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FORUM ENERGY TECHNOLOGIES

Operation Maintenance Manual • Handling Equipment • Hoisting Equipment

Automated-Multi-Pipe Elevators AMP® Type Series

Hydraulic operated elvator [with optional rotators]

Operating Instructions

Original Operating Instructions

Type	P/N	Rated Capacity	Type	P/N	Rated Capacity
AMP®-350/1	638100-Y-350	350 tons	AMP®-500/2	648200-Y	500 tons
AMP®-375/1	638100-Y-375	375 tons	AMP®-750/1	678100-Y	750 tons
AMP®-350/2	638200-Y	350 tons	AMP®-1000/1	618100-Y	1000 tons
AMP®-500/1	648100-Y	500 tons	AMP®-1250/1	688000-Z	1250 tons

Manual PN 688000-Z-D Revision: 06, 07-2018

FORUM Handling Tools

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02	2015-05	B+VOT ROK, ROK, MH	Address, Installation schematics and service update
03	2015-11	Forum B + V Oil Tools, ROK, MH	Company Name Change, Layout Change, AMP® 375-1 added, Type Series Update
04	2016-04	Forum B + V Oil Tools, OK, MH	Document Update, AMP®-350/1 added to Type Series
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Document Approval

Version	Author	Eng. Check	Appoval Check
06	FORUM Handling Tools St.S 07-2018	FORUM Handling Tools as per revision 5	FORUM Handling Tools as per revision 5

API Q®
7K-0001
8C-0037

All data in this manual takes place using best knowledge. This manual is based on the latest product information that was available at the time of printing. Depending on ongoing technical improvements (ISO 9001), FORUM Handling Tools reserves the right to alter the design and specifications without notice. The values specified in this manual represent the nominal value of a unit produced in series. The values in individual units may have slight differences.

Only with written consent from FORUM Handling Tools may the contents of this instruction manual be passed on to third persons. Procedure descriptions and explanations are not to be passed on to third persons.

Copying or multiplying for internal use is permitted.

We are grateful for suggestions and comments regarding this documentation or the product itself.
oiltools@f-e-t.com

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A. General

I Basic Information

This operation maintenance manual (hereinafter-called OMM) refers to the Automated-Multi-Pipe Elevators (hereinafter-called AMP®) Type Series from FORUM Handling Tools for use on oil drilling platforms and rigs.

This OMM covers several different FORUM Handling Tools models from the AMP® 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 OMM is intended for the operator of the AMP®. It is intended to ensure safe operation and must be read carefully and kept where it is accessible for AMP® users at all times.

This OMM contains all information on safe and proper operation of the AMP®. 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 AMP® is designed to be used vertical in hanging links. The AMP® conduces as an association between the Top Drive, the Link and the drill tubes. The load capacity of the elevator is designated by the Type Series model. The load capacity is limited in vertical direction only.

Due to replaceable bushing segments and a positive locking mechanism it is possible to operate the AMP® by one man. The design of the bushing segments allows the AMP® 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 operation only.

This OMM contains all information on safe and proper operation of the FORUM Handling Tools AMP®. Observance of these instructions is the prerequisite for safe operation.

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 OMM, 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 AMP® is allowed for the intended use only. All FORUM Handling Tools AMP® 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 equipment releases FORUM Handling Tools from any liability for personal injury or property damage resulting therefrom.

The AMP® is intended exclusively for lifting and holding the specified pipes in conjunction with the use of the FORUM Handling Tools products Elevator Rotator System. Refer to the specifications in chapter „1.4 Technical Data", on page 19.

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.
- Holding pipe taper for which use is not specified.
- Increasing the load limit of the AMP®.
- Every use of the AMP®, which is not intended.

Moreover, operation of the AMP® is prohibited under the following conditions:

- When the AMP® is used for applications other than intended.
- When the hydraulic equipment is not installed properly.
- When the AMP® 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 AMP® is not operating properly.
- When humans or foreign objects or personnel are located in the hazard area of the AMP®.
- When conversions or modifications have been performed without previous, written approval by FORUM Handling Tools.
- When equipment 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 companies not authorized by FORUM Handling Tools have performed repair or service work on the equipment.

Observe also the chapter "Warranty and Liability".

IV Potential Misuse

This OMM contains information and warnings on procedures that address 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 AMP® or service procedures contained within this OMM must be completely satisfied that personal and/or AMP® 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 AMP® 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 AMP® in methods not intended. The AMP® should be used ONLY in the methods described in this OMM.

V Warranty and Liability

Liability

The technical information, data and instructions for operation contained in this OMM 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 expertise.

We reserve all rights to make technical modifications within the scope of technical development of the Automated-Multi-Pipe Elevators treated in this OMM. Claims or entitlements cannot be deduced or derived from information, illustrations and /or descriptions in this OMM. 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-operating safety and/or protective equipment;
- 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 Automated-Multi-Pipe Elevators 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. 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 AMP® must be trained by the operating company for the work performed on and with the AMP®.

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 only qualified personnel perform work on the AMP®.
- The operating company must authorize the personnel for such work.
- The personnel must wear the prescribed protective equipment.
- Procedures, competencies and responsibilities must be clearly defined and established in the area of the AMP® Proper behaviour 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 AMP® 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 AMP® is in operation where it is easily accessible for everyone and in an easily legible condition.
- Use the AMP® exclusively for its intended purpose.
- Use the AMP® 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 AMP® includes knowledge of the general safety precautions. Ensure that the AMP® 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 AMP® 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 AMP® 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 AMP®.
- Sufficient qualifications for working on the AMP® 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. • Behaviour 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 AMP.

Special Technical Knowledge

Only specially trained personnel should perform the following work:

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.

⚠ 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 sections or sections. They apply for the entire section 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** 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 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

1. Shut off Equipment.
2. Disconnect supply lines.
3. Attach Equipment to crane.
4. ...

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.

Sequential numbers (1, 2, 3 ...) in the left margin indicate enumerations in a certain sequence (e.g. a series of work steps).

For example:

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

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 AMP®

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 AMP® satisfies all requirements in applicable directives and standards. A sample of the EC Declaration of Conformity is given in the appendix.

INFO

This OMM is a part of the technical documentation for the AMP®. The EC Declaration of Conformity is delivered together with the AMP®. Keep these instructions and the associated documents for later use.

XI Contact 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
E-Mail: 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-Standorte

Email: ForumDP.Sales@f-e-t.com

Canada

Nr. 106, 3903 - 75 Ave
Leduc, Alberta T9E 0K3
Tel: + 1 780.980.0345
Fax: + 1 780.986.3278

Mexico

Avenida Avante Monterrey N 300
Parque 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

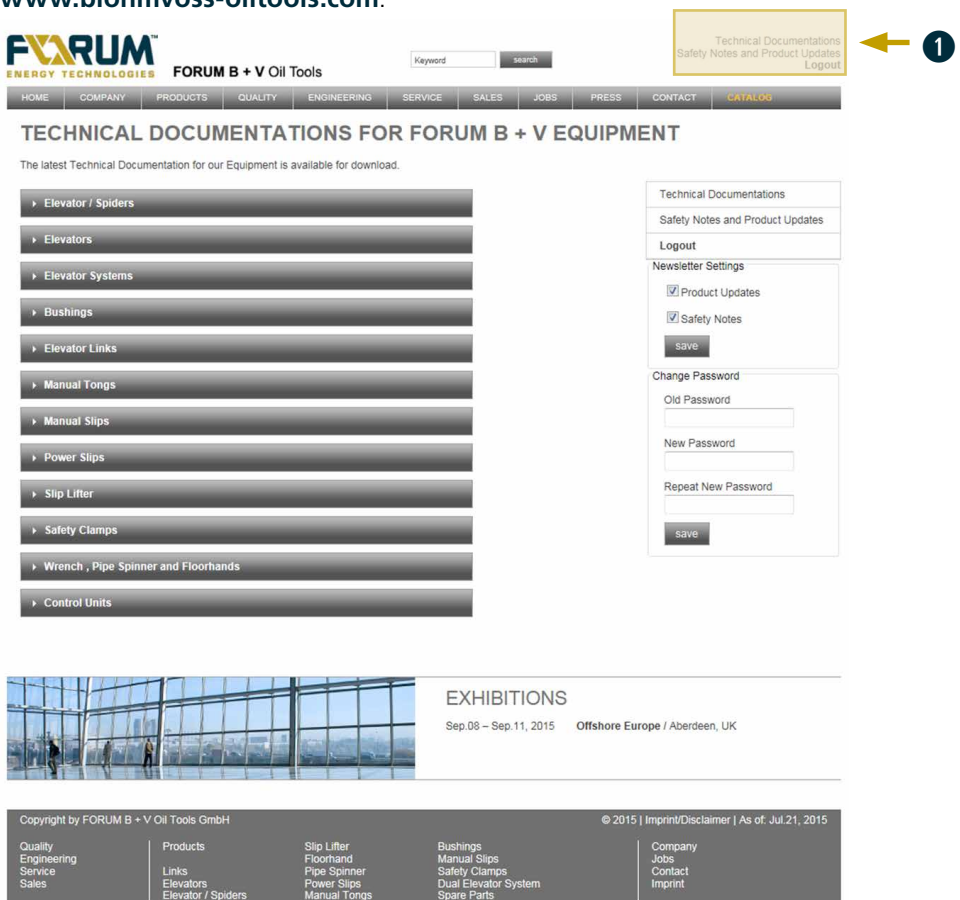
No 51 Benoi Road #06-00
Liang Huat Industrial Complex
629908
Tel: + 65.6465.4850
Fax: + 65.6465.4851
Out of hours
+ 65.913.898.12

XII Information on the FORUM Handling Tools home page

INFO

For further and actual information, you can also visit our home page 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 FORUM Handling Tools home page. To join our internet Technical Documentation service with the latest updates on new technical documentation in a casual way, you must register to our service with your email-address and name in the customer-login area ❶ on **www.blohmvoss-oiltools.com**.



XIII Information via Extranet

INFO

For further and actual information, you can also visit our Extranet home page.

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 casual way, you must register to our service with your email-address and name in the customer-login area ❶ on **https://www.accessoiltools.com/fx/**.

Fig. 2: Illustration Service–Extranet

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DESCRIPTION

1 Description

The FORUM Handling Tools AMP® Elevators are designed with strength and safety factors in accordance with API Regulations Section 8C - and is to be used for handling long, heavy strings of pipes. Due to replaceable bushing segments and a positive locking mechanism, it is possible to operate the AMP® by one man.

All Elevators are made with a Latch and a Lock to secure the lock mechanism against accidental opening. When the doors and latch are open, the pipe is placed in the AMP®. When the pipe activates the automatic closing trigger, the AMP® automatically closes.

When the AMP® is closed, a hydraulic cylinder moves out. This cylinder is an additional verification function (mechanical and visual).

Not before the AMP® is properly closed and latched and the verification cylinder is completely moved out, 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.

INFO

The load can be hold by the bushing assembly after the AMP® has been closed and latched properly and the feedback signal has been registered by the system/operator.
As long as the pipe load is hold by the AMP® bushings, the load sensor is activated, so the elevator cannot be opened (even by operation failure).

1.1 AMP® Main Assemblies

The AMP® consists of the assemblies described below.

INFO

Please note that this illustration does not reflect the scope of delivery (refer to Chapter „IV Potential Misuse“, on page 6).
FORUM Handling Tools offers bushing assemblies as accessories to match the specific pipe diameters.

Item	Name	Item	Name
1	AMP® Frame	2	Bushing system
3	AMP® Door right	4	Latch
5	AMP® Door left	6	[Hydraulic Assembly]
6	Single Elevator Rotator (optional)	–	Double Elevator Rotator (optional)

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

1.2 Operational Environment

The AMP® is designed and constructed for use in the drilling industry on ships and platforms.

The AMP® complies with the Machinery Directive 2006/42/EC.

The AMP® is approved for operation in explosion hazard areas.
For equipment 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 according to CE (with reference to the ATEX guideline) is as followed:

CE Ex II 2G IIB T5 for hydraulic and pneumatic equipment 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	Temperature class

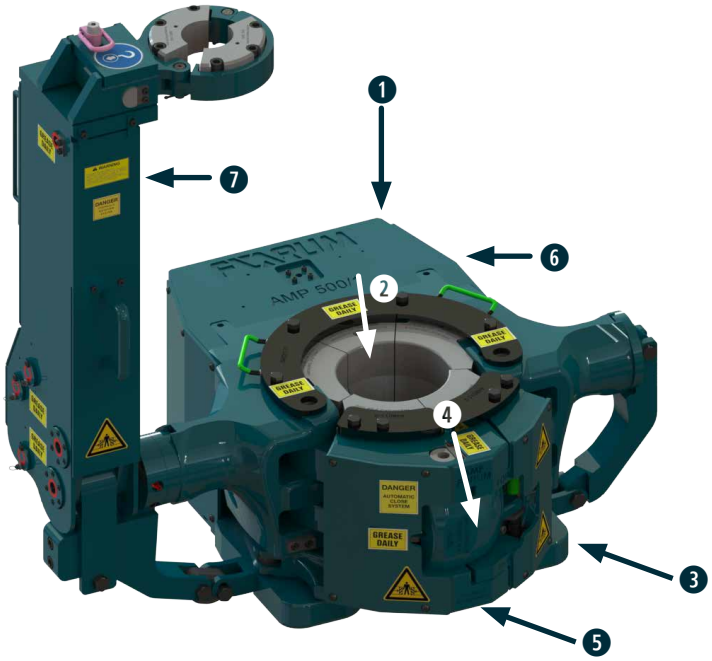

Fig. 3: AMP® with single Rotator Assembly

1.3 Assemblies and Components

AMP® Frame [with door and Latch incorporation]

The AMP® frame is made of high quality, heat-treated and tested steel castings or forgings to meet the high demands and satisfy the strong safety requirements.

