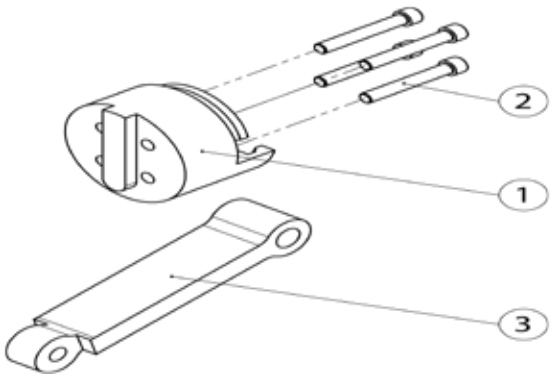


Fig. 142: 645820 Adapter Kit VES-SD $^{350}/_{500}$-$^{1}/_{500}$-$^{2}/_{500}$-3

5.3.8.4 645830 Adapter kit VES-SD 750 / 1000

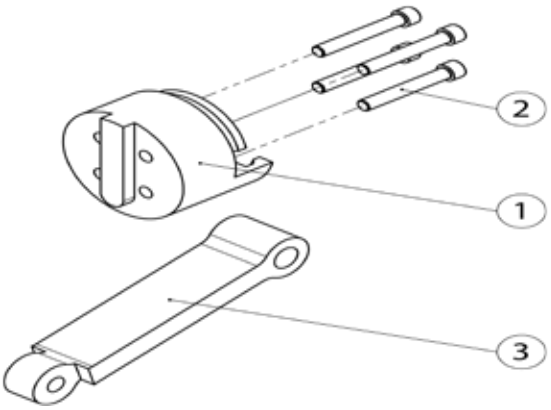


Fig. 143: 645830 Adapter kit VES-SD 750 / 1000

Part list 645820 Adapter Kit VES-SD $^{350}/_{500}$-$^{1}/_{500}$-$^{2}/_{500}$-3

No.	Qty.	Part No.	Description
1	2	645018	Screw
2	2	753014	Nut
3	2	735404	Split Pin
4	8	726041	Screw
5	2	645821	Coupling Frame 1+2
6	2	645822	Link Retainer Frame 1+2

Part list 645830 Adapter kit VES-SD 750 / 1000

No.	Qty.	Part No.	Description
1	1	645831	Coupling 750-1000 R
2	1	645831-1	Coupling 750-1000 L
3	8	725467	Screw

5.3.8.5 645603-7 Hydraulic Plan Rotation System

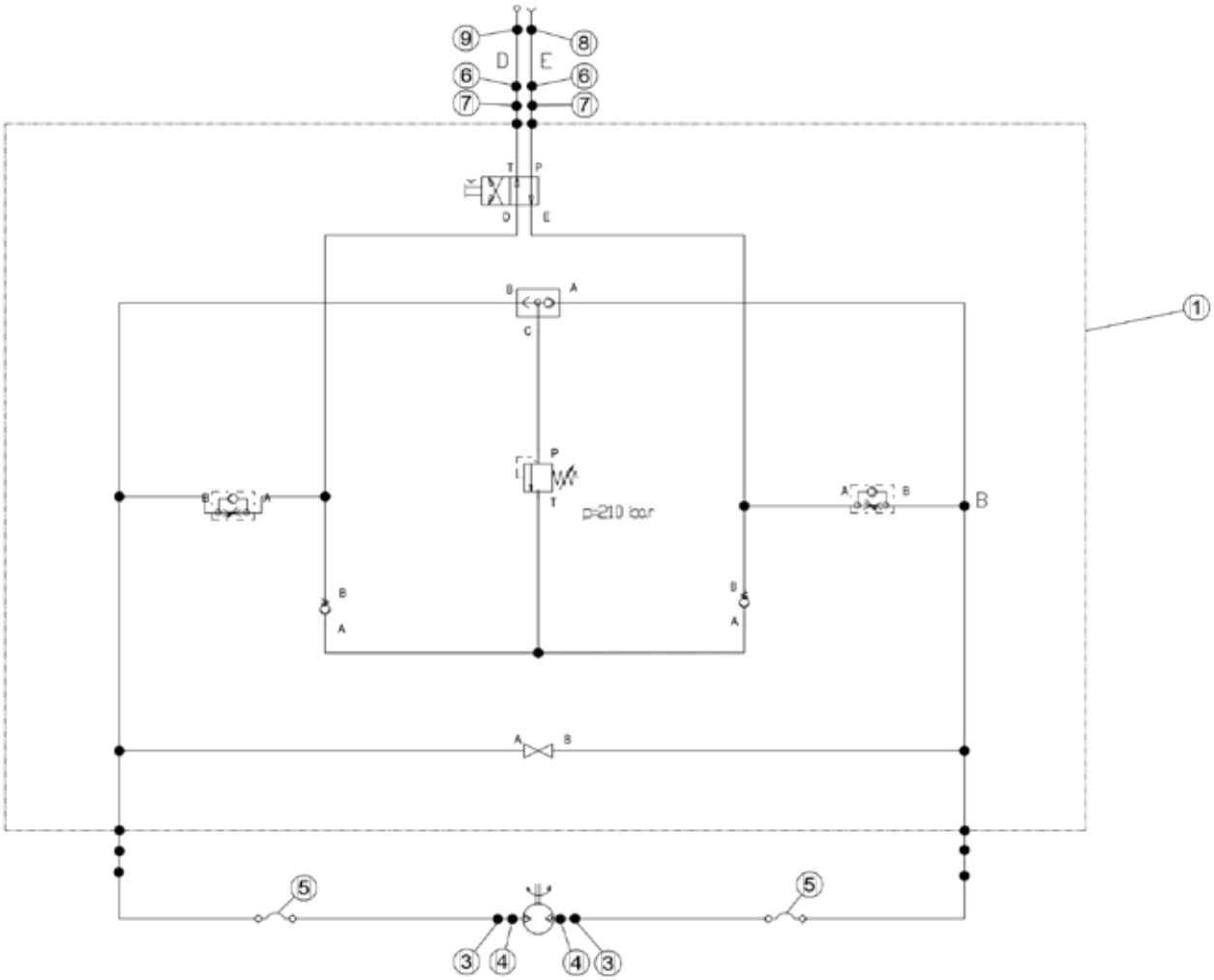


Fig. 144: 645603-7 Hydraulic Plan Rotation System

Part list 645603-7 Hydraulic Plan Rotation System

No.	Qty.	Part No.	Description
1	1	645815	Hydraulic block assembly
2	1	645602-9	Hydraulic motor
3	2	613945	Swiveling Screw Fitting
4	2	613944	Reducing Nipple
5	2	648819-1	Hose assembly
6	2	645109	Adjustable adapter
7	2	755370	Straight bulkhead coupling
8	1	645834	Quick connect coupling 1/2" female
9	1	645833	Quick connect coupling 1/2" male

5.3.8.6 645815 Hydraulic Plan

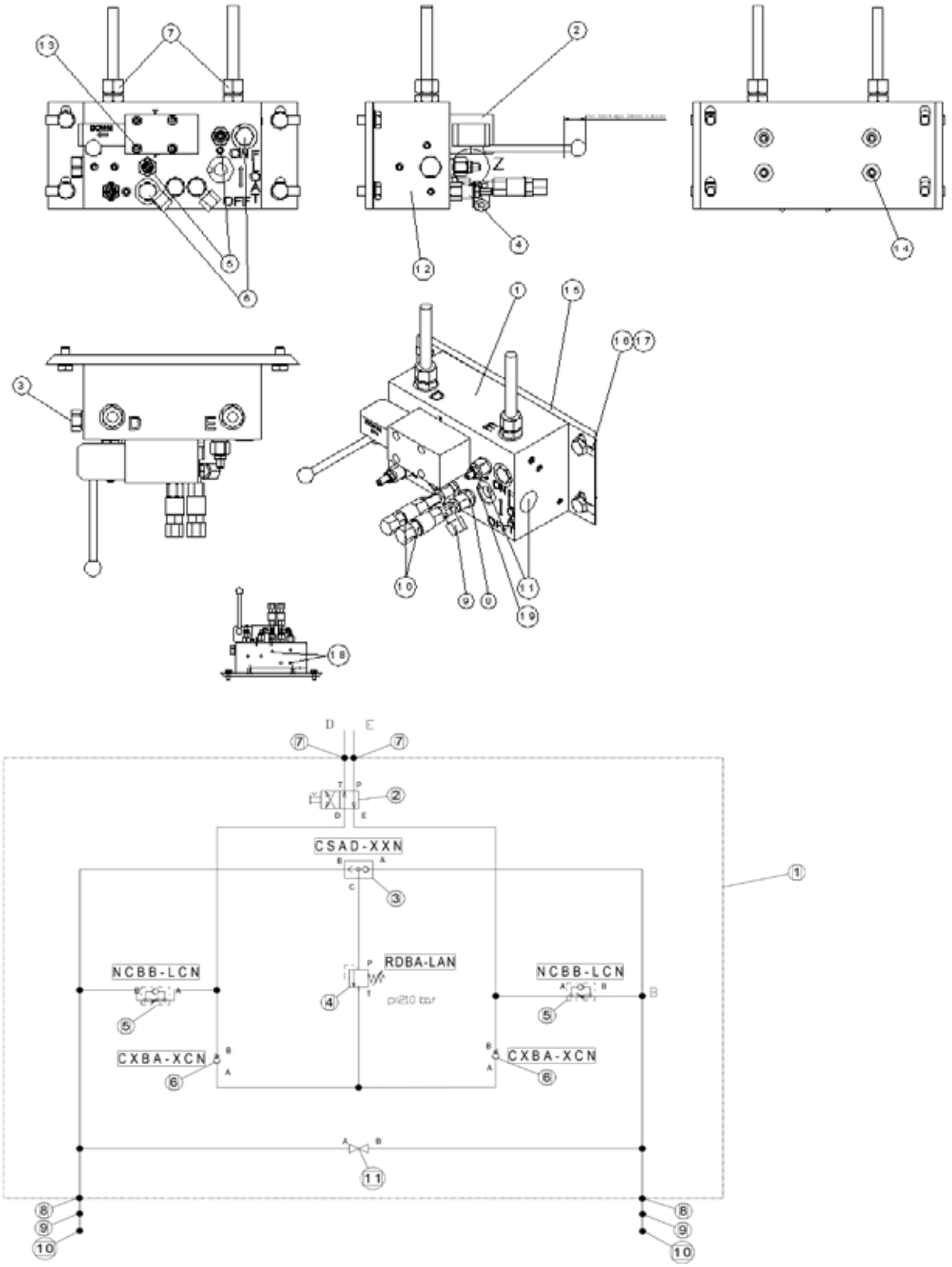


Fig. 145: 645815 Hydraulic Plan

Part list 645815 Hydraulic Plan

No.	Qty.	Part No.	Description
1	1	645817	Hydraulic block
2	1	710703	Control valve
3	1	2015	Single ball, signal at port 2
4	1	2016	Direct Active Relief Valve
5	2	2000	Fully adjustable needle valve with reverse flow
6	2	612952-T	Check valve
7	2	645819	Reducing socket
8	2	612944	Straight connection
9	2	645095	L Adapter
10	2	755361	Pressure Coupling
11	2	645818	Stop valve
12	16	645815 1	Blind Screw
13	4	645815 2	Screw
14	4	612517	Screw
15	1	645816	Adapter Plate
16	4	752118	Screw
17	4	735854	Washer
18	2	612929	Blind Screw
19	1	755613	Securing Ring