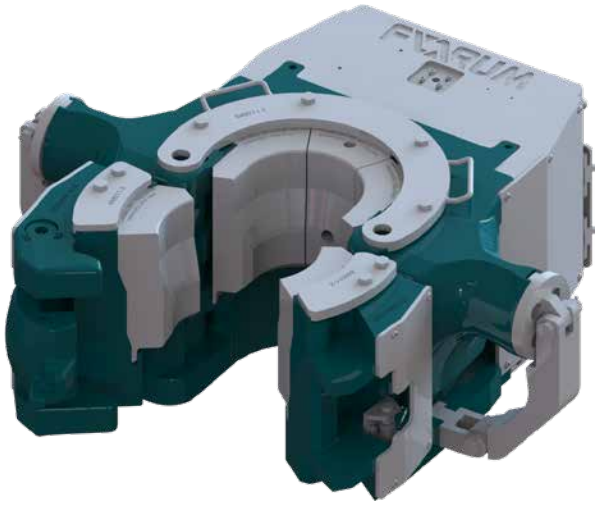

Fig. 4: AMP® Frame, Doors and Latch

Bushing System

The design of the bushing segments allows the AMP® to grip casing with uniform radial pressure, ensuring a safe hold while minimizing the possibility of damage to the pipes.

- The bushings can be mounted individually or connected as assembly using the bushing transport ring.
- The AMP® 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.
- The AMP® is available for hydraulic power bushing operation only. The equipment is approved for operation in explosion hazard areas.

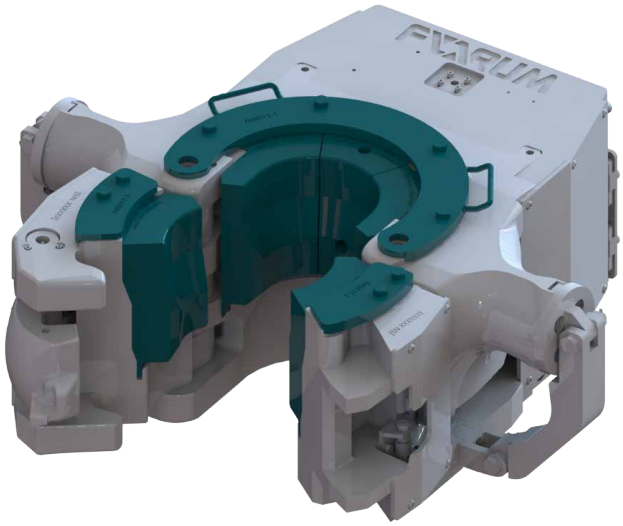

Fig. 5: AMP® Bushing system

AMP® Hydraulic Box and Link Adapter

The hydraulic box contains all the hydraulic components needed to control the AMP®. To enable access to all hydraulic components, the hydraulic box can be opened easily via a door at the rear of the AMP®.

The Elevator-Link Adapters and Link Blocks secure the AMP® to the Elevtor-Links. The design enables quick conversion for using the AMP® with a Single Rotator.

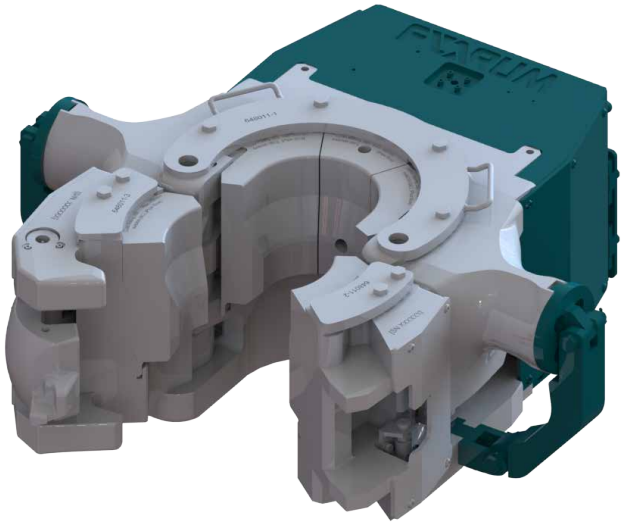

Fig. 6: AMP® Hydraulic Box and Link Adapter

Hydraulic Assembly

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

- The AMP® has four connections on the rear.
  A/P Pressure Line (AMP® Close)
  B/T Return Line (AMP® Open)
  C/XP Feedback (AMP® Closed/Load Sensor)
  FL Signal for Rotator.

- 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 meets the ISO 16028 standard and are ideal for interchangeability with other manufacturers. This feature include the ability to connect with virtually no air inclusion or disconnect with little or no spillage.
  - 3045 psi (210 bar) maximum operating pressure for all sizes (connected and disconnected)
  - Push-to-connect
  - Standard sleeve-locking equipment prevents accidental disconnection

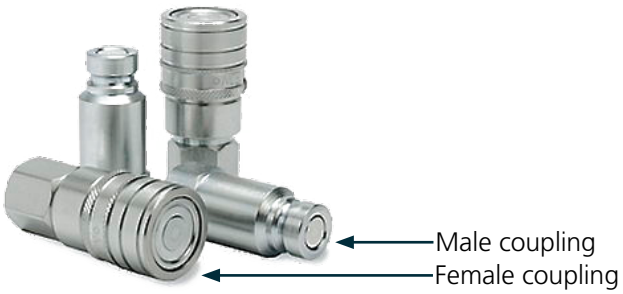

Fig. 7: Hydraulic Connections

Additional Features:

- Closing trigger ❶:
  When the pipe hits the trigger, at first a hydraulic signal is automatically given to close the right, secondly the left door and finally to close the Latch. When the AMP® is fully closed and latched, a hydraulic closing signal (feedback signal) is given.

- AMP® Load Sensor ❷:
  When the AMP® is loaded while lifting a tubular, it is not possible to open the AMP® by mistake.
  The load sensor prevents opening with tubular weights higher than approximately 170 kg (depending which bushing type and sizes are installed).

- Closing signal:
  The pressure value depends on the actual working pressure and adjustment in the control unit.

- Additional visual and mechanical verification function.

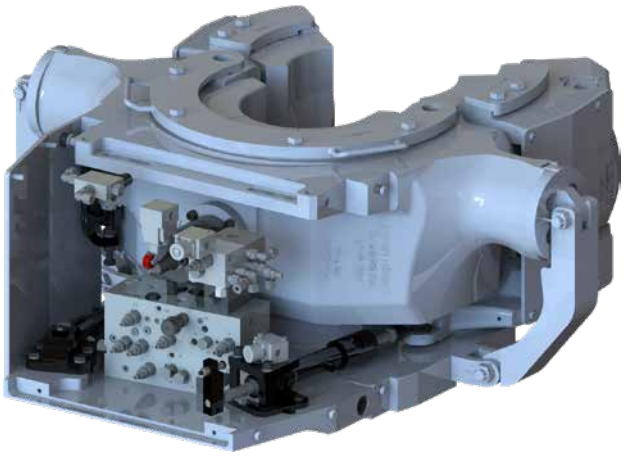

Fig. 8: AMP® Hydraulic Assembly

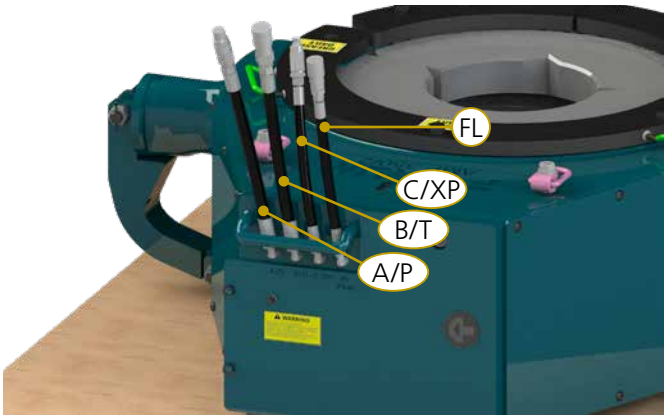

Fig. 9: AMP® Hydraulic connections

Fig. 10: AMP® Trigger

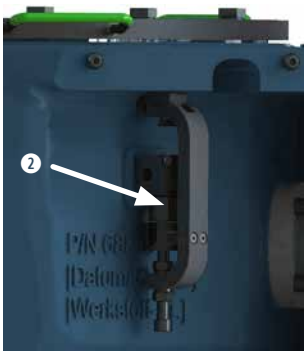

Fig. 11: AMP® Load sensor

1.4 Technical Data

1.4.1 AMP® Type series data

Name	AMP®-350/1	AMP®-375/1	AMP®-350/2	AMP®-500/1	AMP®-500/2
Size	2.3/8" - 11"	2.3/8" - 11"	9.5/8" - 20"	2.3/8" - 11"	9.5/8" - 22"
Capacity	350 tons - 18° 500 tons - 45°-90°	375 tons - 18° 500 tons - 45°-90°	350 tons - 90°	500 tons - 18° 750 tons - 45°-90°	500 tons - 90°
Partnumber	638100-Y-350	638100-Y-375	638200-Y[2]	648100-Y	648200-Y
Rotation System [2]	678800 [Single Rotator - Double Acting] 678801 [Single Rotator - Single Acting] 645 800 [Double Rotator]				
Bushing Assembly	648006-BC	648006-BC	638206-BC	648006-BC	648206-BC
Hook Up Kit	648100-HUK	648100-HUK	648100-HUK	648100-HUK	648100-HUK
Weight [1] kg [lbs]	835 [1840]	835 [1840]	1020 [2248]	855 [1885]	1310 [2888]

Name	AMP®-750/1	AMP®-1000/1	AMP®-1250/1
Size	2.3/8" - 11"	2.3/8" - 11"	5.1/2" to 9.7/8"
Capacity	750 tons - 18° 1000 tons - 45°-90°	1000 tons - 18°	1250 tons - 18° 1500 tons - 45°-90°
Partnumber	678100-Y	618100-Y	688000-Z
Rotation System [2]	678800 [Single Rotator - Double Acting] 678801 [Single Rotator - Single Acting] 645 800 [Double Rotator]		
Bushing Assembly	678 106-BC	618 106-BC	688 006-BC
Hook Up Kit	648100-HUK	648100-HUK	648100-HUK
Weight [1] kg [lbs]	1425 [3142]	1425 [3142]	1950 [4300]

[1] weight without bushing. [2] refer to chapter „1.8 Elevator Rotator Systems", on page 25.

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.

1.4.2 AMP® Technical Data and Dimensions

Main Dimensions

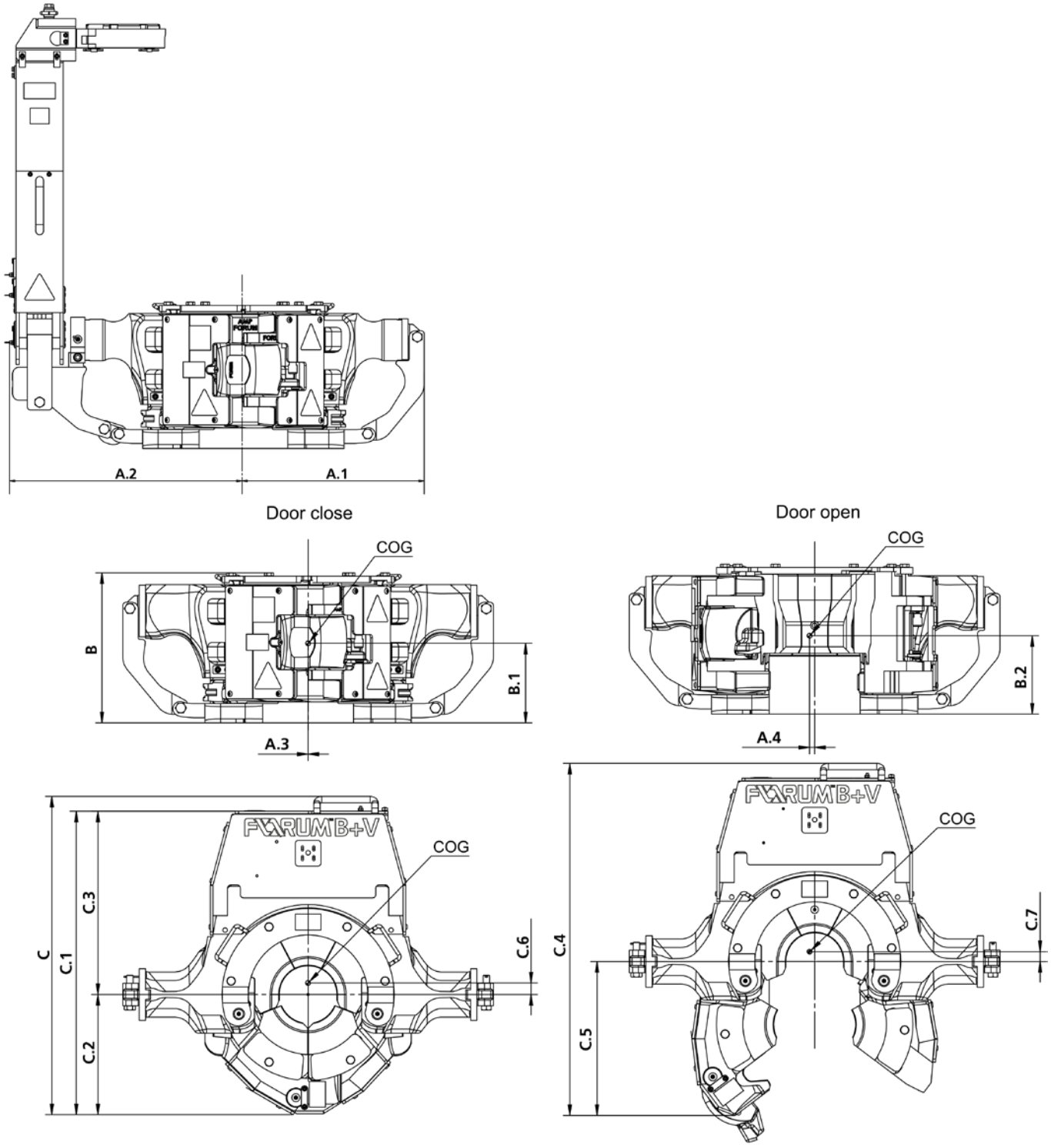

Fig. 12: AMP® Main Dimensions

Technical Data

	Main Dimensions							
	A.1 [inch/mm]	B inch [mm]	C inch [mm]	C.1 inch [mm]	C.2 inch [mm]	C.3 inch [mm]	C.4 inch [mm]	C.5 inch [mm]
AMP®-350/1	22,64 [575,0]	18,32 [465,4]	38,90 [988,0]	37,09 [942,0]	14,69 [373,0]	22,40 [569,0]	43,03 [1093,0]	18,82 [478,0]
AMP®-350/2	27,20 [691,0]	18,11 [460,0]	47,36 [1203,0]	45,55 [1157,0]	18,39 [467,0]	27,20 [691,0]	53,54 [1360,0]	24,53 [623,0]
AMP®-375/1	22,64 [575,0]	18,32 [465,4]	38,90 [988,0]	37,09 [942,0]	14,69 [373,0]	22,40 [569,0]	43,03 [1093,0]	18,82 [478,0]
AMP®-500/1	22,64 [575,0]	18,32 [465,4]	38,90 [988,0]	37,09 [942,0]	14,69 [373,0]	22,40 [569,0]	43,03 [1093,0]	18,81 [477,8]
AMP®-500/2	30,75 [781,0]	18,91 [480,4]	50,18 [1274,5]	48,37 [1228,5]	18,98 [482,0]	29,39 [746,5]	54,50 [1384,4]	23,30 [591,9]
AMP®-750/1	26,97 [685,0]	22,52 [572,0]	43,52 [1105,5]	41,67 [1058,5]	17,15 [435,5]	24,53 [623,0]	48,90 [1242,0]	22,52 [572,0]
AMP®-1000/1	26,97 [685,0]	22,52 [572,0]	43,52 [1105,5]	41,67 [1058,5]	17,15 [435,5]	24,53 [623,0]	48,90 [1242,0]	22,52 [572,0]
AMP®-1250/1	28,19 [716,0]	25,39 [645,0]	46,50 [1181,0]	44,69 [1135,0]	18,15 [461,0]	26,54 [674,0]	52,40 [1331,0]	24,06 [611,0]

	Single Rotator	Center of Gravity - COG					
	A.2 [inch/mm]	A.3 [inch/mm]	A.4 [inch/mm]	B.1 [inch/mm]	B.2 [inch/mm]	C.6 [inch/mm]	C.7 [inch/mm]
AMP®-350/1	29,37 [746,0]	0,02 [0,51]	0,61 [15,48]	7,95 [202,0]	7,80 [198,0]	1,43 [36,4]	1,25 [31,8]
AMP®-350/2	33,86 [860,0]	0,02 [0,40]	0,18 [4,57]	9,87 [250,7]	9,87 [250,7]	2,25 [57,1]	1,37 [34,8]
AMP®-375/1	29,37 [746,0]	0,02 [0,51]	0,61 [15,48]	7,95 [202,0]	7,80 [198,0]	1,43 [36,4]	1,25 [31,8]
AMP®-500/1	30,47 [774,0]	0,02 [0,49]	0,62 [15,77]	9,72 [246,8]	9,57 [243,2]	1,42 [36,0]	1,20 [30,6]
AMP®-500/2	38,58 [980,0]	0,01 [0,30]	0,30 [7,60]	10,35 [262,9]	10,35 [262,9]	1,73 [44,0]	0,39 [10,0]
AMP®-750/1	32,01 [813,0]	0,01 [0,16]	0,52 [13,17]	12,08 [306,8]	12,08 [306,81]	1,23 [31,2]	0,51 [12,9]
AMP®-1000/1	32,01 [813,0]	0,01 [0,16]	0,52 [13,17]	12,08 [306,8]	12,08 [306,81]	1,23 [31,2]	0,51 [12,9]
AMP®-1250/1	34,41 [874,0]	0,02 [0,54]	0,69 [17,59]	13,75 [349,2]	13,75 [349,36]	1,12 [28,6]	0,44 [11,1]

General Data (Valid for AMP® Type Serie)	
Working pressure	Min 140 bar (2030 Psi), Max 210 bar (3046 Psi)
Maximum allowed pressure	210 bar (3046 Psi)
Minimum required Oil clearness	NAS 9
Required Flow rate	Min 6 Gpm (22,7 l/m) Max 10 Gpm (37,9 l/m)
Temperature working range*	- 20°C to + 50°C - 4° F to + 122° F

* Temperatur working range from - 40°C to + 60° (- 40° F to + 140° F) on request.

	AMP®-350/1 AMP®-375/1	AMP®-350/2	AMP®-500/1	AMP®-500/2
Load Capacity	350 sh tons (45° and 90° load shoulder) 350 sh tons (18° load shoulder)	350 sh tons (45° and 90° load shoulder) 350 sh tons (18° load shoulder)	500 sh tons (18° load shoulder) 750 sh tons (45° and 90° load shoulder)	500 sh tons (18° load shoulder) 750 sh tons (45° and 90° load shoulder)
API Proof Load Test	562,5 sh tons	525 sh tons	750 sh tons	750 sh tons
Pipe Diameter Range	2.3/8" - 11"	9.5/8" - 20"	2.3/8" - 11"	2.3/8" - 11"
90° Tool Joint	yes	yes	no	yes
Elevator Links	2.3/4" - 3.1/2"	2.3/4" - 3.1/2"	3.1/2" - 4.3/4"	3.1/2" - 4.3/4"

	AMP®-750/1	AMP®-1000/1	AMP®-1250/1
Load Capacity	750 sh tons (18° load shoulder) 1000 sh tons (45° and 90° load shoulder)	1000 sh tons (18° load shoulder)	1250 sh tons (18° load shoulder) 1500 sh tons (45° - 90° load shoulder)
API Proof Load Test	1125 sh tons	1500 sh tons	1875 sh tons
Pipe Diameter Range	2.3/8" - 11"	2.3/8" - 11"	5.1/2" - 9.7/8"
90° Tool Joint	yes	no	no
Elevator Links	4.3/4" - 5.1/2"	4.3/4" - 5.1/2"	5.1/2" - 6.1/2"

1.4.3 AMP® weight table

Weight without bushings

AMP	AMP® -350/1	AMP® -375/1	AMP® -350/2	AMP® -500/1	AMP® -500/2	AMP® -750/1	AMP® -1000/1	AMP® -1250/1
Weight kg [lbs]	855 [1885]	1000 [2205]	1000 [2205]	855 [1885]	1310 [2888]	1425 [3142]	1425 [3142]	2010 [4431]

Weight with bushings

PartNo	Bushing Size	Taper	AMP® -350/1	AMP® -375/1	AMP® -350/2	AMP® -500/1	AMP® -500/2	AMP® -750/1	AMP® -1000/1	AMP® -1250/1
678106-101	2.3/8" EU, DP	18°	195 [420]	195 [420]	n/a	195 [420]	n/a	284 [620]	284 [620]	n/a
678106-102	2.7/8" IU, DP	18°	185 [400]	185 [400]	n/a	185 [400]	n/a	280 [610]	280 [610]	n/a
648006-105	3.1/2" EU, DP	18°	176 [380]	176 [380]	n/a	176 [380]	n/a	273 [600]	273 [600]	n/a
648006-106	4" IU, DP	18°	166 [360]	166 [360]	n/a	166 [360]	n/a	265 [580]	265 [580]	n/a
678106-107	4" - 4.1/2" IU + IEU, DP	18°	160 [350]	160 [350]	n/a	160 [350]	n/a	260 [570]	260 [570]	n/a
648006-109	4.1/2" EU & 5" IEU, DP	18°	157 [340]	157 [340]	n/a	157 [340]	n/a	255 [560]	255 [560]	243 [530]
648006-111	5.1/2" IEU, DP	18°	149 [320]	149 [320]	n/a	149 [320]	n/a	245 [540]	245 [540]	232 [510]
678106-112	6.906", DP	18°	138 [300]	138 [300]	n/a	138 [300]	n/a	226 [490]	226 [490]	208 [450]
688006-112HB	6.906", DP	18°	136 [290]	136 [290]	n/a	136 [290]	n/a	225 [490]	225 [490]	205 [450]
648006-114	6.5/8" IEU, DP	18°	133 [290]	133 [290]	n/a	133 [290]	n/a	227 [500]	227 [500]	210 [460]
648006-115	5.7/8", DP	18°	148 [320]	148 [320]	n/a	148 [320]	n/a	243 [530]	243 [530]	229 [500]
678106-117	5.68" HWDP, DP	18°	150 [330]	150 [330]	n/a	150 [330]	n/a	247 [540]	247 [540]	220 [480]
678106-118	5.1/2", DP	18°	154 [330]	154 [330]	n/a	154 [330]	n/a	239 [520]	239 [520]	215 [470]
678106-121	6.5/8" Knobby, DP	18°	132 [290]	132 [290]	n/a	132 [290]	n/a	227 [500]	227 [500]	218 [480]
678106-182	4.3/4", DC	90°	158 [340]	158 [340]	n/a	158 [340]	n/a	270 [590]	270 [590]	260 [570]
678106-186	6", DC	90°	155 [340]	155 [340]	n/a	155 [340]	n/a	256 [560]	256 [560]	245 [540]
678106-187	6.1/4", DC	90°	152 [330]	152 [330]	n/a	152 [330]	n/a	252 [550]	252 [550]	240 [520]
678106-188	6.1/2", DC	90°	150 [330]	150 [330]	n/a	150 [330]	n/a	249 [540]	249 [540]	235 [510]
678106-189	6.3/4", DC	90°	148 [320]	148 [320]	n/a	148 [320]	n/a	245 [540]	245 [540]	230 [500]
678106-194	8", DC	90°	135 [290]	135 [290]	n/a	135 [290]	n/a	225 [490]	225 [490]	202 [440]
648006-195	8.1/4", DC	90°	130 [280]	130 [280]	n/a	130 [280]	n/a	220 [480]	220 [480]	194 [420]
678106-196	8.1/2", DC	90°	125 [270]	125 [270]	n/a	125 [270]	n/a	216 [470]	216 [470]	188 [410]
678106-198	9", DC	90°	115 [250]	115 [250]	n/a	115 [250]	n/a	207 [450]	207 [450]	180 [390]
648006-199	9.1/2", DC	90°	110 [240]	110 [240]	n/a	110 [240]	n/a	196 [430]	196 [430]	173 [380]
678106-202	10", DC	90°	105 [230]	105 [230]	n/a	105 [230]	n/a	185 [400]	185 [400]	n/a
678106-203	9.3/4", DC	90°	108 [230]	108 [230]	n/a	108 [230]	n/a	191 [420]	191 [420]	165 [360]
648006-229	7", Csg	90°	144 [310]	144 [310]	n/a	144 [310]	n/a	n/a	n/a	220 [480]
688006-231	7.5/8", Csg	90°	n/a	n/a	n/a	n/a	n/a	n/a	n/a	207 [450]
648006-234	8.5/8", Csg	90°	119 [260]	119 [260]	n/a	119 [260]	n/a	n/a	n/a	185 [400]
648006-236	9.5/8", Csg	90°	101 [220]	101 [220]	301 [660]	101 [220]	470 [1030]	n/a	n/a	162 [350]
638206-238	10.3/4", Csg	90°	n/a	n/a	290 [630]	n/a	456 [1000]	n/a	n/a	n/a
638206-239	11.3/4", Csg	90°	n/a	n/a	278 [610]	n/a	n/a	n/a	n/a	n/a
638206-242	13", Csg	90°	n/a	n/a	261 [570]	n/a	n/a	n/a	n/a	n/a
638206-243	13.3/8", Csg	90°	n/a	n/a	255 [560]	n/a	402 [880]	n/a	n/a	n/a
638206-245	16", Csg	90°	n/a	n/a	210 [460]	n/a	n/a	n/a	n/a	n/a
638206-247	18", Csg	90°	n/a	n/a	164 [360]	n/a	n/a	n/a	n/a	n/a
648206-248	18.5/8", Csg	90°	n/a	n/a	n/a	n/a	257 [560]	n/a	n/a	n/a