5.3.9 Drawing and Parts List Single Elevator Rotation System

5.3.9.1 678800 Single Elevator Rotation System (double acting)

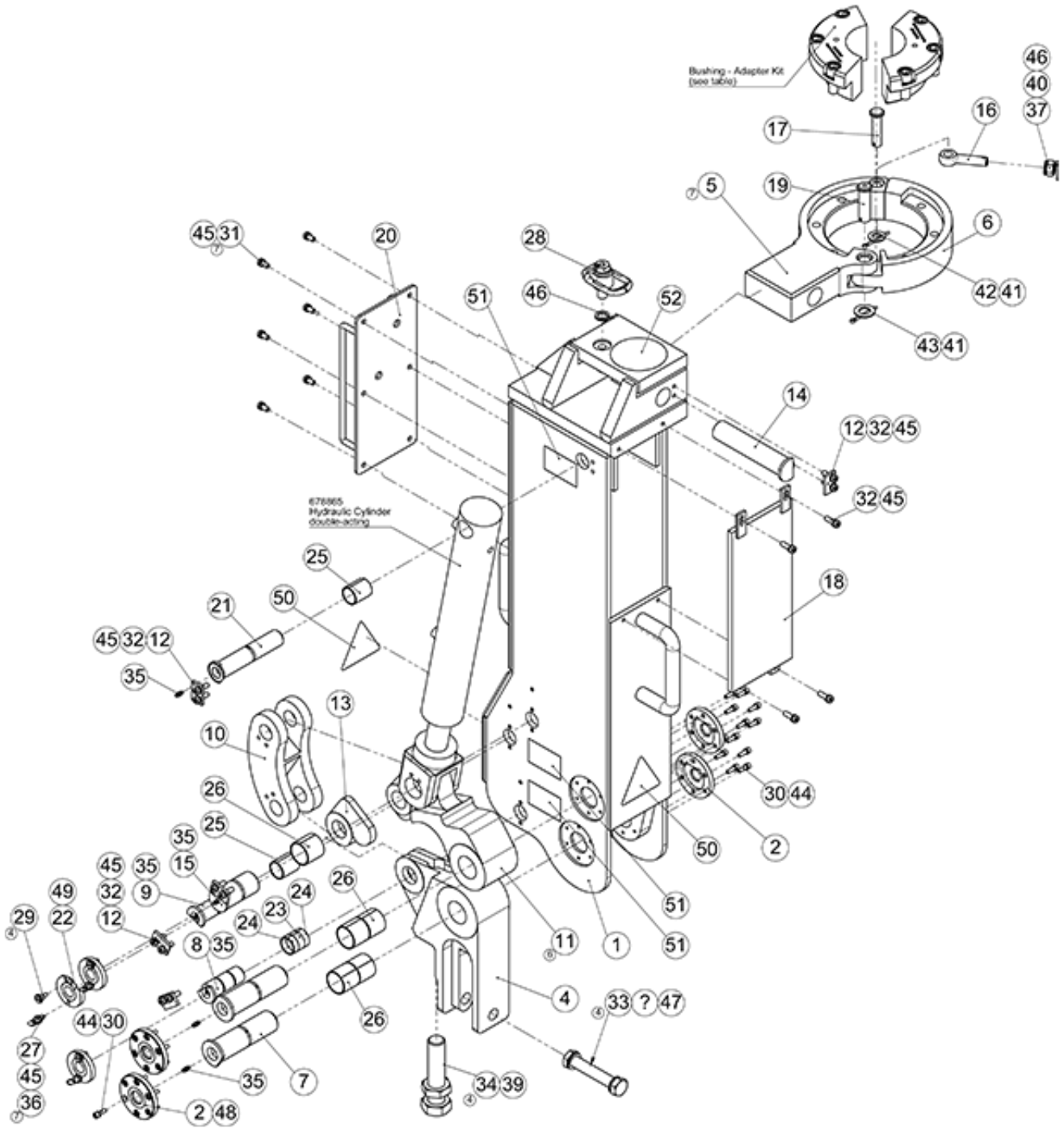


Fig. 146: 678800 Single Elevator Rotation System

Part list 678800 Single Elevator Rotation System

No.	Qty.	Part No.	Description
1	1	678810	Cover for VES-SD Rotator
2	4	678812	Cap
3	1	678800-H	Hydraulic Assembly,;double-acting,;VES-SD Ro
4	1	678813	Link block connector
5	1	678815	link clamp fix

No.	Qty.	Part No.	Description
6	1	678817	link clamp movable
7	2	678818	Pin
8	1	678854	Pin;Elevator Rotator System
9	1	678819	Pin, VES-SD-Rotator
10	1	678831	rotating lever
11	1	678832	rotating lever
12	5	678833	security plate
13	1	678834	Stopper
14	1	678838	Pin
15	1	678839	Fork Pin
16	1	678846	Eye Screw
17	1	678847	Cylinder Pin
18	1	678850	Protection Plate
19	1	638276-1	Cylinder Pin
20	1	678853	Zylinder Cover
21	1	678855	Pin;VES-SD/SD Rotator
22	3	678890	Plate
23	1	678843	Bushing
24	2	678843-2	Bushing
25	2	678844	Bushing
26	5	678845	Bushing
27	3	678892	Lock bolt
28	1	553468	Lifting eye
29	3	678891-1	Screw
30	24	612597	Screw
31	6	726218	Screw
32	14	772878	Screw
33	1	753079	Screw
34	1	790062-1	Screw
35	6	756790	Lubricating nipples
36	3	678856	Nut
37	1	755137	Nut
38	1	725415	Nut
39	1	87714	Nut
40	1	660416	Split Pin
41	2	70263	Split Pin
42	1	615879	Washer
43	1	612679	Washer
44	24	792111	Washer
45	23	792112	Washer
46	2	792106	Washer;(replaces 753700-13)
47	2	792108	Washer
48	2	612530-3	Marking Point;for Grease Nipple
49	4	612530-5	Marking Point;for Grease Nipple
50	2	671641	Warning sign "squeeze danger"
51	3	671642	Warning sign "GREASE DAILY"
52	1	671646	sign "lifting point" - sticker

5.3.9.2 678801 Single Elevator Rotation System (single acting)

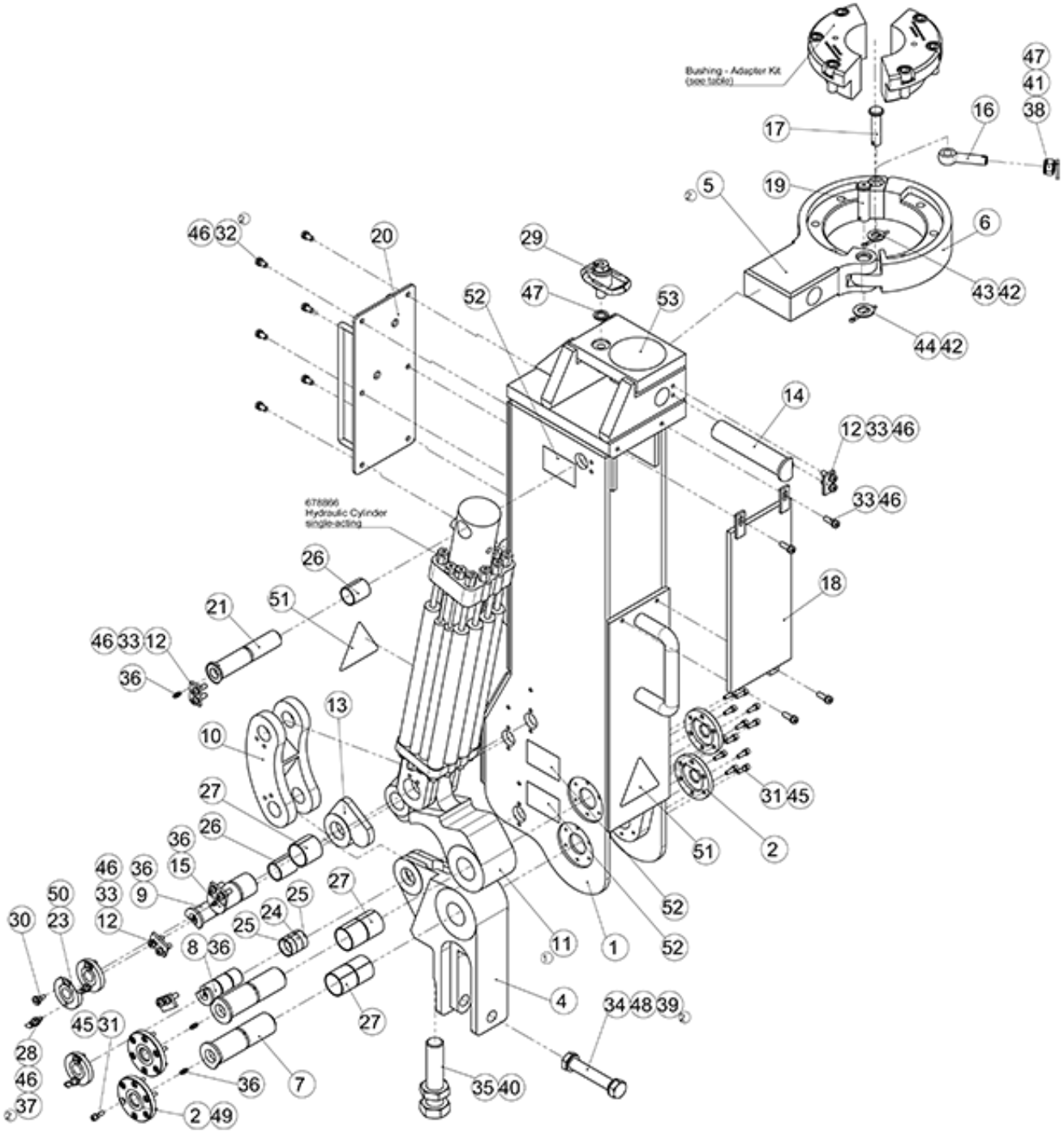


Fig. 147: 678801 Single Elevator Rotation System

Part list 678801 Single Elevator Rotation System

No.	Qty.	Part No.	Description
1	1	678810	Cover for VES-SD Rotator
2	4	678812	Cap
3	1	678801-H	Hydraulic Assembly,;single-acting,;VES-SD Ro
4	1	678813	Link block connector
5	1	678815	link clamp fix
6	1	678817	link clamp movable