638206-249	20", Csg	90°	n/a	n/a	111 [240]	n/a	211 [460]	n/a	n/a	n/a
638206-255	14", Csg	90°	n/a	n/a	246 [540]	n/a	n/a	n/a	n/a	n/a
638206-259	13.5/8", Csg	90°	n/a	n/a	252 [550]	n/a	396 [870]	n/a	n/a	n/a
638206-264	15", Csg	90°	n/a	n/a	229 [500]	n/a	n/a	n/a	n/a	n/a
638206-265	9.7/8", Csg	90°	n/a	n/a	299 [650]	n/a	n/a	n/a	n/a	155 [340]
678106-276	4.3/4", DC	90°	n/a	n/a	n/a	n/a	267 [580]	n/a	n/a	n/a
678106-284	6.1/4", DC	90°	n/a	n/a	n/a	n/a	246 [540]	n/a	n/a	n/a
678106-286	6.1/2", DC	90°	n/a	n/a	n/a	n/a	243 [530]	n/a	n/a	n/a
688006-287	6.3/4", DC	90°	n/a	n/a	n/a	n/a	n/a	n/a	n/a	222 [480]
688006-293	8", DC	90°	n/a	n/a	n/a	n/a	n/a	n/a	n/a	197 [430]
678106-295	8.1/4", DC	90°	n/a	n/a	n/a	n/a	212 [460]	n/a	n/a	190 [410]
678106-296	8.1/2", DC	90°	n/a	n/a	n/a	n/a	206 [450]	n/a	n/a	185 [400]
678106-298	9.1/2", DC	90°	n/a	n/a	n/a	n/a	185 [400]	n/a	n/a	161 [350]
678106-301	10", DC	90°	n/a	n/a	n/a	n/a	172 [370]	n/a	n/a	n/a
688006-312	9.3/8", Csg	90°	n/a	n/a	n/a	n/a	n/a	n/a	n/a	167 [360]
678106-532	8", RRT	90°	n/a	n/a	n/a	n/a	218 [480]	n/a	n/a	n/a
648006-538	9.5/8", RRT	90°	100 [220]	100 [220]	n/a	100 [220]	n/a	n/a	n/a	n/a
688006-540	9.63", RRT, Csg	90°	n/a	n/a	n/a	n/a	n/a	n/a	n/a	159 [350]
678106-545	8" SC, RRT	90°	n/a	n/a	n/a	n/a	217 [470]	n/a	n/a	n/a
688006-713	6.5/8" IEU, DP	45°	n/a	n/a	n/a	n/a	n/a	n/a	n/a	203 [440]
688006-714	6.5/8" IEU, DP	45°	n/a	n/a	n/a	n/a	n/a	n/a	n/a	211 [460]

1.5 Optional Accessories

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

- **Grease Pump**
  Manual operated **PN 755667-3**
  Pneumatic operated **PN 776810**
  Pneumatic operated (ATEX) **PN 775810-A**
  Grease pumps to apply lubricant to the lubrication points.

- **Control Manifold for AMP®** **PN 645002-EL**
  Control Manifold for Rotator **PN 678190-EL**
  The Control Manifold allows simple and convenient control of the AMP® and the Rotator. The control Manifold contains all controls and regulating elements required for operation of the AMP® and the Rotator.

- **Transport Tool** **PN 678133**
  The optional Transport Tool enables the changes of a complete set of bushings with one task.

- **Hook Up Kit / Elevator Tool Kit**
  The Hook Up Kit (P/N 648100-HUK) for the AMP® contain equipment required by the customer for transport, setup and startup. The kits consists of following Items:

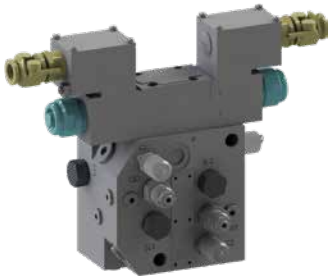

Fig. 13: Control Manifold Rotator

Fig. 14: Control Manifold AMP®

Fig. 15: Transport Tool

Fig. 16: Manual Grease pump

1.6 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)]	Below -4 °F (-20 °C)
Aral	435.2 (224)	Aral Vitam GF 46	392 (200)	Aral Vitam GF 32
Castrol	392 (200)	Hyspin AWS-46	366.8 (186)	Hyspin AWS-32
Gulf	410 (210)	Harmony 46AW	395.6 (202)	Harmony 32AW
Shell	424.4 (218)	Tellus 46	408.2 (209)	Tellus 32
Finke	572 (300)	Aviaticon HY-HE-46	509 (265)	Aviaticon HY-HE-32
Fuchs	428 (220)	Renolin MR 10	410 (210)	Renolin MR 15

1.7 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 Lubricant	- 20 °C to + 29 °C (- 4 °F to + 84.2 °F)	NLGI 0
Fuchs	NESSOS SF0 EP Lubricant for non-oil tight gear trains	- 20 °C to + 29°C (- 4 °F to + 84.2 °F)	NLGI 0 DIN 51826 GPOF-25 DIN 51502 GPOF-25

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

INFO

The specified lubricants are obtainable through FORUM Handling Tools. Contact your local representative.

1.8 Elevator Rotator Systems

The FORUM Handling Tools Elevator Rotators are designed to be used for rotating an elevator. The control manifold delivered by FORUM Handling Tools can use the rotation angle proportionally. For use with the AMP® specially designed Adapter Kits based on the type series must be installed.

Fig. 17: Single Elevator Rotator Link Bushing

Fig. 18: Rotator Adapter

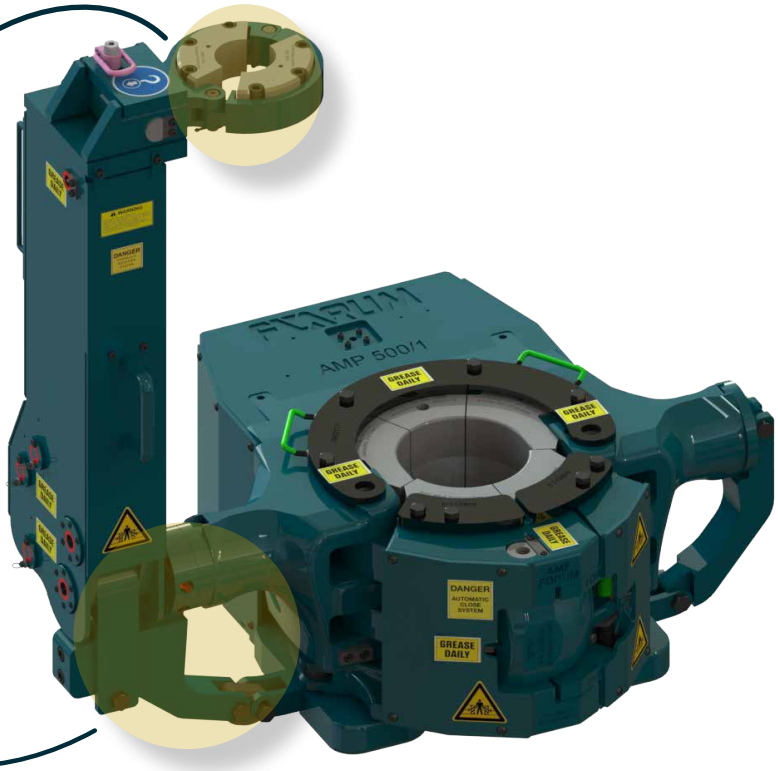

Fig. 19: AMP® with Single Rotator

Name	Single Elevator Rotator
Partnumber	678800 (Double acting) 678801 (Single acting)
Working pressure	210 bar (3,045 PSI)
Max. Pressure	300 bar (4,350 PSI)
Required Flow rate	2.2 to 10 GPM (8,3 - 37,9 Lpm)
Temperature range	- 20°C to + 80°C (- 4°F to 176°F)
Rotation Angle	+ 90°
Weight	192 [423] (Single acting Rotator) 174 [384] (Double acting Rotator)

Main Dimensions

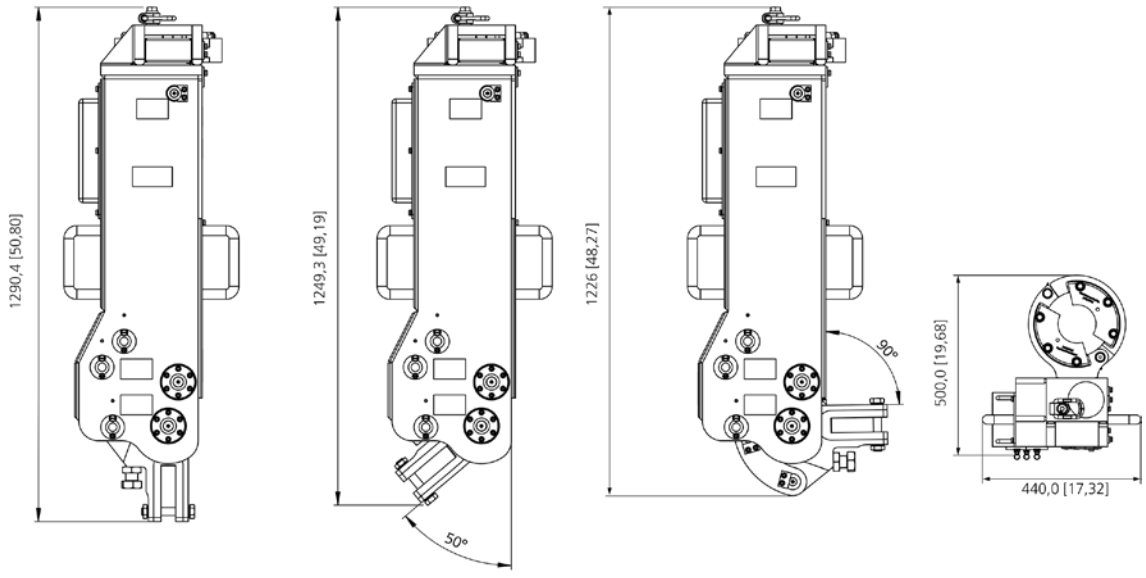

Fig. 20: FORUM Handling Tools Single Elevator Rotator System Main Dimensions

1.9 Equipment Markings

The markings serve for traceability and provide general information about the component/ equipment. 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 ❶.

Fig. 21: Contact with Technical Support

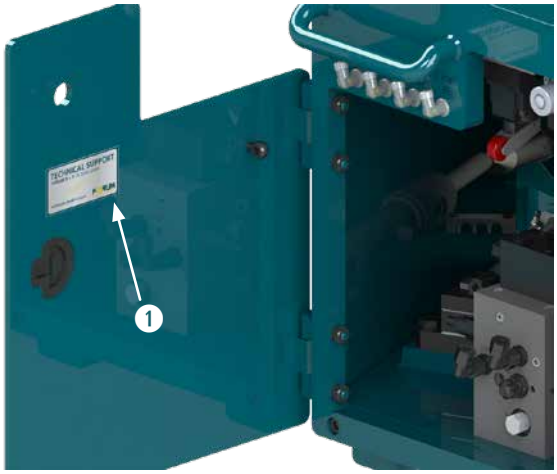

Fig. 22: Position of Technical Support Sticker

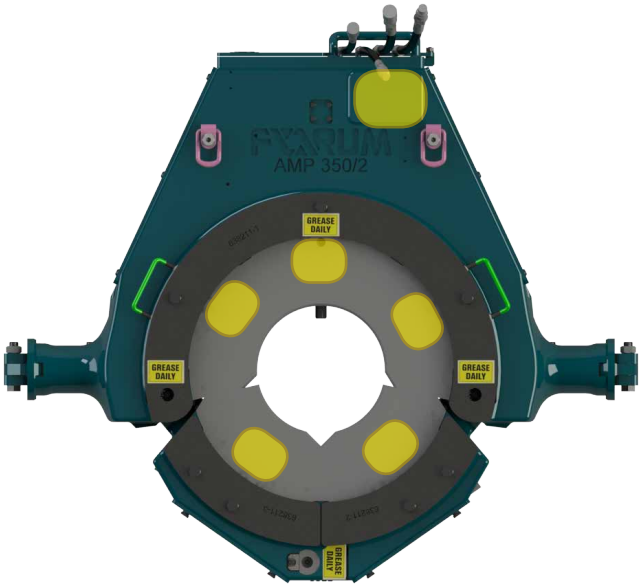

Fig. 23: Position of Equipment Markings

1.10 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 „XI Contact Worldwide“, on page 11).

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.

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SAFETY

2 Safety

SAFETY IS EVERYONES RESPONSIBILITY BUT IT STARTS WITH YOU!

The AMP® is designed and produced with consideration of all required safety precautions. Failure to observe the safety precautions and operating instructions specified in this OMM can lead to hazardous situations when operating the AMP®. While it is not possible to eliminate all hazardous situations with awareness and instruction from this OMM, good judgement should be used at all times surrounding the use of the AMP®. The AMP® should only be used for its intended purpose. Rectify all faults immediately, which could have a negative effect on the AMP® safety.

2.1 General Safety Precautions

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

For safe and proper operation of the AMP®, it is essential that all personnel working on the AMP® take the prescribed safety measures and observe the safety precautions specified in this OMM.

Before switching on and before working on the AMP® always ensure that no one is put in a hazardous situation. All safety features must be installed completely before switching on the AMP®.

Safety features may be released only when:

1. The entire AMP® is switched off.
2. Switching back on unintentionally is not possible.

The AMP® contains components subject to wear. After longer periods of operation, the safety can be reduced due to wear. Service the AMP® regularly in compliance with the maintenance chart („6.2 Inspections“, on page 132) 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 not able to guarantee, switch off the AMP® and secure it against being switched back on unintentionally. Advise the responsible service organization. Rectify every fault, which affects the safety, immediately.

INFO

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.

2.2 Safety Equipment

The AMP® 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 AMP® are marked with signs 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.
- The complex structure of the hydraulic circuit prevents opening of the AMP® when it is under load.

» 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 hold responsible.

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

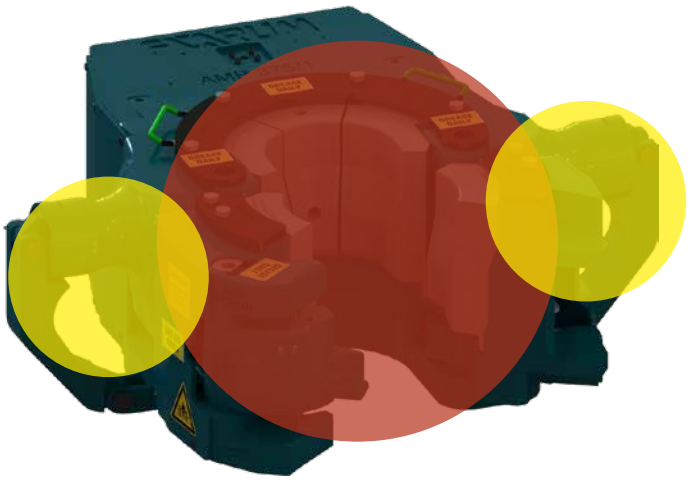


Fig. 24: AMP® Hazardous Locations

⚠ 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.

2.3 Safety Precautions

The safety precautions in this OMM are using standardized depictions and symbols. Examples of the symbols and terms used in this OMM are explained below. They are shown wherever possible hazards are present.

2.3.1 Warning Signs

⚠ 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.

⚠ WARNING

Danger of pinching/crushing body!

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

⚠ WARNING

Separated hydraulic lines pose an injury hazard!

This symbol 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 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.

⚠ Caution

Risk of stumbling/tripping!

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

2.3.2 Warning and Safety Instructions on AMP®

Warning and safety stickers indicate hazardous points on the AMP®.

INFO

Ensure that warning and safety signs are always present and readable. They must be in an easily legible state and replaced as required. Refer to our Service department with the part numbers given on this page.

Fig. 25: Safety Precautions on AMP®

1 **⚠ WARNING**

Danger of pinching/ crushing hands!

ANSI Z535.4
PN 671640-1

2 **⚠ WARNING**

Danger of pinching/ crushing body!

ANSI Z535.4
PN 671641

3 **⚠ WARNING**

DANGER
AUTOMATIC CLOSE SYSTEM

WARNING against unintended closing.

ANSI Z535.4
P/N 671639

4 **⚠ NOTE**

Lifting point location.

P/N 671646

5

WARNING

THIS PRODUCT COULD BE HAZARDOUS IF IMPROPERLY USED. MISUSE OF THIS TOOL COULD CAUSE SERIOUS INJURY TO PERSONNEL. THIS MUST BE PROPERLY INSTALLED AND MAINTAINED IN FIRST CLASS CONDITION. DO NOT REMOVE OR ALTER ANY PARTS. DO NOT WELD OR ALTER WITHOUT FACTORY AUTHORIZATION. ALL REPLACEMENT PARTS MUST BE OF FORUM HANDLING TOOLS MANUFACTURE.

PN 671638

6

PN 613129

2.4 Safety Precautions for Protection against Remaining Hazards

The AMP® was designed and produced in consideration of the safety precautions specified in EC Directive 2006/42/EC on Machinery.

The AMP® may be used only for:

- Its intended purpose (refer to „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 equipment can generate sparks.

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

» Only use non-metallic tools for loosening of clamping components.

INFO

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

2.4.1 Incorrect Handling of Hydraulic Equipment

⚠ WARNING

Defective hydraulic lines pose an injury hazard!

Hydraulic lines are subjected to wear and may be damaged during operation.

» Route hydraulic lines safely and check regularly for damages.

» 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!

Weak hydraulic lines due to incorrect routing or damages 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.

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, always wear protective gloves!

» Use paper or wood to check for minor leaks.

7. Leaks and damaged pressure lines have to be repaired or replaced immediately.

2.4.2 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 are possible. 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 Human Error

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

Safe Work

1. All personnel working with the AMP® are responsible for paying attention to their colleagues.
2. Consumption of alcohol and drugs is prohibited.
3. Work on the AMP® 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 AMP®, to allow communication via hand signals.
5. Always keep your personal protective equipment in perfect condition.
6. All personnel working on the AMP®, must be familiar with and observe the safety precautions in this instruction manual and on the equipment.
7. Observe the instructions for handling and maintenance intervals specified in this OMM.
8. Keep a copy of this OMM near the equipment, where it is accessible at all times.

2.6 Organisational Measures

The operating company is responsible for ensuring that all legally and officially prescribed approvals for operation of the equipment are present in compliance with national laws and regulations.

The required personal protective equipment („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 AMP® must be easily legible at all times and replaced as required.

The operating instructions must be kept so that they are available to those operating the AMP® at all times.

Personal Protective Equipment

The required Personal Protective Equipment (PPE) must be used when operating the AMP®. 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.

SAFETY INSTRUCTIONS

for AMP®

WARNING

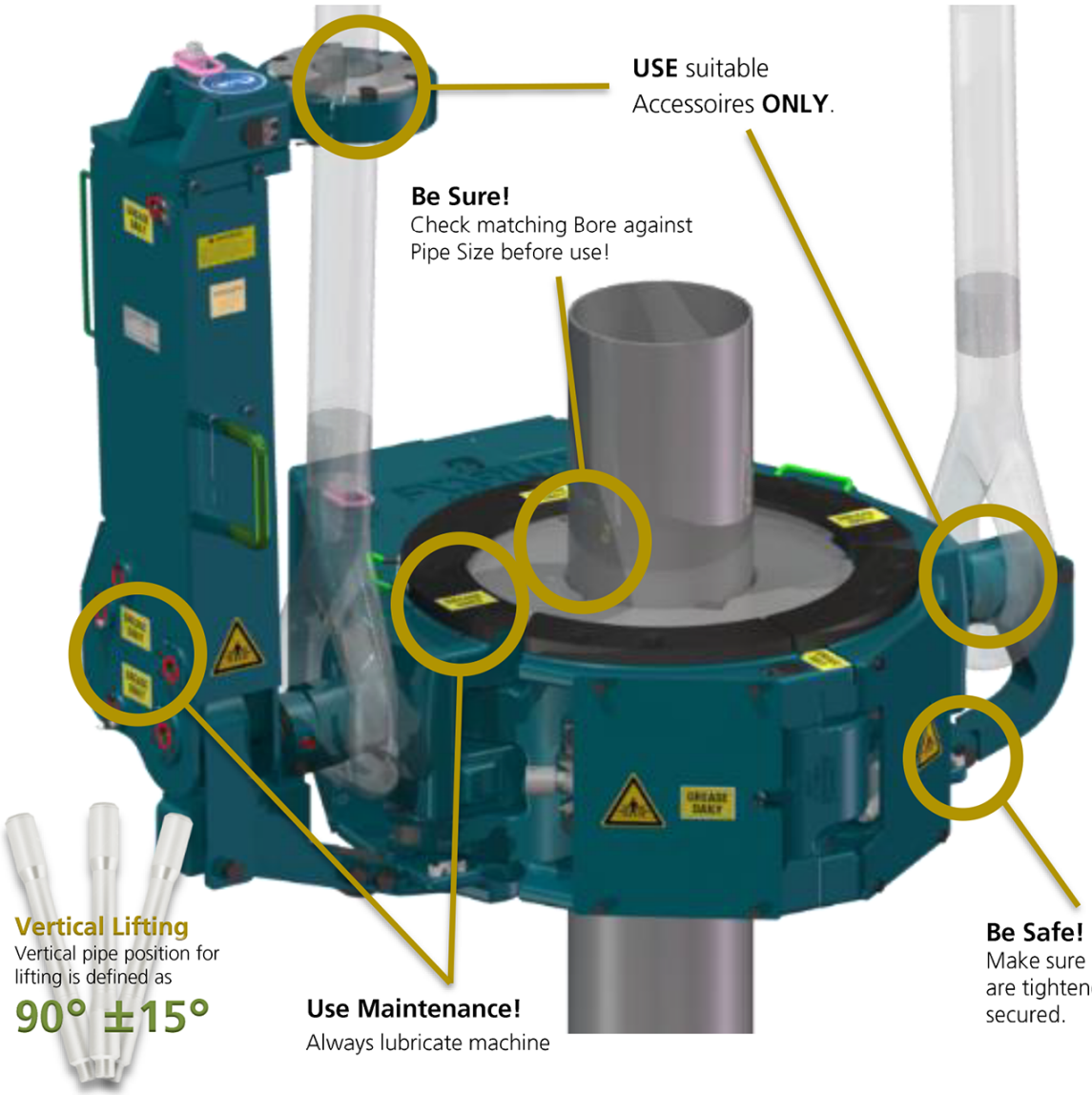
To reduce the risk of injury, everyone using, installing, performing maintenance, changing accessories on, or working with this tool must read and understand these instructions before operation.

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

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

Inspection Guide

- **Use the AMP®** 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 AMP contains components **subject to wear** (e.g. Hinge Pins).
- **Check the specified wear limits regularly**.
- **Replace worn or defective parts** immediately with new parts



FORUM™ Pipe Handling Tools

DO NOT DISCARD - GIVE TO OPERATOR

SAFETY INSTRUCTIONS

for AMP®

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 the AMP® is **YOU**.
YOUR good judgement is the best protection against injury.