No.	Qty.	Part No.	Description
7	2	678818	Pin
8	1	678854	Pin;Elevator Rotator System
9	1	678819	Pin, VES-SD-Rotator
10	1	678831	rotating lever
11	1	678832	rotating lever
12	5	678833	security plate
13	1	678834	Stopper
14	1	678838	Pin
15	1	678839	Fork Pin
16	1	678846	Eye Screw
17	1	678847	Cylinder Pin
18	1	678850	Protection Plate
19	1	638276-1	Cylinder Pin
20	1	678853	Zylinder Cover
21	1	678855	Pin;VES-SD/SD Rotator
22	3	678890	Plate
23	1	678843	Bushing
24	2	678843-2	Bushing
25	2	678844	Bushing
26	5	678845	Bushing
27	3	678892	Lock bolt
28	1	553468	Lifting eye
29	3	678891-1	Screw
30	24	612597	Screw
31	6	726218	Screw
32	14	772878	Screw
33	1	753079	Screw
34	1	790062-1	Screw
35	6	756790	Lubricating nipples
36	3	678856	Nut
37	1	755137	Nut
38	1	725415	Nut
39	1	87714	Nut
40	1	660416	Split Pin
41	2	70263	Split Pin
42	1	615879	Washer
43	1	612679	Washer
44	24	792111	Washer
45	23	792112	Washer
46	2	792106	Washer;(replaces 753700-13)
47	2	792108	Washer
48	2	612530-3	Marking Point;for Grease Nipple
49	4	612530-5	Marking Point;for Grease Nipple
50	2	671641	Warning sign "squeeze danger"
51	3	671642	Warning sign "GREASE DAILY"
52	1	671646	sign "lifting point" - sticker

5.3.9.3 646120-1 Adapter kit VES-SD $^{350}/_{500}$-$^{1}/_{500}$-$^{2}/_{500}$-3

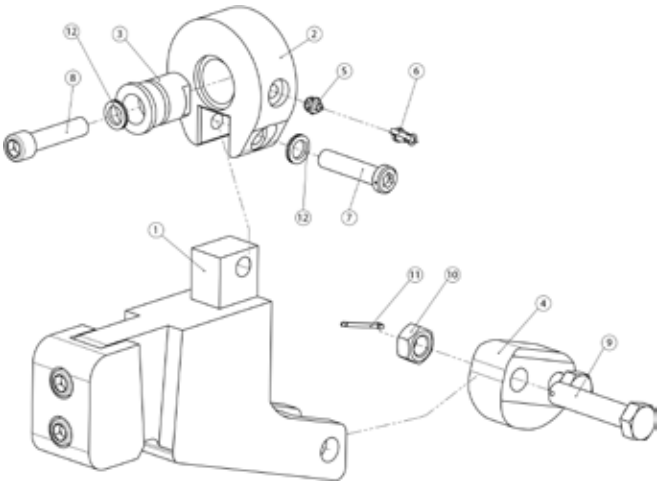


Fig. 148: 646120-1 Adapter kit VES-SD $^{350}/_{500}$-$^{1}/_{500}$-$^{2}/_{500}$-3

5.3.9.4 676020-1 Adapter Kit VES-SD 750 / 1000

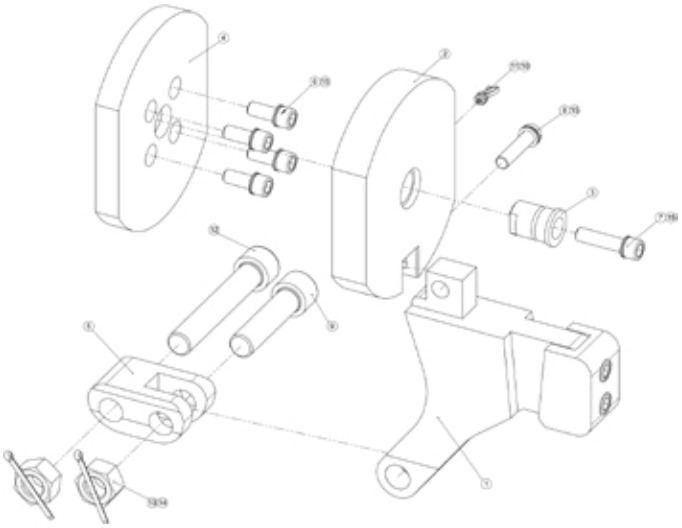


Fig. 149: 676020-1 Adapter Kit VES-SD 750 / 1000

Part list 646120-1 Adapter kit VES-SD $^{350}/_{500}$-^{1}/ 500-$^{2}/_{500}$-3

No.	Qty.	Part No.	Description
1	1	638220-2	Link Block Assembly;VES-SD/SD Rotator
2	1	638220-4	Bracket 350 / 2;VES-SD 350 / 2 Rotator;VES-SD/SD Rota
3	1	638220-5	Pin 350 / 2;VES-SD/SD Rotator
4	1	678816	Connection
5	1	612515	Grease nipple
6	1	612518	Protection Cap
7	1	798229	Screw
8	1	755167	Screw
9	2	613623-11	Screw
10	2	613556-41	Nut
11	2	752339	Split Pin
12	2	792108	Washer

Part list 676020-1 Adapter Kit VES-SD 750 / 1000

No.	Qty.	Part No.	Description
1	1	676020-2	Link Block Assembly ;VES-SD 750;AMP/ SD Ro
2	1	676020-4	Bracket SD 750;AMP/SD Rotator
3	1	638220-5	Pin 350 / 2;AMP/SD Rotator
4	1	676020-6	Base plate SD 750;AMP/SD Rotator
5	1	646120-7	Connection
6	4	725466	Screw
7	1	775435	Screw
8	1	798229	Screw
9	1	790017-1	Screw
10	1	612515	Grease nipple
11	1	612518	Protection Cap
12	1	645018	Screw
13	2	753014	Nut
14	2	735404	Split Pin
15	6	792106	Washer

5.3.9.5 678800-H Hydraulic Assembly Single Rotator (double acting)

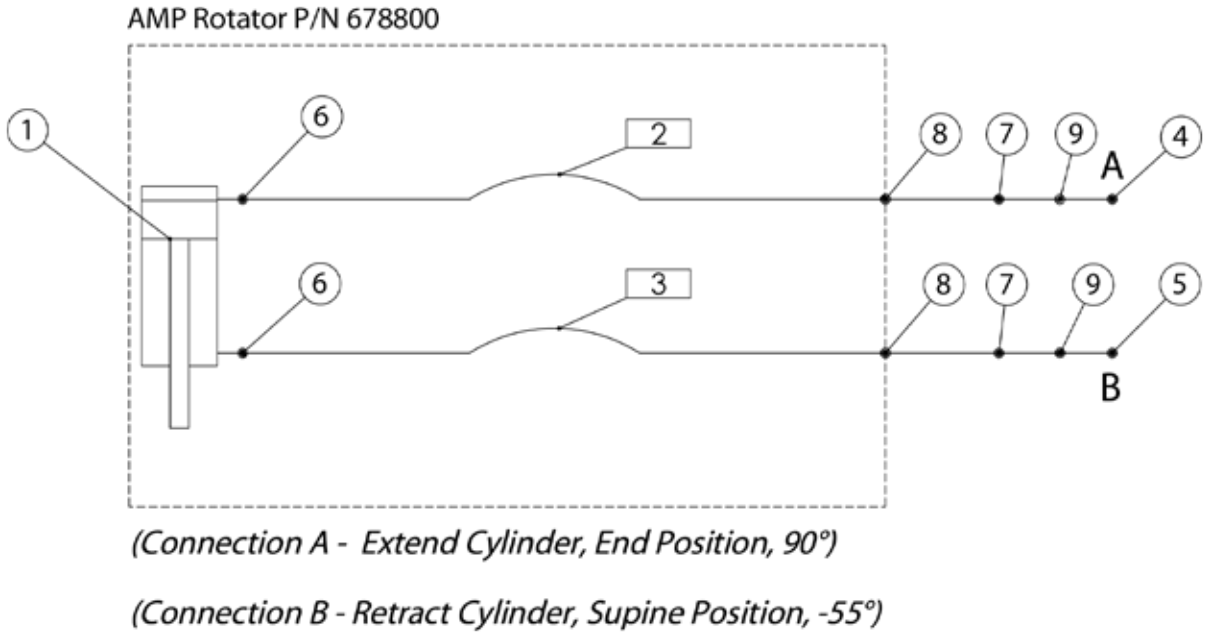


Fig. 150: Drawing 678800-H Hydraulic Assembly Single Rotator

Part list 678800-H Hydraulic Assembly Single Rotator

No.	Qty.	Part No.	Description
1	1	678865	Hydraulic Cylinder;
2	1	678800-H-A	Hose Assembly;Connection A L=mm
3	1	678800-H-B	Hose Assembly;Connection B L=285mm
4	1	645833	Cuppling, Flat Face
5	1	645834	Cuppling, Flat Face
6	2	613945	Swivelling Screw Fitting 90°;(replaces 61
7	2	613946	straight connection
8	2	645106	Connection
9	2	613944	Reducing Nipple

5.3.9.6 678801-H Hydraulic Assembly Single Rotator (single acting)

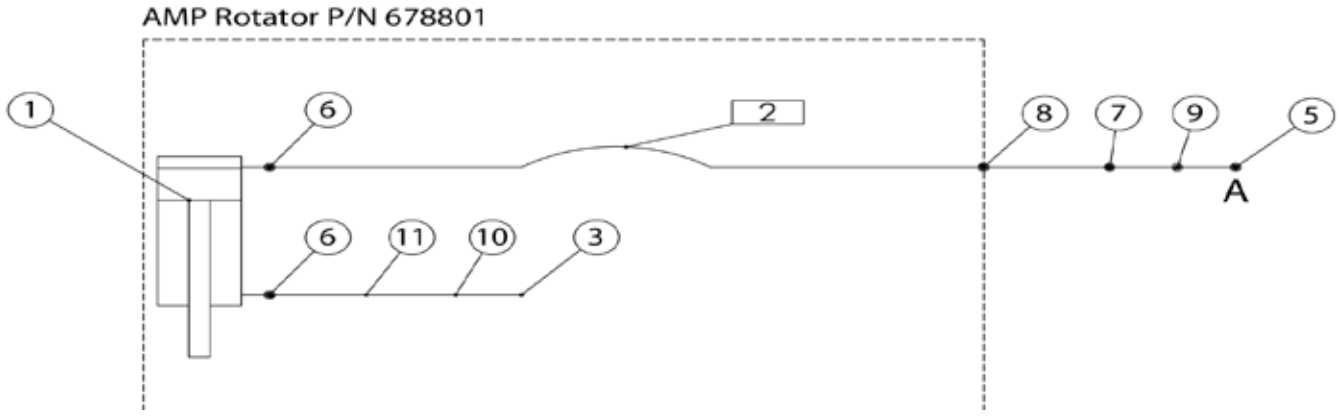


Fig. 151: Drawing 678801-H Hydraulic Assembly Single Rotator

Part list 678801-H Hydraulic Assembly Single Rotator

No.	Qty.	Part No.	Description
2	1	678801-H-A	Hose Assembly;Connection A L=285mm
3	1	678866-1	Filter;
4	1	645833	Cuppling, Flat Face
5	1	645834	Cuppling, Flat Face
6	1	613945	Swivelling Screw Fitting 90°;(replaces 61
7	1	613946	straight connection
8	1	645106	Connection
9	1	613944	Reducing Nipple
10	1	645117	Direct Pipe Fitting
11	1	612945	Straight Connection 8L-8L

5.4 Recommended Spare Parts

FORUM Handling Tools recommended spare parts provide a list of potential wear items that may be beneficial to keep on hand for repair and maintenance.