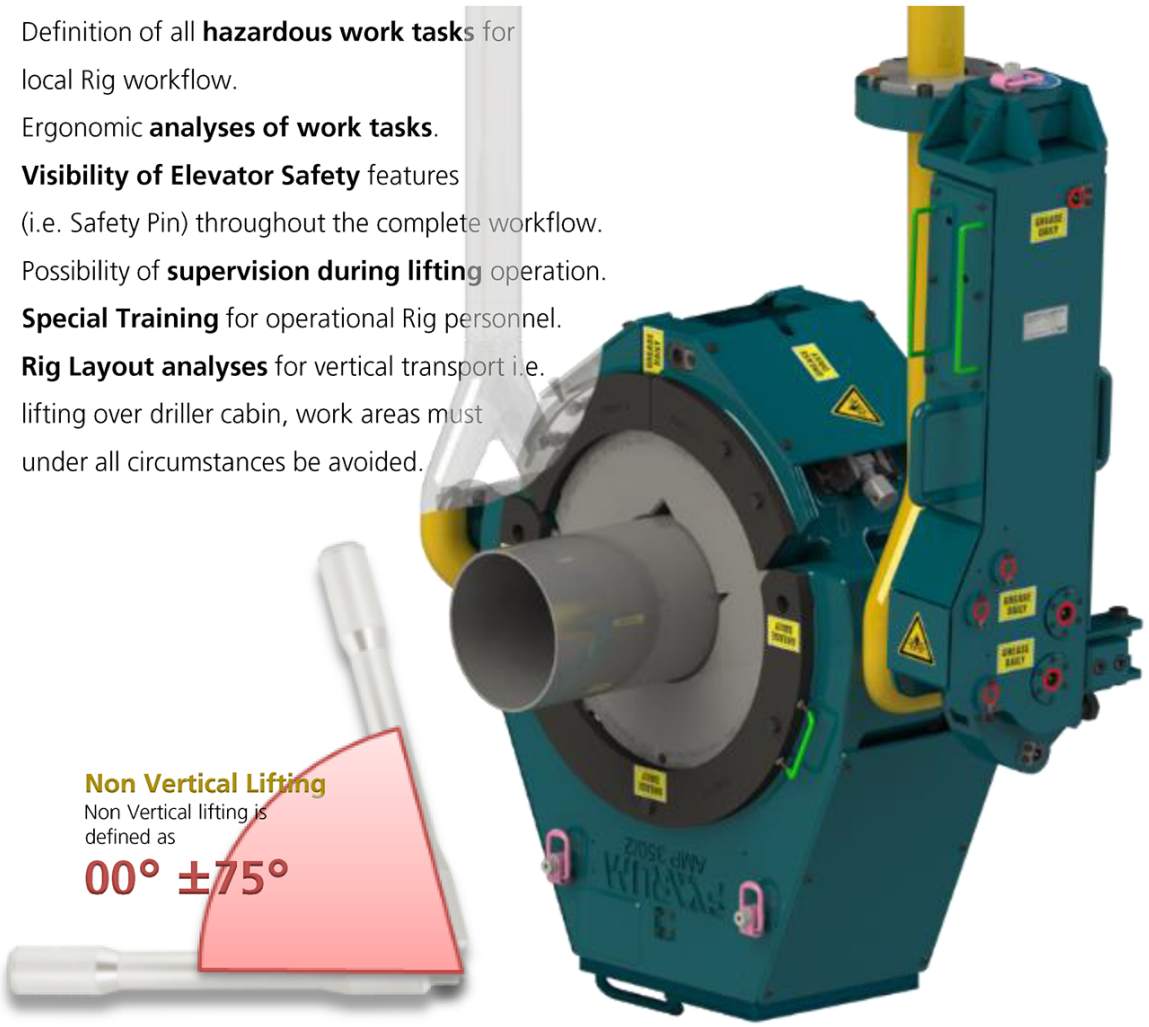
Non vertical use Disclaimer

In general the intended use of the AMP® is vertical lifting.
Using the AMP® for non-vertical lifts is therefore a not intended use which can be performed under defined circumstances only. The defined hazard analyses for the AMP® is nullified for non-vertical lifts and must be re-analyzed with the on-site specification by the operating company.

Non-vertical lifting is allowable with proper, actual and on-site defined hazard identification with all premises fulfilled only!

A Risk Analyses according to DIN ISO12100 must be performed.
The Risk Analyses must include without being limited to:

- Identification of all **hazardous areas** in Non-Vertical lifting operation.
- Definition of all **hazardous work tasks** for local Rig workflow.
- Ergonomic **analyses of work tasks**.
- **Visibility of Elevator Safety** features (i.e. Safety Pin) throughout the complete workflow.
- Possibility of **supervision during lifting** operation.
- **Special Training** for operational Rig personnel.
- **Rig Layout analyses** for vertical transport i.e. lifting over driller cabin, work areas must under all circumstances be avoided.



FORUM™ Pipe Handling Tools

DO NOT DISCARD - GIVE TO OPERATOR

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TRANSPORT/ SETUP

3 Transport / Setup

Ensure that only sufficiently qualified and trained personnel accomplish setup and installation work.

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

3.1 Delivery

The AMP® and all accessory parts are shipped in a transport crate. Instructions for safe transport are attached to the transport crate. Transport the packed equipment as specified in these instructions.

3.2 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 („XI Contact Worldwide“, on page 11).

The scope of delivery includes all components required for the intended operation of the AMP®.

3.2.1 Unpacking and Disposal of Packing Material

Remove the transport packaging and transport aids before hoisting the equipment to final site.

INFO

Do not remove transport retainers!
Remove transport retainers only at the installation site just before start up.

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 AMP® has been damaged during transport or the shipment is incomplete, please notify the manufacturer immediately („XI Contact Worldwide“, on page 11).

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

3.2.2 Intermediate Storage

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

- Leave the AMP® in the transport packaging. This provides sufficient protection against external influences.
- Secure the AMP® to prevent it from Slipping or falling due to motion.

Fig. 26: Fixed AMP®

3.3 Transport

⚠ DANGER

Suspended load!

The falling load can cause severe, even lethal injuries.

» NEVER stand beneath or in the swing area of lifted loads or loads suspended from a crane.

WEAR PROTECTIVE HELMET!

WEAR PROTECTIVE GLOVES!

WEAR SAFETY SHOES!

INFO

Internal transport and Safe Lifting Points!

Lifting point locations especially bores for load hooks are marked on the AMP®.

» Make Sure all load hooks are fully installed in the lifting point.

» Use a pallet for transport.

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

» Detailed weight specifications are given in the Chapter „1.4 Technical Data“, on page 19.

Principles for transport

1. Dimension all transport routes sufficiently.
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 only sufficiently qualified personnel perform such work.
5. Ensure that visual and audio contact exists between the crane operator and operating personnel.
6. Secure the area against not authorized entry. If necessary mark the area with information signs to warn of maintenance and repair work.
7. Secure moving parts in suitable manner
8. Use only approved slinging and transport equipment, which is in perfect condition and suitable for the intended purpose. Observe specified load limits.
9. Secure equipment against slipping/sliding. Observe equipment weight. Observe centre of gravity.
10. Never stand under suspended loads.
11. Transport the AMP® carefully. Do not fasten, lift or pull equipment on parts, which are not suitable for transport. Avoid sudden stops.
12. Always use hoisting equipment (slings, hoisting cables, shackles, etc.), which has been inspected and is sufficiently dimensioned.
13. Ensure that all installation and hoisting procedures comply with recognized rules of practice and industrial standards.

3.4 Lifting arrangements

This chapter shows save lifting arrangements for the main assemblies.

It may show the AMP® in different assembled states, refer to the suitable set-up chapter for assemble tasks.

Hoist the equipment safely

1. Attach the AMP® only at the attachment points provided for transport.
2. Only use approbate lifting material with a load carrying capacity suitable to the weight of the elevator / spider.
3. Attach and tension the hoisting ropes so that they are straight without kinks.
4. Use hoisting cables and load hooks with sufficient supporting capacity.

INFO

Lifting angle limited to 45°!

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

⚠ DANGER

Safe Lifting!

» Always install load hooks completely to lifting points before lifting the AMP®.

⚠ DANGER

Suspended load!

» Always use the marked lifting points to lift the AMP®.

3.4.1 AMP® Lifting arrangement

1. Fasten the lifting material on AMP® lifting points.
2. Lift the AMP® 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 AMP®.

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

Fig. 27: Hoisting points for transport AMP®

3.4.2 AMP® Bushing lifting arrangement

1. Fasten the lifting material on Bushing segment.
2. Lift the Bushing segment 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 Bushing segment.

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

Fig. 28: Hoisting points for transport AMP®

3.4.3 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 AMP®.

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 - Single Rotator

⚠ Warning

Be aware that the correct size of Rotator Link Bushing is used.

- It is off-limits to use the Single Elevator Rotator with a not matching component size (i.e. 4.1/2" bushing assembly with a 4.3/4" Link), as the clearance between the rotator link bushing and Link diameter must be exact. The Rotator Elevator-Link Bushing must not be too close to the Elevator-Link as the Single Rotator cannot move up and down.

» Never operate the Single Elevator Rotator without or with incorrect Link Bushing.

3.4.4 Space Requirement

During operation, the AMP® is connected to the Top drive in vertical drilling direction via Elevator-Links.

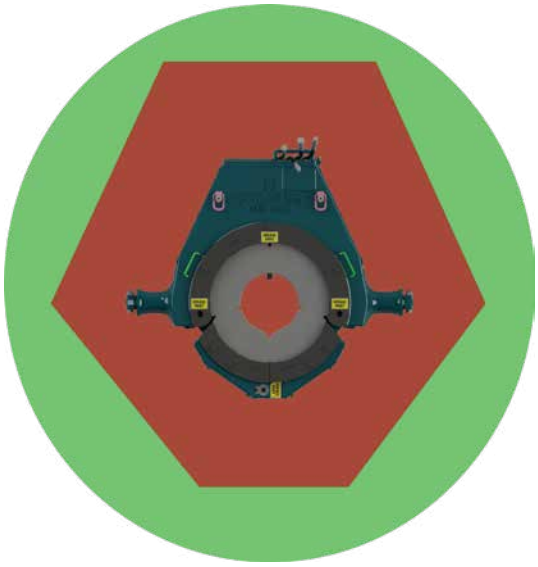


Fig. 30: AMP® Hazardous Locations

Maintenance work

- Enough space around the AMP® is required for safe maintenance work.

Lifting and Operation

- Always ensure a sufficient distance to the AMP® during operation. FORUM Handling Tools recommend a distance of at least one and a half meter to two meter.

3.5 Setup

⚠ 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

Pinching/crushing hazard from lowering!

Severe pinching/crushing up to loss of limbs.

» NEVER step over edge of Rotary Table with feet.

⚠ 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.

WEAR PROTECTIVE HELMET!

WEAR PROTECTIVE GLOVES!

WEAR SAFETY SHOES!

⚠ **WARNING** Never operate the AMP® without bushings.

Hydraulic Supply Connection Requirements

Hydraulic pressures	
140 - 210 bar (2030 - 3046 psi	Operating pressure (Line P,T,C1)
40 - 210 bar (580 - 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):

⚠ **NOTE** The feedback pressures of 85 bar and 110 bar occur at a working pressure of 140 bar. The increase of the operating pressure will change the feedback pressures. Always maintain a pressure deviation from working pressure to feedback pressure of 20 to 30 bars.

3.6 Mounting the AMP® to Elevator-Links

Preparation

1. Remove the transport packaging and transport aids from the AMP®.
2. Position the AMP® on the rig near the Elevator-Links.

Procedure

1. Place the AMP® on a plane surface.
2. Open the Link Adapter ❶ by removing the upper Link Block screw.
3. Move the Link Block ❷ upwards.

Fig. 31: Installation step I

4. Carefully guide the Elevator-Link to the AMP® ❸. Make sure, the Elevator-Link is mounted and placed correctly.

WARNING Pinching and crushing!
Always guide Elevator-Links from the outside of the Lifting ear opening of the AMP®. Use ropes to adjust the Elevator-Links.

Fig. 32: Installation step II

5. Move Link Block upwards and secure with Link Block screw ❹.
6. Tighten screw with 309 lb ft / 419 Nm.
7. Repeat step 2 to 6 on the other side of the AMP®.

Removal

1. Perform the installation tasks in reversed order.

Fig. 33: Installation step III

3.7 Installation of the Single Elevator Rotator

In order to install the Single Elevator Rotator for each FORUM Handling Tools AMP® 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!

Equipment

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

Procedure

1. Place the elevator on a plane surface.
2. Remove the standard Elevator Link adapter ❶.
3. Install the approbate Elevator Rotator adapter to the AMP®. Tighten all screws ❷.
4. Carefully guide the link to the elevator ❸. Make sure, the Elevator Link is mounted and placed correctly.

⚠ WARNING Pinching and crushing!
Always guide Elevator-Links from the outside of the Lifting ear opening of the AMP®. Use ropes to adjust the Elevator-Links.

5. Put up the Elevator Rotator adapter to the AMP® ❹ and Tighten the screw ❺.

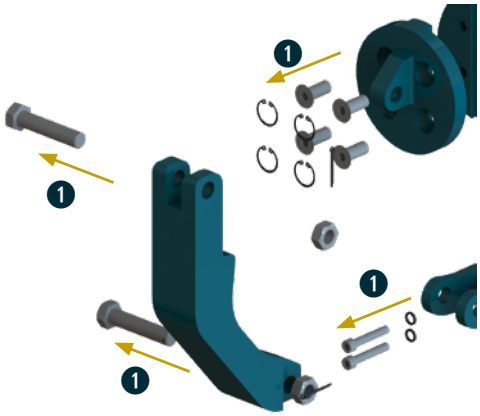


Fig. 34: Installation step I

Fig. 35: Installation step II

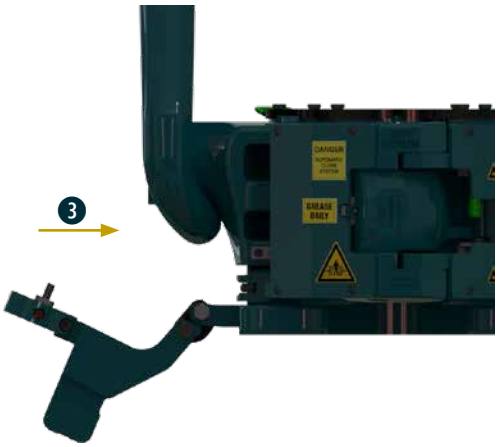


Fig. 36: Installation step III

Fig. 37: Installation step IV

6. Attach the Single Elevator Rotator to a crane ❻.

7. Lift the Single Rotator gently.

8. Open upper Elevator-Link attachment ❼ of Single Rotator.

WARNING Be aware that the correct size of Rotator Link Bushing is used. It is off-limits to use a Rotator Bushing assembly for 4.1/2" Elevator-Links with a 4.3/4" Elevator-Link and vice versa. There must be enough clearance between the Rotator Bushing and diameter of the attached Elevator-Link. Never operate the Single Elevator Rotator without or with incorrect Rotator Bushing.