5.4.1 646000-RSP One year spare part VES-SD 350 / 500-1

No.	Qty.	Part No.	Description
1	1	646000-RSP-H	Hydraulic Spare Parts
2	1	645800-RSP-R	Spare parts for tilt system
3	1	645188-1	Door sensor
4	1	645040	Trigger assembly
5	2	645033	Bushing retainer plate
6	2	755334	Cotter pin
7	2	613623	Nut
8	6	70064	Grease nipple
9	6	612515	Grease nipple
10	2	645119	Door pin
11	2	645067	Bolt with head
12	4	645064	Brass disk
13	2	645066	Bolt for fork
14	4	645079-24	Bolt
15	2	645062-1	Fork
16	8	612515	Grease nipple
17	12	735854	Washer
18	6	613722	Washer
19	8	645059	Washer
20	8	70653	Cotter Pin
21	6	645196	Cotter Pin
22	8	735404	Cotter Pin
23	6	645026	Securing ring
24	6	645185-3	Securing ring
25	4	671638	Warning Sign Blohm+Voss
26	4	671639	Warning Sign “Automatic”
27	4	671642	Warning Sign “Grease”
28	4	643801-11	Rope clemp ø3mm
29	1	643801	Rope ø3mmx300mm
30	6	617520	Safety sheet

5.4.2 646000-RSP-H Hydraulic spare parts VES-SD 350/500-1

No.	Qty.	Part No.	Description
1	1	645297	Hydraulic Cylinder for SD elevator; 500
2	1	615914	Feedback valve
3	1	645118	Valve
4	1	755355	Plastic protective coil sleeve
5	2	643779	2/2 Way Valve
6	2	1038-F	Quick connect coupling 3/8 female
7	2	1038-M	Quick connect coupling 3/8 male
8	1	1014-M	Quick connect coupling 1/4 male
9	1	1014-F	Quick connect coupling 1/4 female
10	1	2000	Fully adjustable needle valve with reverse
11	1	2001	Pilot to open check 3-port valve; non vent
12	1	2002	Pilot to open check 3-port valve; non vent
13	1	2003	Check 2 port valve; free flow side to nos
14	1	2004	Sequence 3 port valve; direct acting
15	1	2005	Fully adjustable needle valve - pilot cap
16	1	2006	Installation kit 3-way ball valve

5.4.3 645800-RSP-R Tilting arrangement spare parts VES-SD 350/500-1

No.	Qty.	Part No.	Description
1	1	710020	Lifting eye M24
2	1	645805	Rubber sheet left
3	1	645805-1	Rubber sheet right
4	6	645036	Screw
5	9	613728	Nut
6	6	70316	Cotter pin
7	1	645602-9	Hydraulic motor

5.4.4 646200-RSP One year spare part VES-SD 500-2

No.	Qty.	Part No.	Description
1	1	646000-RSP-H	Hydraulic Spare Parts
2	4	643801-11	Rope clemp ø3mm
3	1	643801	Rope ø3mmx300mm
4	5	645035	Link Pin
5	2	645217	Door Pin
6	2	645038	Bolt
7	1	645621	Bolt
8	1	645624	Bolt
9	2	645669	Bolt
10	4	645069	Bolt
11	4	645667	Bolt
12	2	645294	Bolt
13	4	735404	Cotter Pin
14	4	620608	Securing Ring
15	8	675044	Securing Ring
16	8	617520	Washer with 2 TAPS
17	4	671638	Warning Sign Blohm+Voss
18	4	671639	Warning Sign “Automatic”
19	4	671642	Warning Sign “Grease”
20	4	671641	Warning sign "squeeze danger"
21	4	611524	Warning sign "don`t touch"

5.4.5 676000-RSP One year spare part VES-SD 750 / 1000

No.	Qty.	Part No.	Description
1	1	646000-RSP-H	Hydraulic Spare Parts
2	4	643801-11	Rope clemp ø3mm
3	1	643801	Rope ø3mmx300mm
4	5	645035	Link Pin
5	2	676010	Door Pin
6	1	645038-1	Bolt
7	1	645038	Bolt
8	1	675020	Bolt
9	1	645013	Bolt
10	1	645039	Bolt
11	1	645039-1	Bolt
12	1	647022	Bolt
13	1	646022	Bolt
14	2	676068	Bolt
15	2	676299	Bolt
16	2	645066	Bolt
17	6	80340-1	Cotter Pin
18	8	735404	Cotter Pin
19	4	645026	Securing Ring
20	3	70064	Grease Fitting
21	4	645059	Washer with 2 TAPS
22	4	671638	Warning Sign Blohm+Voss
23	4	671639	Warning Sign “Automatic”
24	4	671642	Warning Sign “Grease”
25	4	671641	Warning sign "squeeze danger"
26	4	611524	Warning sign "don`t touch"

5.4.6 PN 645800-RSP-H One year spare part double rotator

No.	Qty.	Part No.	Description
1	2	613944	Reducing Nipple
2	2	755370	Straight Bulkhead Coupling
3	2	1012-F	Quick connect coupling 1/2 female
4	2	1012-M	Quick connect coupling 1/2 male
5	1	2016	Direct-active Relief Valve
6	1	2000	Fully adjustable needle valve with revers
7	1	612952-T	Check Valve;
8	1	2015	Valve
9	1	710703	Control Valve RPR3-06-2-J15-V
10	2	645819	Reducing Socket
11	2	755361	Pressure Coupling
12	2	645815-1	Locking screw
13	2	612944	Straight Connection 8L-1/4"
14	2	645095	Adjustable Stud Barrel Tee
15	2	645819	Reducing Socket
16	2	613945	Swivelling Screw Fitting 90°
17	1	645819-1	Hose Assembly
18	2	645813	Warning Sign
19	2	645814	Danger Sign
20	2	671638	Warning sign FORUM Handling Tools
21	2	671642	Warning sign "GREASE DAILY"
22	6	671641	Warning sign "squeeze danger"

5.4.7 PN 645800-RSP-R One year spare part double rotator

No.	Qty.	Part No.	Description
1	2	710020	Lifting eye bolt
2	1	645805	Rubber sheet left
3	1	645805-1	Rubber sheet right
4	10	645036	Screw
5	10	613728	Castle Nut
6	10	80340-1	Split Pin

5.4.8 PN 678800-RSP One year spare part single rotator

No.	Qty.	Part No.	Description
1	1	553468	Lifting eye
2	6	756790	Lubricating nipples
3	1	753079	Screw
4	6	772878	Screw
5	6	725466	Screw
6	1	755137	Nut
7	1	752137-2	Nut
8	4	70263	Split Pin
9	2	660416	Split Pin
10	2	792108	Washer
11	8	792106	Washer
12	6	792112	Washer
13	4	612679	Washer
14	2	671646	sign "lifting point" - sticker
15	4	612530-3	Marking Point;for Grease Nipple
16	8	612530-5	Marking Point;for Grease Nipple
17	4	671641	Warning sign "squeeze danger"
18	6	671642	Warning sign "GREASE DAILY"
19	1	678800-H-A	Hose Assembly;Connection A L=mm
20	1	678800-H-B	Hose Assembly;Connection B L=285mm
21	1	645833	Coupling, Flat Face
22	1	645834	Coupling, Flat Face

INSPECTION / MAINTENANCE

6 Inspection / Maintenance

This chapter contains important information on how to service your machine safely, correctly and economically. It helps to avoid dangerous situations and reduce repair costs and downtimes. Furthermore, the reliability and the service life of the machine will be increased by following the instructions in this manual.

Ensure that setup and installation work are performed only by sufficiently qualified and trained personnel.

Read these instructions carefully before setting up the equipment and putting it into service.

WEAR EYE PROTECTION!

WEAR PROTECTIVE HELMET!

WEAR PROTECTIVE GLOVES!

WEAR SAFETY SHOES!

Instructions for inspection and maintenance

1. In the event of visible damage or excessive wear, contact the FORUM Handling Tools Service Department or an authorized repair company.
2. Ensure that welding work on primary load components is performed exclusively by the FORUM Handling Tools Service Department or an authorized repair company observing the FORUM Handling Tools welding instructions.

Instructions for inspection and maintenance

3. Ensure that all other maintenance work is performed only by personnel trained for this work and familiar with the risks involved in operating the equipment.
4. Ensure that all repair work not performed by FORUM Handling Tools is, nevertheless, performed in compliance with the manufacturer's specifications and instructions.
5. Small cracks and irregularities, which do not affect the safety or proper operation of the VES SD, can be removed by light buffing or grinding (refer to section „Critical Areas“ on page 141).
6. After repair always check the repaired part in a suitable manner to ensure that the defect has been remedied.

Prerequisites for maintenance work

1. Ensure that the VES SD is stable and resting down on a good supporting surface so that it cannot tip.
2. Provide sufficient lighting at the workplace.
3. The VES SD must be removed from the Master Bushings and cleared from the area around well center to avoid objects dropped downhole during maintenance.

Trouble shooting

1. In all events where the VES SD's function is not as expected, the following checks must be carried out to identify the cause.
2. Check proper lubrication.
3. Check size and installation.

6.1 Lubrication

⚠ WARNING

Lubricants can pose a health hazard!

Lubricants irritate skin and eyes.

Avoid contact with lubricants.

WEAR EYE PROTECTION!

WEAR PROTECTIVE GLOVES!

Fig. 153: Instructions: Lubricate at Least Once Daily (P/N 671642)

6.1.1 Lubrication Intervals

The Elevators are supplied with lubricating grease manually by a grease gun through lubrication nipples.

When the Equipment is in use, the following lubrication procedure should be performed daily, or as inspection indicates

Tools

- Grease pump (P/N 775810)

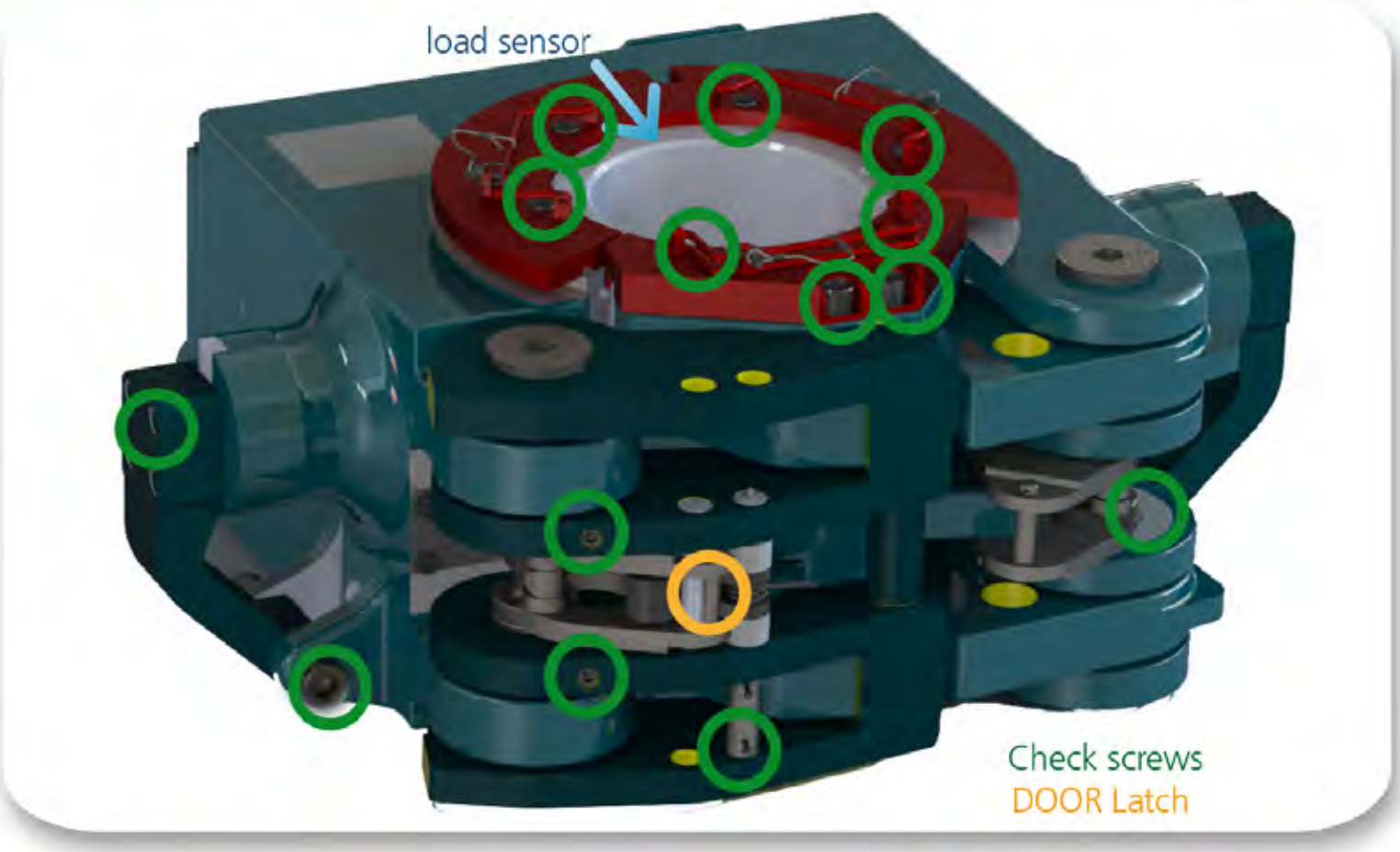
Fig. 152: Recommended Grease Gun (P/N 775810).

Smart Solutions.
Powerful Products

SD Elevator Type Series
Daily Equipment Inspection

FORUM ENERGY TECHNOLOGIES

Operation Maintenance Instructions• Handling Equipment • Hoisting Equipment



1 Visual Inspection

1. Clean elevator with high-pressure water
2. Check for loose items, damaged parts, broken parts, and loose screws
3. Check that the retainer plate is fixed in position (if bushings are installed)
4. Check the condition of the retainer plate fixation
5. Check for corrosion
6. Grease all greasing points

2 Load Sensor check

1. Check the mechanical load sensor (movement of bushings)
2. Check the door-opening sequence function (first, the latch opens , and then the door opens)
3. Check closing function by actuating the trigger

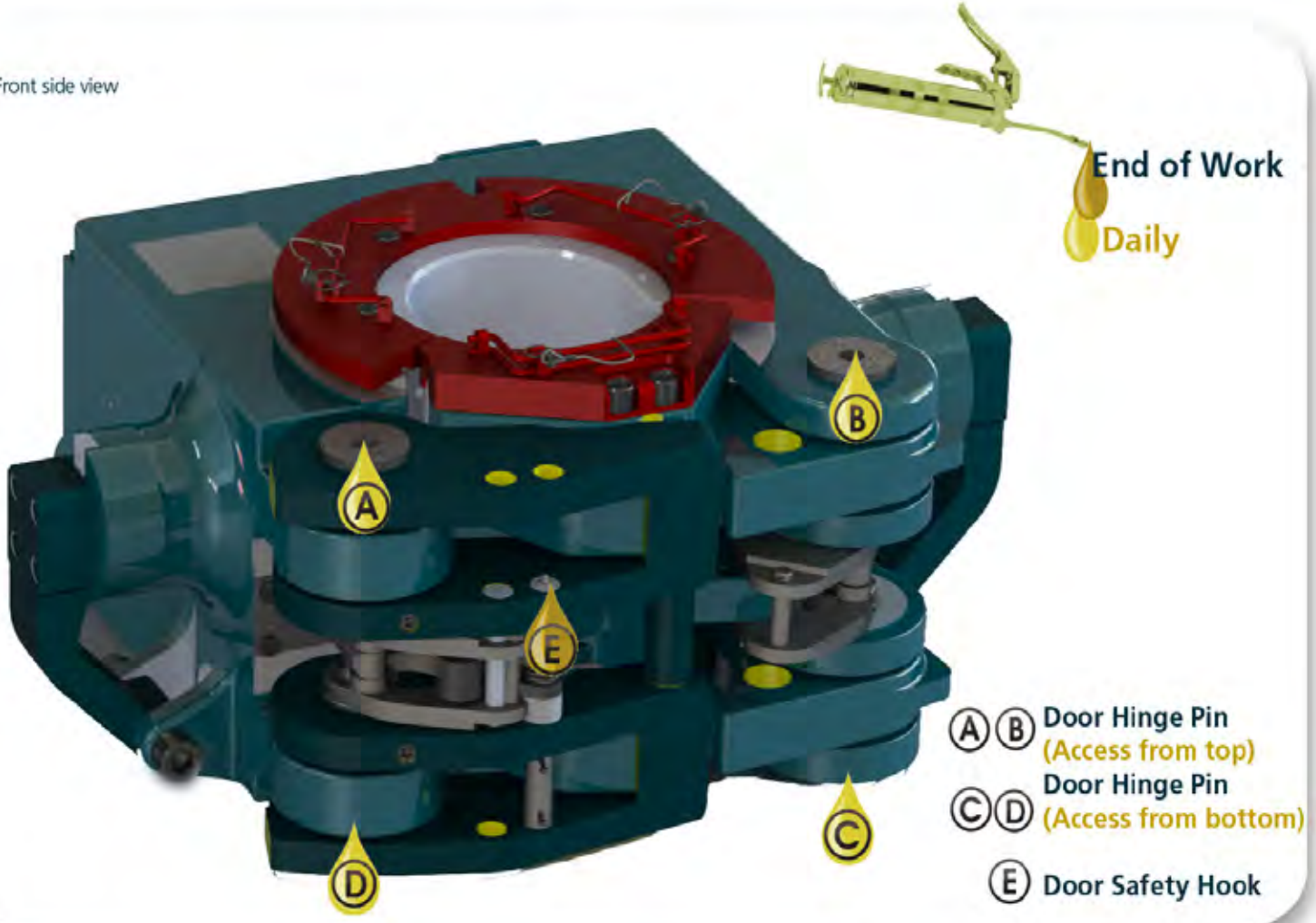
3 Feedback check

1. Perform a full function test (including trigger)
2. Check the mechanical trigger adjustment
3. Check signal function on display (cyberbase screen)

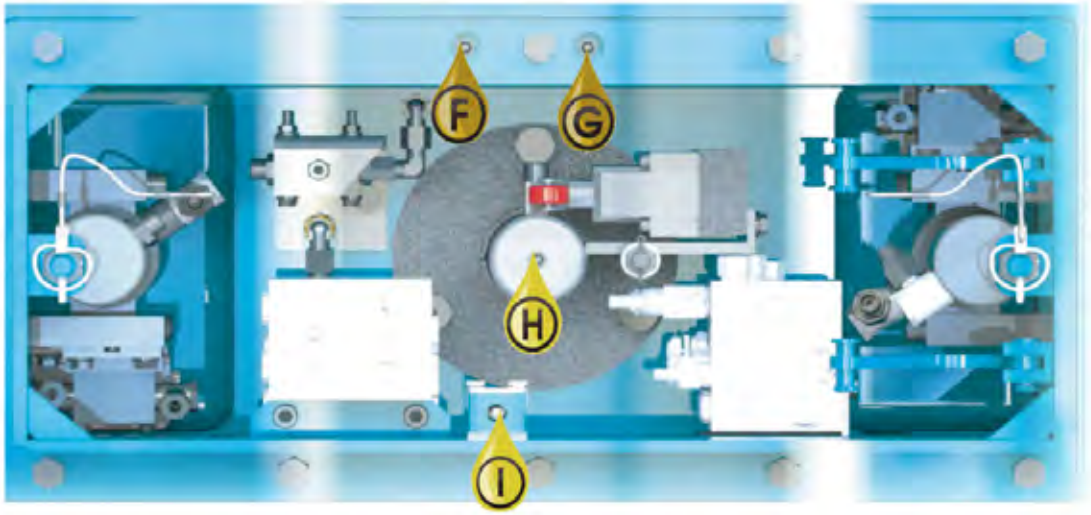
FORUM Handling Tools

Fig. 154: Daily Inspection Overview - Example for VES SD 500-1 VC

Front side view



Back side view



6.2 Inspections

Perform inspections in compliance with API RP 8B at specified intervals and in inspection categories. Otherwise the frequency of required inspections is dependent on the conditions of use of the Insert Bowls type series.