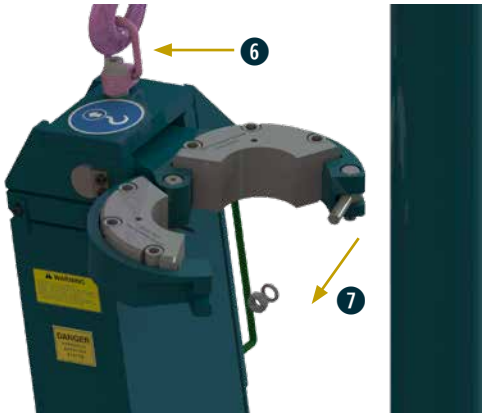


Fig. 38: Installation step V

9. Slowly lift and guide the Single Elevator Rotator towards the Elevator Link and AMP®.

10. Connect the Single Rotator with the Hydraulic Supply.

11. Apply pressure to the Single Rotator and align the arm of the Single Rotator to the Rotator Adapter.

12. Lift the Single Elevator Rotator above the Link Block. Position the Single Rotator arm in the recess of the Rotator Adapter ❽.

Fig. 39: Installation step VI

13. Place and tighten screw, nut and washer ❾.

Fig. 40: Installation step VII

14. Close upper Elevator-Link attachment of Single Rotator and secure Elevator-Link attachment. Tighten screw, nut and washer ❿.

» The Single Elevator Rotator is installed to the AMP®.

Removal

1. Perform the installation tasks in reversed order.

NOTE Positioning of the Single Rotator!
Make sure the Single Rotator arm is pointing downwards. This is the only way to pull out the Single Rotator out of the Rotator Adapter safely.

Fig. 41: Installation step VIII

3.8 Installation Checklist

The AMP® has to be installed as shown in the OMM.

Recommended Checks for general equipment

OK	☐	There are no foreign objects in the working area of the AMP®.
OK	☐	Lifting equipment has been removed.
OK	☐	All assemblies, parts, areas and surfaces which have to be lubricated, are lubricated.
OK	☐	All hydraulic lines are aligned correctly.
OK	☐	The right size Bushing is in use and secured with Bushing Retainer.
OK	☐	There are no loose fittings, hoses, valves and screws.
OK	☐	All warning signs are present and readable.
OK	☐	No visual damages recognizable.
OK	☐	The AMP® is mounted properly to Elevator-Links.
OK	☐	All transport tools have been removed.

Recommended Checks for additional equipment

OK	☐	Lifting equipment has been removed.
OK	☐	No visual damages recognizable.
OK	☐	There are no loose screws, washers, parts or components.
OK	☐	All assemblies, parts, areas and surfaces which have to be lubricated, are lubricated.
OK	☐	All transport tools have been removed.
OK	☐	The Elevator Rotator is installed correctly [if applicable].
OK	☐	The Control Unit is placed and installed correctly [if applicable].
OK	☐	The right size Bushing Assembly is in use [if applicable].
OK	☐	Both Bushing segments have the identical serial number [if applicable].

Info

The Installation Checklist shown above contains only essential points and main contents of an Installation process. Check at least the mentioned points on your AMP®. For further questions or complete Installation Checklists (templates), please contact the Technical Support from FORUM Handling Tools.

COMMISSIONING / OPERATION

4 Commissioning and Operation

Ensure that the AMP® is operated only by personnel trained for this work and familiar with the risks involved in operating the AMP®.

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

INFO

FORUM Handling Tools recommends having the AMP® 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!

» Hydraulic fluid can escape under high pressure.

» Always relieve pressure in hydraulic equipment before working on AMP®.

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

⚠ 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

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.

⚠ 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!

⚠ 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.

⚠ 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.

4.1.1 Safety Considerations

Safety considerations for operation

1. Do not touch the AMP® during operation.
2. During operation, keep a safe distance from the AMP®.
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 Safety checks before initial operation

Safety checks before initial operation

4. All covers are attached and completely screwed down.
5. All screw connections tightened properly.
6. All screw retainers are present.
7. Serial numbers of Bushing segments are identical.
8. All components correspond to type/size of pipe used.
9. All hydraulic connections are correctly connected and securely laid.
10. No hydraulic lines damaged.
11. All lubrication points lubricated properly.

4.1.3 Connecting the Hydraulic System

nsure that only personnel trained for such work and conscious of the risks involved perform work on the hydraulic system.

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!

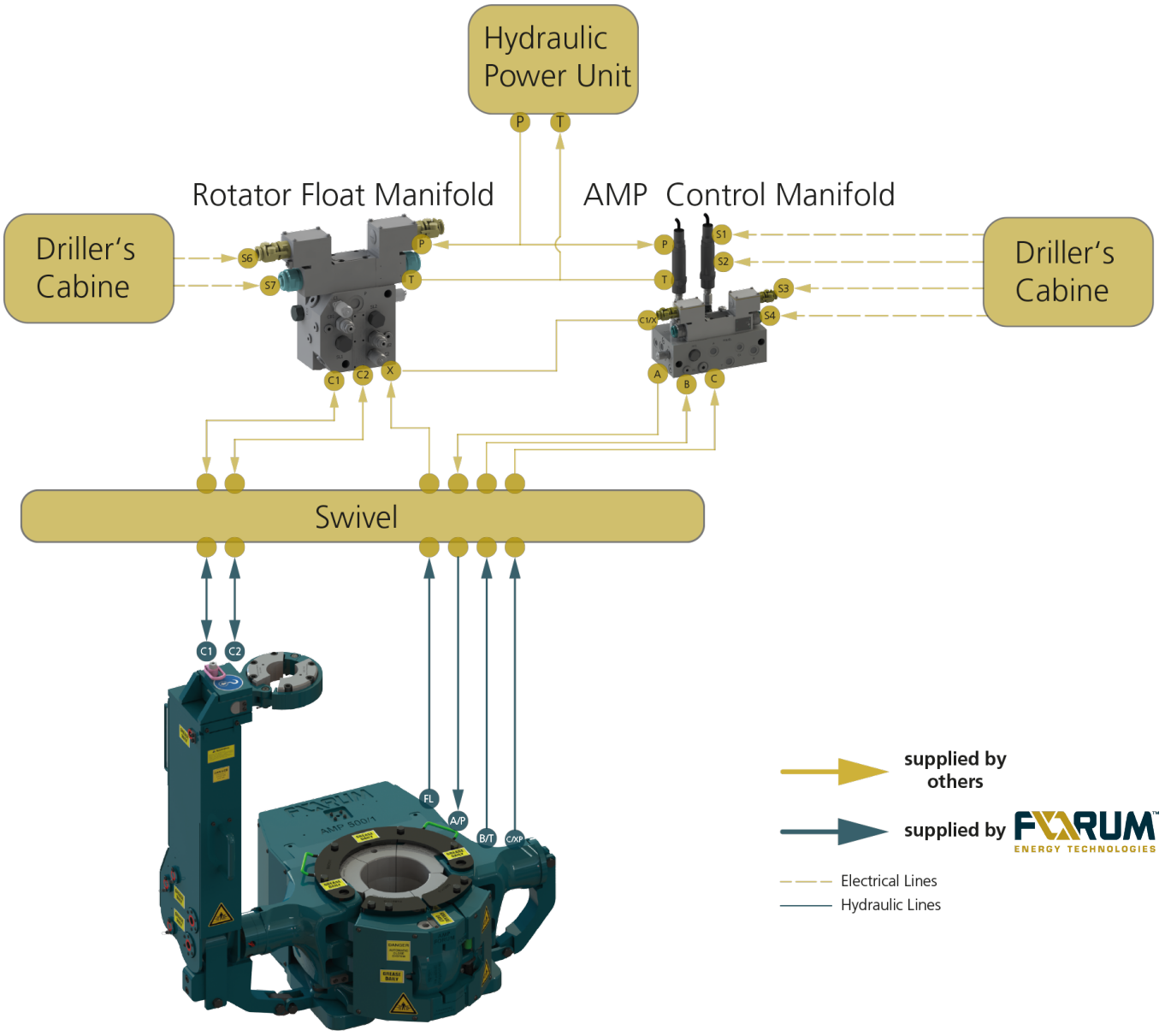
⚠ **NOTE** During installation, when setting up and taking down as well as during operation of the AMP ensure that the hydraulic lines do not chafe. If necessary, provide hydraulic lines with chafe guard.

INFO

Bleeding

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

4.1.4 Installation Schematic



Info

This illustration shows a typical arrangement of the AMP®. The particular arrangement may vary according to individual requirements.

Hydraulic pressures	
140 - 210 bar (2030 - 3046 psi)	Operating pressure (Line A/P, B/T, C1, C2)
85 - 110 bar (1233 - 1595 psi)	Feedback pressure (Line C/XP)
140 - 210 bar (2030 - 3046 psi)	Floating pressure (Line FL)

Electric connection	
S1	Signal - AMP® open
S2	Signal - AMP® closed
S3	Feedback - AMP® closed
S4	Feedback - Load Sensor activated
S6	Signal - Rotate up
S7	Signal - Rotate down

Caption	
P	Pressure Supply
T	Tank / Return
A	Elevator Close
B	Elevator Open
C	Feedback Closed / Load Sensor
FL	Float Signal Pilot Line
C1	Rotate Up
C2	Rotate Down
X	Float Signal Pilot Port

4.2 Commissioning Checklist

FORUM Handling Tools strongly recommends accomplishing the commissioning with the FORUM Handling Tools Commissioning Service.

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

OK	☐	Operating personnel is aware of all dangers regarding handling the FORUM Handling Tools AMP® and it's additional equipment.
OK	☐	The entire operating personnel went through the OMM.

Check Installation and Lubrication

OK	☐	AMP® and all additional components are installed as shown in chapter 3.
OK	☐	The Installation Checklist has been filled out completely. No fields are left blank and no fields have the status NOK.
OK	☐	All parts, components (lifting equipment, etc.) not required for the actual operation have been removed.
OK	☐	There are no people in the working area.
OK	☐	All assemblies, parts, areas and surfaces which have to be lubricated, are lubricated.

Hydraulic Characteristics

OK	☐	Operating pressure:	140 bar (2030 PSI) - 210 bar (3046 PSI)
OK	☐	Volumetric flow:	22.7 l/min (6 GPM) - 37.9 l/min (10 GPM)
OK	☐	Min. required hydraulic Oil clearness:	NAS 9
OK	☐	Correct Hydraulic connection/line arrangement.	

Function Test AMP®

OK	☐	The doors close after supplying pressure to connection “A”.
OK	☐	The doors open after supplying pressure to connection “B”.
OK	☐	Feedback signal appears when doors and Latch have been closed. Line “C/XP” - 85 bar (1233 PSI).
OK	☐	Feedback signal appears when doors and Latch have been closed and load sensor is actuated. Line “C/XP” - 110 bar (1595 PSI).
OK	☐	Rotate the AMP® using the Single Rotator. Close the doors and set the Slips. The AMP® is now in Float mode. Check that the AMP® now automatically lowers to a horizontal position.

Function Test Rotator

OK	☐	The Rotator begins to rotate upwards after supplying pressure to connection “C1”.
OK	☐	The Rotator begins to rotate downwards after supplying pressure to connection “C2” (double acting). The Rotator begins to rotate downwards after releasing pressure from connection “C1” (single acting).

Info

This commissioning Checklist contains only essential points and main contents of an internal commissioning. Check at least the mentioned points on your AMP®. For further questions or complete Commissioning Checklists (templates), please contact the Technical Support from FORUM Handling Tools.

4.3 Operation

Ensure that the AMP® is operated only by personnel trained for this work and familiar with the risks involved in operating the AMP®.

Read these instructions carefully before operating the AMP®.

⚠ 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!

» Do not fix any disconnected hydraulic lines without depressurizing the complete hydraulic system and all hydraulic lines and couplings.

⚠ WARNING

Defective hydraulic lines pose an injury hazard!

» Protect yourself from leaks.

⚠ 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 PROTECTIVE GLOVES!

WEAR EYE PROTECTION!

WEAR SAFETY SHOES!

WEAR PROTECTIVE HELMET!