Before inspection remove all foreign material such as dirt, paint, lubricants, oil, abrasion, etc. from the affected parts. Use suitable methods such as stripping off paint, steam cleaning, sand blasting, etc.

After an operating inspection, the scope and results of the tests performed should be documented and retained.

Periodic inspections and inspections following critical assignments should be performed at the operating location by the operators under the supervision of a supervisor.

In the event of cracks, excessive wear, etc. contact FORUM Handling Tools or an authorized service company.

INFO

Specified maintenance intervals are recommended for theVES SD during its service life. The necessity of inspections depends primarily on the following conditions:

- Ambient conditions
- Load cycles
- Regulatory requirements
- Period of use
- Tests
- Repairs
- Overhauls

6.2.1 Inspection of Hydraulic Equipment

Check the hydraulic equipment daily for leakage. If unacceptably high leakage occurs internally or externally contact FORUM Handling Tools or an authorized service company.

6.2.2 Inspection Following Critical Loads

Perform an inspection IMMEDIATELY following any critical or unexpected loads. Critical loads could be:

- Loads resulting from shock when the drill pipe sets,
- Pulling wedged drill strings,
- Holding heavy drill pipes / drill strings
- Jarring
- Operation at very low ambient temperatures (<-20 °C / -4 °F).

6.2.3 Inspection Following Removal

Generally the VES SD should be inspected immediately after it is taken out of service temporarily or it is stored.

Moreover, it should be inspected prior to being put back into service.

- It is necessary to disassemble the VES SD in an appropriately equipped workshop to check for excessive wear, deformation, cracks and other damage.
- Perform repair work only in compliance with the manufacturer's recommendations. These are available from FORUM Handling Tools.
- Ensure that welding work on critical parts is performed only by FORUM Handling Tools or an authorized service company in compliance with the welding specifications issued by FORUM Handling Tools.
- If the field inspection indicates that further inspection work is required, remove the VES SD and have it inspected in an appropriately equipped workshop.
- Check carefully for visible wear and material fatigue.

Inspection Intervals

Category	Interval	Preparatory measures
I	Daily	- VES SD in working environment,
II	Weekly	- VES SD on work location
III	Semi-annually	- VES SD on work location - VES SD disassembled
IV	Every 1 years	- VES SD on work location - VES SD disassembled

6.3 Inspection Categories

Always perform a complete inspection according to the instructions in Categories III or IV before AND after critical loads (6.3.2).

INFO

Inspection categories in accordance with API RP 8B

6.3.1 Inspection Category I

This category consists of observing the equipment during operation for signs of inadequate operation.

Scope/Prerequisites

- During operation, check the equipment daily for visible damage such as cracks, breaks, loose connecting elements and obvious signs of wear.

Procedure:

- Visual check.
- Check for proper function.
- Ensure that this check is performed by a person with appropriate technical knowledge.

6.3.2 Inspection Category II

Category II includes additional tests not included in, but in addition to Category I inspections.

Scope/Prerequisites

- Check for signs of corrosion, deformation, loose or missing parts, aging processes, proper lubrication, externally visible cracks and adjustment work.

Procedure:

- Category II inspections may require removal of certain parts to assess the wear limits according to the specified tolerances.

6.3.3 Inspection Category III

Category III includes additional tests not included in, but in addition to Category II inspections.

Scope/Prerequisites

- Before inspection remove all foreign material such as dirt, paint, lubricants, oil, abrasion, etc. from the affected parts. Use suitable methods such as stripping off paint, steam cleaning, sand blasting, etc.

Procedure:

- Non-destructive testing (NDT) is required in critical areas as well as removal of certain parts to determine the wear limits according to the specified tolerances (refer to section „Critical Areas“ on page 141) for designated areas).

6.3.4 Inspection Category IV

In addition to the inspections in Category III, Category IV includes removal of all primary, load-bearing parts for non-destructive testing (NDT).

Scope/Prerequisites

- Appropriately equipped workshop
- Remove all primary load-bearing parts or parts critical for operation to such an extent that complete inspection is possible.
- Inspect all parts for excessive wear, cracks, deformation and other damage.
- Inspect critical areas as well as removal of certain parts to determine the wear limits according to the specified tolerances.

Procedure:

- Ensure that all tests are performed according to the manufacturer’s specifications.

Before inspection remove all foreign material such as dirt, paint, lubricants, oil etc. from the affected parts. Use suitable methods such as stripping off paint, steam cleaning, sand blasting, etc.

6.3.5 Inspection tasks list table

INFO

The following check lists serve as copy templates for inspections to be performed in compliance with API 8K

Task / Interval	Daily	Weekly	6 Monthly	1 Year
Ongoing observation.	✓	✓	✓	✓
Ongoing cleaning.	✓	✓	✓	✓
Visual inspection and repair (if needed)	⚠	⚠	⚠	⚠
Check status of Equipment lubrication	✓	✓	✓	✓
Check for loose , missing parts and completeness of warning labels	⚠	⚠	⚠	⚠
Check hoses for signs of cracks, wear or abrasion	✗	⚠	⚠	⚠
Check proper engagement of all parts	✗	✓	✓	✓
Check the turnbuckle jaw nut to ensure tightness. Hand tighten as necessary	✗	✓	✓	✓
Check the turnbuckle threads to ensure no rust. Clean and lubricate as necessary	✗	✓	✓	✓
Condition and completeness of warning labels.	✗	✗	⚠	⚠
Check for visible cracks, breaks, elongation, corrosion, damages, wear.	✗	✗	⚠	⚠
NDT testing of all critical parts.	✗	✗	✗	⚠

Caption:

✗ Not necessary

✓ Necessary

⚠ Safety task!
Take out of Service for repair, if NOK!

6.3.6 Inspections cover sheet

INFO

The following check lists serve as copy templates for inspections to be performed in compliance with API 8L and are required to file performed inspections as defined in the user manual [.refer to section 6.4.5 “Inspection tasks list able” on page 135]

Ensure that maintenance work is accomplished only by sufficiently qualified and trained personnel.

Machine model	☐ Double Door Elevator VES SD –
Serial number	
Part number	

☐ Inspection Category I

Date / Place of Inspection	Checked OK NOK	Name of Inspection Operator / Supervisor	Sign.
	☐ ☐		

Remarks:

☐ Inspection Category II

Date / Place of Inspection	Checked OK NOK	Name of Inspection Operator / Supervisor	Sign.
	☐ ☐		

Remarks:

☐ Inspection Category III

Date / Place of Inspection	Checked OK NOK	Name of Inspection Operator / Supervisor	Sign.
	☐ ☐		

Remarks:

☐ Inspection Category IV

Date / Place of Inspection	Checked OK NOK	Name of Inspection Operator / Supervisor	Sign.
	☐ ☐		

Remarks:

6.4 Measuring of wear

It is obvious that a visual inspection is not enough to check a lifting device like the VES SD. To measure link ears it is necessary to use calipers and a ruler.

Significant wear is restricted to the top link ear, it is here that the measurement is taken. Hinge Pins, Latch Pins and socket holes are not normally measured for wear in the field. When it becomes apparent that the Hinge or Latch Pins have more tolerances, the Elevator should be dismantled for general engineering check up.

For Double Door Elevator VES SDs a rule marked in sixteenth of an inch as adequate. The straight edge of a rule is used to check the squareness of the top bore and the end of a rule is inserted into the worn pockets and ridges. Wear of $^1/_{16}$ inch (1,6 mm) or more should require refacing of collar surface.

6.4.1 Wear at the Tool Joint of a Drill Pipe

The Elevator wear is measured directly at the pipe inlet of the Elevator. The maximal wear at the bore is:
Nominal pipe size + 0,25 inch.

(Ⓐ = Tool joint diameter, Ⓑ = Actual Center Bore)

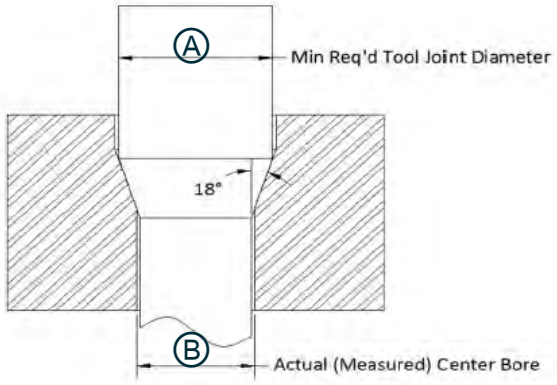


Fig. 155: Minimum A and B for VES SD Elevators

INFO

Example to Tool Joints table:

5 DP Bushing, rated 500 t

1. Actual Centre Bore is $5.^1/_2$
   Follow vertical to 500 t
2. Follow horizontal to scale

» Required Tool Joint is A= 7.3

The following table shows the minimum required Tool Joint diameter, depending on the Centre Bore. As soon as the Tool Joint diameter falls below the rating line, the bushing/ Elevator or the pipe has to be changed
(Contact FORUM Handling Tools or a FORUM Handling Tools authorized Repair Centre).

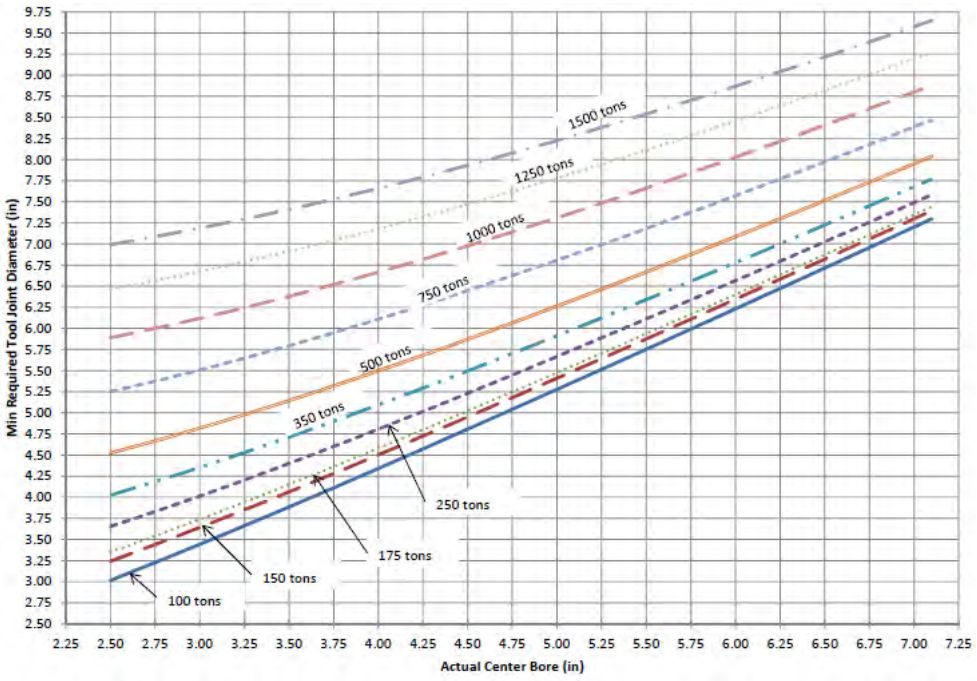


Fig. 156: Minimum A for Tool Joints

6.4.2 Minimum ear dimensions

WARNING Minimum ear dimensions are only valid when the Elevator is in otherwise good condition, does not have excessive wear, cracks or other defects or previous weld repair and has not been misused. This inspection criteria can not on their own determine the overall condition of the Elevator and suitability for continued use.

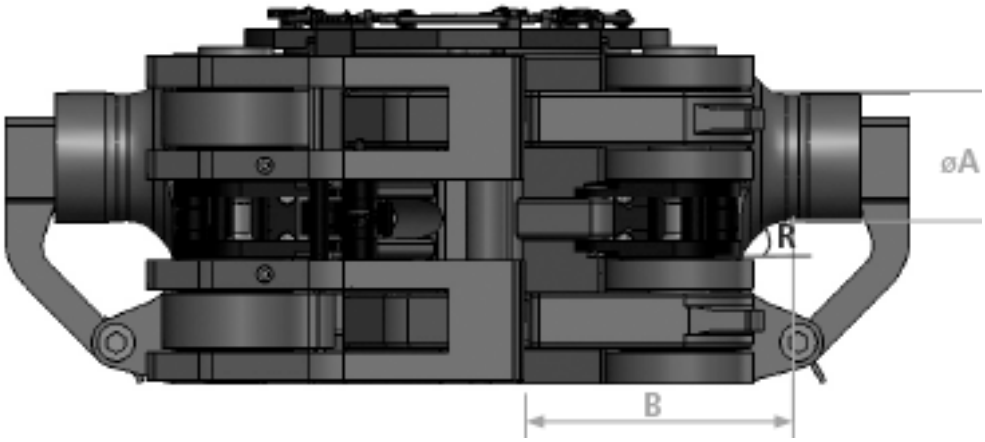


Fig. 157: Minimum ear dimension

Type Series in [mm]	VES-SD 350	VES-SD 500 / 1	VES-SD 500 / 2	VES-SD 500 / 3	VES-SD 750
Elevator Ears					
Dimension, A	4,9 [124,5]	5,9 [149]	5,9 [149]	5,9 [149]	8,4 [213]
Radius, R	-*	-*	-*	-*	-*
Dimension, B	-*	-*	-*	-*	-*

* on request

6.4.3 Hinge and Latch wear data criteria

Fig. 158: Minimum ear dimension

All kind of repairs not performed by FORUM Handling Tools , should nevertheless be done in accordance with their methods and procedures or with their agents. Minor cracks or defects, which may be removed without reducing safety or operation of the , can be removed by grinding. Following the repair, the parts should again be inspected by an appropriate method to insure that the defect has been completely removed.

Type Series in [mm]	VES-SD 350	VES-SD 500 / 1	VES-SD 500 / 2	VES-SD 500 / 3	VES-SD 750
Hinge Pin – Standard					
Nominal Bore Diameter	2,95 [75]	2,95 [75]	3,15 [80]	3,15 [80]	2,95 [75]
① Pin Ø New (min)	2,95 [75]	2,95 [75]	3,15 [79,9]	3,15 [79,9]	2,95 [75]
② Bore Ø New (max)	2,96 [75,106]	2,96 [75,106]	3,15 [80,1]	3,15 [80,1]	2,96 [75,106]
③ Bore Ø Worn (max)	2,98 [75,606]	2,98 [75,606]	3,17 [80,6]	3,17 [80,6]	2,98 [75,606]

* Applies to Critical Lugs Only. Spring Retainer Lugs are exempt from this requirement.

6.4.4 Critical Areas Double Door Elevator VES SD

Check critical areas shown according to inspection check lists.

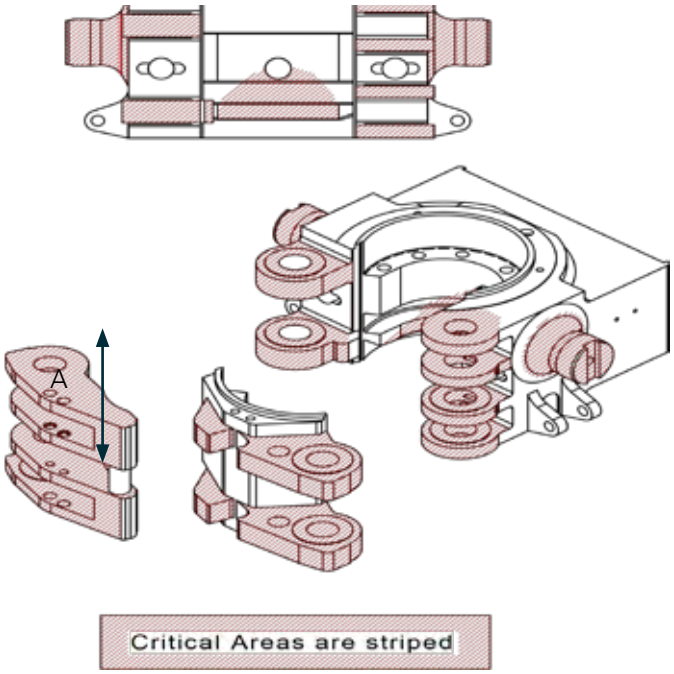


Fig. 159: Critical Areas VES SD 350 / 1 and VES SD 500 / 1

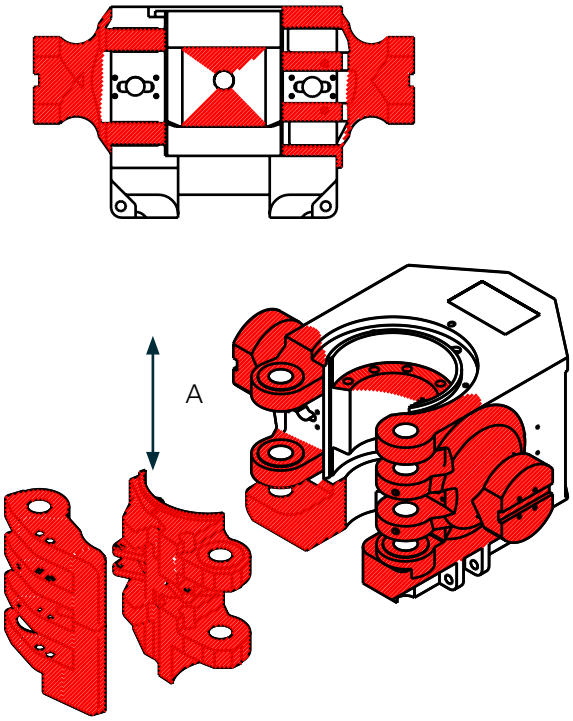
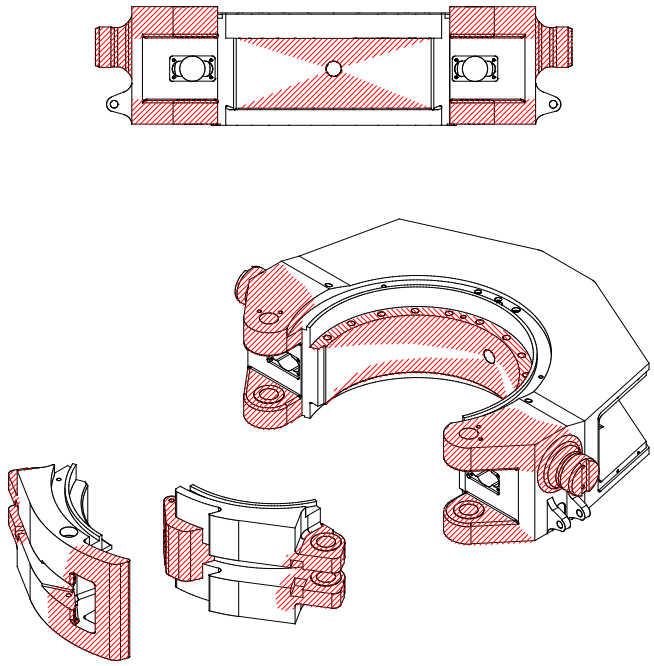


Fig. 160: Critical Areas VES SD 750



Critical area's are hatched.

Fig. 161: Critical Areas VES SD 500-2 and VES-SD 500-3

6.5 Wear Check of bushings

Normal wear of bushings and Elevator ears caused by usage will eventually reduce the load capacity of elevators.

The existence of cracks or the appearance of defects can indicate severe deterioration and even failures. Prompt attention is required either to remove the Elevator from service immediately or to undertake appropriate repair.

A wear condition in its early stages is common. Frequently, it results in a Equipment joint sticking to the Elevator.

Elevators showing hammer marks around the top of the bore should be closely examined to determine whether it is the Elevator, the Equipment joint or both are faulty.

To identify the conditions of the 18° Elevator taper gauges are available for all FORUM Handling Tools Elevators (P/N 600018).

A set of gauges consists of an 18° gauge (GOOD) and a 15° gauge (BAD)

How to check the bushing or Bore Code of the Elevator the correct way

1. Fit the gauge to the inner bore of the bushing.
2. Push the gauge against the bushing and start to move the gauge downwards until the chamfer touches the 18° shoulder or the bore.
3. Check the result as follows.

Check of results

1. Using the GOOD gauge: If the gauge sits directly on the bushing without showing any clearance between gauge and bushing, the bushing is OK.
2. If the gauge shows space between the gauge and the bushing, you have to check with the second gauge.
3. Using the BAD 15° gauge: If the gauge shows any clearance between gauge and bushing, the bushing is OK.
4. If the gauge sits directly on the bushing without showing any space between gauge and bushing or BC, take the Elevator out of service.

⚠ **CAUTION** The results have to be evaluated in a conservative way.

» If the taper is less than 15° take the Elevator out of service or exchange the bushing.

» If the taper is between 18° and 15°, reduce the elevators load capacity to 90%.

⚠ **CAUTION** Never use the Elevator without a bushing.

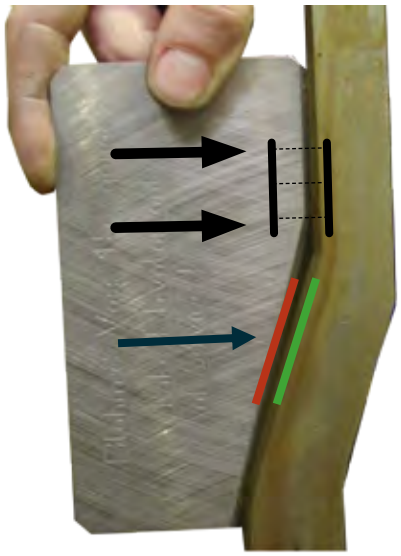


Fig. 162: Position the 18° and 15° gauge

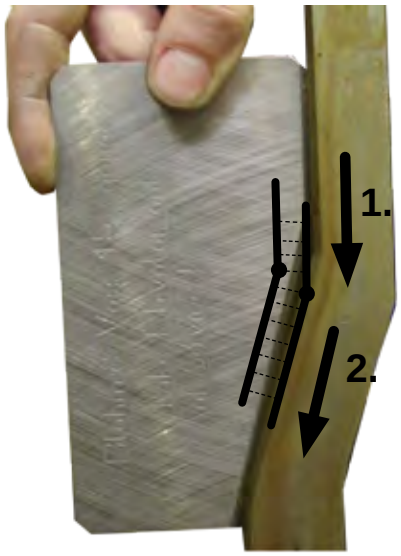


Fig. 163: Move for measurement

Fig. 164: 18°and 15° Gauge (P/N 600018)

6.6 Cleaning

⚠ WARNING

Health hazards from service products!

Splashes of diluted drilling mud and small parts.

ALWAYS wear your personal protective equipment.

WEAR EYE PROTECTION!

WEAR PROTECTIVE GLOVES!

The operating conditions and operating environment result in contamination on the VES SD. Remove this contamination regularly to prevent incrustation and ensure safe operation of the Equipment.

6.6.1 Time of Cleaning

Clean contamination from drilling from the VES SD regularly. The Equipment should be cleaned thoroughly at the end of each shift at the latest. Also observe the instructions (refer to section 6.4.5 “Inspection tasks list able” on page 135)..

6.6.2 Procedure and Cleaning Agents

FORUM Handling Tools recommends cleaning the VES SD with a high pressure steam cleaner.

Use it to clean the body thoroughly from inside and outside..

STORAGE / DISPOSAL

STORAGE / DISPOSAL

7 Storage / Disposal

This section deals with procedures to be taken to the storage after the decommissioning of the VES SD. The aim is to protect the Equipment, the environment and people from damages. Therefore FORUM Handling Tools recommends to read and implement the following procedure accurately.

7.1 Storage of the entire device

Storage procedure

1. Store the equipment on a pallet located on an even, supporting surface.

» Observe the weight specifications in the technical data.

2. Ensure that the equipment is stored so that no person can be injured by moving parts or sharp edges.
3. Secure the equipment with tensioning cables or in another manner to prevent it from slipping or tipping when moved. .
4. Grease the equipment as described in section "Lubrication".
5. Conserve all bare metal surfaces.
   FORUM Handling Tools recommends the use of a lubricant or Tectyl.

» These surfaces should be checked periodically to be sure that no corrosion has occurred.

6. Protect the equipment against water penetration with a plastic tarp

Short-term storage for less than three months

Lubrication	
Protection of tools	• Apply lubricant to all bare surfaces (e.g. cylinders). • Protect all other bare surfaces with Tectyl Type 864 or an equivalent agent.
Ambient Conditions	• Store in dry surroundings (maximum humidity 80%).

Short-term storage for less than three months

Lubrication	
Protection of tools	• Apply lubricant to all bare surfaces (e.g. cylinders). • Protect all other bare surfaces with Tectyl Type 864 or an equivalent agent.
Ambient Conditions	• Store in dry surroundings (maximum humidity 80%).

Fig. 165: Correct Storage I

Fig. 166: Correct Storage on palette

Fig. 167: Correct Storage on palette boxes

7.2 Disposal

When used properly the Equipment does not pose any hazard for users or the environment.

However, operation of FORUM Handling Tools equipment requires use of hydraulic fluids, lubricants and/or cleaning agents, which can pollute the environment. For this reason always ensure that such substances are disposed of properly in accordance with international, national and local regulations.

Never dispose of hydraulic fluids, oils, greases, oily cleaning rags or oily water together with industrial or domestic wastes.

Observe the safety data sheets published by the manufacturers on environmental hazards and disposal of the service and operating products used.

Ensure that all service and operating products as well as replacement parts are disposed of safely and ecologically.

Please note specifically that FORUM Handling Tools is not obligated to take back used equipment.

List of Service Products Used

The Safety Data Sheets on the service products used are included in the appendix to this operating manual.

Our goal is to become the leading provider of mission critical oilfield products and related services in terms of customer satisfaction, safety and financial performance.

Our experienced management team and employees are dedicated to solving our customers' problems. We invest in long term relationships and cooperate on product development with our clients, we consider them our partners.

OUR CORE VALUES

Integrity: In everything we do, in every interaction, both internally and externally, we strive to operate with the upmost integrity and mutual respect.

Customer focused: Our products enhance our customer's performance and we listen to their needs and work with them to solve their challenges.

Good place to work: We are committed to creating a workplace that fosters innovation, teamwork and pride. Every team member is integral to our success and is treated equally and fairly.

No one gets hurt: The safety of our employees and customers is our first priority coupled with a healthy respect for the environment.

FORUM™
ENERGY TECHNOLOGIES

FORUM Handling Tools

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1023 Forum Drive
Broussard, LA 70518 (USA)
tel: +1.337.373.1800
fax: +1.337.369.6893

APPENDIX

APPENDIX

8 Appendix

A. Sample of EC Declaration of Conformity

FORUM B + V Oil Tools GmbH

EC-DECLARATION OF CONFORMITY

We, **FORUM B + V Oil Tools GmbH**
Hermann-Blohm-Strasse 2
20457 Hamburg / Germany

declare that the products: [refer to section 1.3 "Technical Data Type series" on page 19]

which is the subject of this declaration, fulfils all of the relevant requirements of:

2006/42/EC	Machinery Directive,
2014/34/EC	ATEX Directive of Equipment for use in ha

Amongst others following harmonized and technical standards and specifications were used:

API 8C, 5. Edition	Drilling and Production Hoisting Equipment (PSL1 and PSL2)
DIN EN ISO 13535	Petroleum and natural gas industries - Drilling and production equipment - Hoisting equipment
DIN EN ISO 12100	Safety of machinery, Risk assessment and Risk Reduction
DIN ISO 14121-1	Safety of machinery, Risk assessment
DIN EN 13463-1	Non-electrical equipment for use in potentially explosive atmospheres

Description of Product:

The following named lifting accessory will be described in more detail in the accompanying Data Book and/or certificate and the associated Technical Documentation

Product / Device Type:	[refer to section 1.3 "Technical Data Type series" on page 19]
Rated Capacity	[refer to section 1.3 "Technical Data Type series" on page 19]
Part Number:	[refer to data book]
Serial Number:	[refer to data book]
Delivery Date:	[refer to data book]
B+V Order No.:	[refer to data book]
Marking:	CE Ex II 2G T5

The Engineering Manager of FORUM B + V Oil Tools GmbH, Hermann-Blohm-Strasse 2, 20457 Hamburg, Germany, is authorized to compile the technical files.
Documents in accordance to Directive 94/9/EC Article 8 (1) b) ii) are lodged at IBExU - Institut für Sicherheitstechnik GmbH, Fuchsmühlenweg 7, D-09599 Freiberg, Notified Body No. 0637, reference IB-14-6-001/200, Archive-No. 219/14
FORUM B + V Oil Tools has established a quality assurance system in accordance to ISO 9001 approved by GL System Certification, Hamburg / Germany, Certificate No. QS-8339 HH.

Hamburg, issued on [refer to data book]

Authorized Representative: Name Mathias Theiss
Position Managing Director

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E-Mail: oiltools@f-e-t.com
Internet: www.blohmvoss-oiltools.com
Registered Office: Hamburg
Blohm + Voss is a trademark of Blohm + Voss Shipyards GmbH

Managing Directors: Mathias Theiss , James W. Harris
Commercial Register: District Court of Hamburg, HRB 125 898
Tax-No.: 48/722/02575, VAT-ID. No.: DE 294 745 990
Banking: HSBC Trinkaus & Burkhardt AG
BIC / SWIFT: TUBD DE DD XXX
EUR-Acc.: IBAN: DE73 3003 0880 0012 8350 19
USD-Acc.: 401 / 2935 / 008 / IBAN: DE50 3003 0880 4012 6350 08

Fig. 168: EC Certificate of Conformity Sample Page

B. Third Party Documents

I Safety Data-Sheet

Material Name	Link to file
[Aerosol] Krylon Paint Aerosols	
[Aerosol] Rust O Leum Paint Aerosols	
[Hydraulic Fluid] Aral Vitam GF 32	
[Hydraulic Fluid] Citgo AW 68	
[Hydraulic Fluid] Conoco Megaflow AW 32 68	
[Hydraulic Fluid] Shell Tellus S2 M 32	
[Hydraulic Fluid] Shell Tellus S2 M 68	
[Hydraulic Fluid] Shell Tellus S2 V 15	
[Hydraulic Fluid] Shell Tonna S2 M 68	
[Lubricant] Buster 2007	
[Lubricant] AVIATICON FETT XRF	
[Lubricant] KO5	
[Lubricant] Lubrimatic Multipurpose Lithium	
[Lubricant] MasterPro Hi Temp WB	
[Lubricant] Mobil CM L	
[Lubricant] Mystik JT 6 Multi purpose #2	
[Lubricant] Permatex 767 Anti Seize Lubricant	
[Lubricant] Shell Gadus S2 V220 2	
[Lubricant] Shell Stamina RLS 2	
[Lubricant] Sprayon LU 100 White Lithium	
[Lubricant] Super S Hi Temp Red	

Material Name	Link to file
[Lubricant] Thermaplex Hi Temp Bearings	
[Paint] Paint Gallon	
[Paint] Paint Marker	
[Paint] Paint Marking Ink	
[Paint] Ruthless Paint and Varnish Remover	
[Paint] Startex Paint Thinner	
[Paint] Uni Paint Markers	
[Safety adhesive] Loctite 242 Threadlocker	
[Safety adhesive] Loctite 262 (High Strength)	
[Safety adhesive] Loctite 515 Gasket Eliminator	
[Safety adhesive] Loctite Clover Compound	
[Safety adhesive] Loctite Silver Grade Anti Seize	

II Components

Component Name	Link to file
[Safety Washer] NordLock	
[Lifting] RUD VRS Starpoint	
[Lifting] RUD VLBG Load Ring	

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No one gets hurt: The safety of our employees and customers is our first priority coupled with a healthy respect for the environment.

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