Operational Safety

1. The Checklists to verify correct installation and commissioning have been fully processed and completed. There are no points on the lists that would have to be answered with NOK
2. Do not touch the AMP® while in operation.
3. All screw retainers present.
4. All hoses have to be laid so that they cannot interfere with your work or that you can stumble upon them.
5. FORUM Handling Tools recommends to have the AMP® operated by the driller.
6. No foreign objects obstruct the view between the operating personnel at the borehole and the operator in the drilling cabin.
7. Never open the AMP® when the pipe load is hold by the AMP®.
8. The Feedback appears when it have to appear.

4.3.1 Handling the Drill String

1. Lower the AMP® to the height of the pipe string. The doors of the AMP® are closed. The AMP® is positioned horizontally.

Fig. 42: Operation step I

2. Apply pressure to port “B”, to open the doors of the AMP®.

Fig. 43: Operation step II

3. Rotate the AMP® upwards by applying pressure to port C1 of the Single Rotator. Based on your individual circumstances, the AMP® is rotated by up to 90 °.

4. Lower the rotated AMP® under the Tooljoint of the pipe string. Place the pipe string in the AMP® so that the Tooljoint protrudes from the AMP®.

Fig. 44: Operation step III

Lift the rotated AMP® gently. Close the doors of the AMP® by applying pressure to port "A". The closed doors release a signal on the "FL" line, which switches the Rotator to float mode.

Fig. 45: Operation step IV

Lift the AMP® gently. The AMP® slowly absorbs the entire load of the pipe string and switches the load sensor at a load of about 140 kg. Now, it is impossible to open the AMP®.

Fig. 46: Operation step V

Fig. 47: Operation step VI

4.3.2 Unconventional Opening

In cases of improperly opening and urgent emergencies, the opening of the AMP® can be enforced. Press the emergency valve which is located at the rear door. The actuation of this valve enables a direct bypass to connection "B". Eliminate the malfunction. Carry out a function test before continue with standard operation.

⚠ WARNING

Danger of crushing!

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

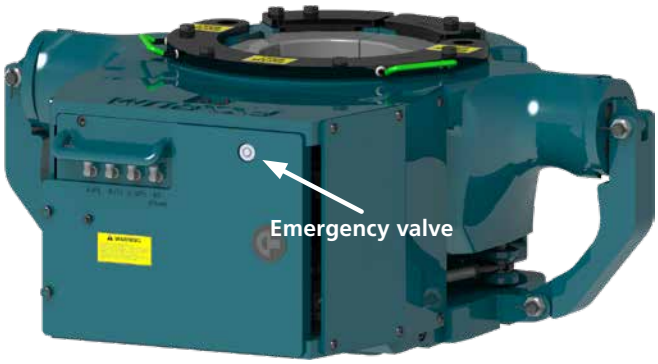


Fig. 48: AMP® Emergency Valve Location

4.3.3 Installation and change of AMP® Bushings

Make sure to be installed AMP® Bushings match with the expected load. Use pairing Bushings with the same size and serial number only. A set of bushings consists of five segments.

⚠ WARNING

NEVER operate the AMP® without bushings!

Preparations

1. Place the AMP® on a plane surface.

Bushing Installation

1. Before installing the new bushings, the seating area in the AMP® have to be cleaned and lubricated ❶.

2. Position and tighten the bushing lifting tool in the bores of the bushings segments.

Fig. 49: Installation step I

3. Attach hoisting equipment to the lifting tool.

4. Position and centre the attached bushing segments over the AMP® ❷.

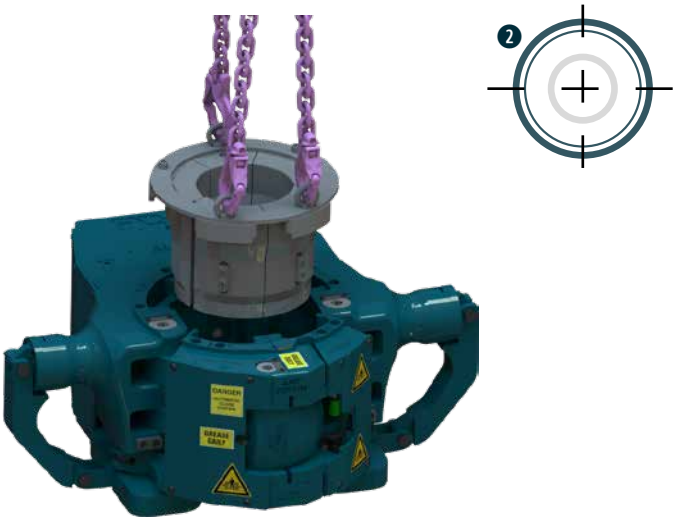


Fig. 50: Installation step II

5. Lower the bushing segments carefully into the AMP® ❸. Make sure all segments are placed and aligned properly.

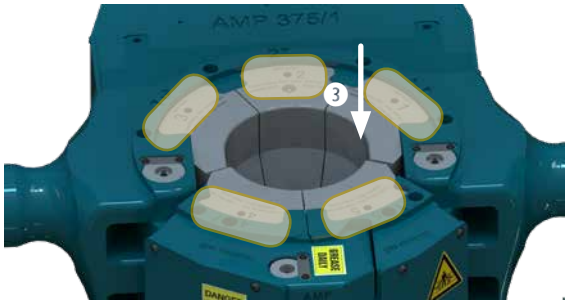


Fig. 51: Installation step III

6. Place all three Bushing Retainers and secure them with the Retainer Bolts and washers ❹.

Fig. 52: Installation and change of Elevator bushings IV

INFO

Function Test of the Load Sensor

Check the load sensor after installing a new Bushing Assembly. Place a weight of approx. 150 kg on top of bushing no. 1 for testings.

» Watch the segment 1 sagging down. Try to open the AMP®, which may not be possible.

Bushing Removal

1. Perform installation tasks in reversed order.

4.3.4 Limiting the Single Rotator

The maximum movement of the Single Elevator Rotator can be limited using the adjustment screw ❶

1. Locate adjustment screw at the bottom of the Single Rotator ❶.

2. Untighten screw and jamnut to full extend to enable a 90° movement (see illustration).

3. Tighten screw and jamnut to limit the movement.

4. Secure adjusted place with jamnut.

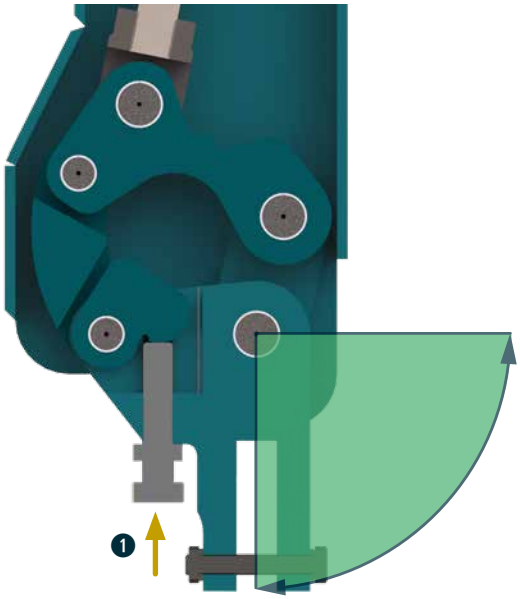


Fig. 53: Single Rotator adjustment

4.3.5 Adjustments on Hydraulic Components

Valve ❶ - Load Retention Valve

Keeps the doors of the AMP open.

- Enhance pressure (load to be hold).
- Reduce pressure (load to be hold).

Valve ❷ - Load Retention Valve

Keeps the doors of the AMP close.

- Enhance pressure (load to be hold).
- Reduce pressure (load to be hold).

Valve ❸ - Directional Valve

Closing sequence of the left Door and the Latch.

- Enhance pressure - Door will close later.
- Reduce pressure - Door will close earlier.

Valve ❹ - Pressure Control Valve

Pressure for feedback Slips set.

- Enhance pressure.
- Reduce pressure.

Valve ❺ - Directional Valve

Pressure on XP.

- Enhance pressure.
- Reduce pressure.

Valve ❻ - Direct-active Relief Valve

Opening sequence of the Latch.

- Enhance pressure (load to be hold).
- Reduce pressure (load to be hold).

Valve ❼ - Directional Valve

Opening sequence of the left door.

- Enhance pressure - Guide Plates retract later.
- Reduce pressure - Guide Plates retract earlier.

Valve ❽ - Throttle Valve

Activates/Deactivates Trigger System.

- Enhance Volumetric Flow - Activation.
- Reduce Volumetric Flow - Deactivation.

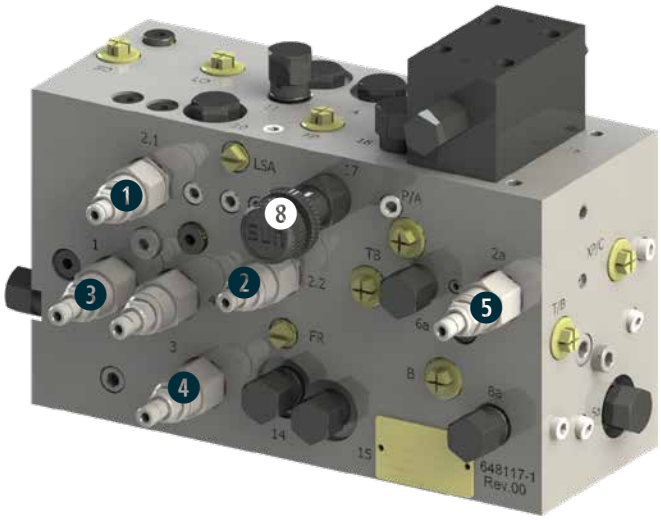


Fig. 54: AMP Valve Block I

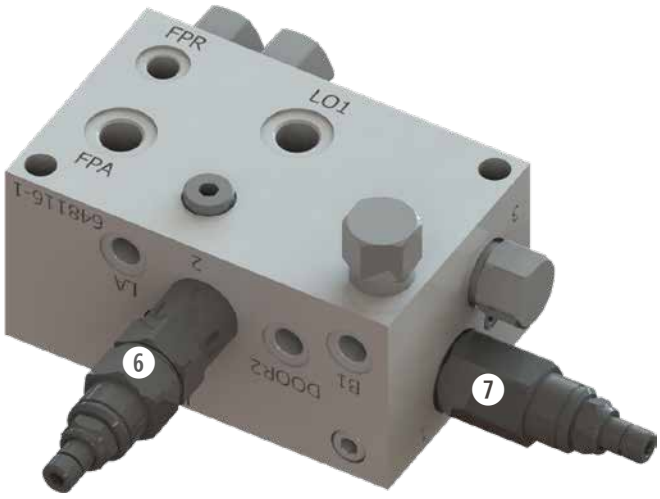


Fig. 55: AMP Valve Block II

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SERVICE

5 Service

INFO

Operational safety and readiness of the AMP® do not only depend on your skill, but also on maintenance and servicing of the AMP®. Insist on using original spare parts when carrying out maintenance and repair work.
This ensures operational safety and readiness of your AMP®, and maintains its value.

5.1 Malfunction

If a malfunction occurs or the AMP® 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 hydraulic unit is switched on.
3. Check whether the right size Bushings have been installed for the size/type of pipe used.
4. Check for proper lubrication of the AMP®.
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 OMM, please contact the FORUM Handling Tools Technical Support or one of the authorized service companies („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 AMP® 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 only FORUM Handling Tools or an authorized service company performs any repair work required on the AMP®.

INFO

Please contact the FORUM Handling Tools Technical Support or one of the authorized service companies („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 lock safely 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 „β“, 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 equipment 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.

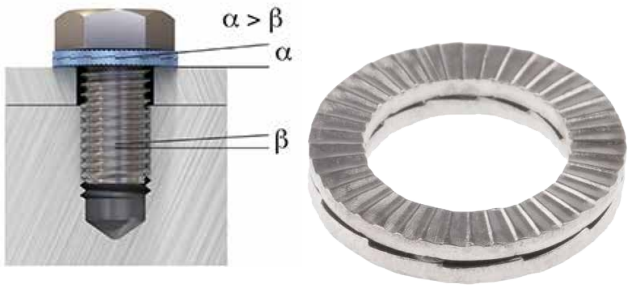

Fig. 56: Nord Lock Washer principle illustration

Tightening torques for Nord Lock washers

Several Nord Lock bolt securing-systems are used on the AMP® 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 („B. Third Party Documents“, on page 148) to generate safe maintenance by the user.

If the tightening torque needed to fasten a screw/nut is not explicitly written in this OMM, please check the screw/nut head and 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.

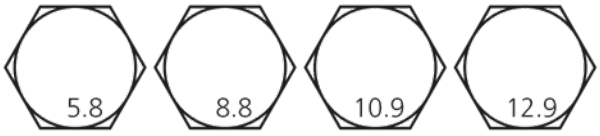

Fig. 57: Bolt head marking

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 in „B. Third Party Documents“, on page 148.

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

INFO

Due to tests, 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 were 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 Break Down and Spare Parts

INFO

Please contact the FORUM Handling Tools Technical Support or one of the authorized service companies („XI Contact Worldwide“, on page 11) to order replacement parts or in the event of any questions.

5.3.1 AMP® Drawings

5.3.1.1 Drawings and Parts List for AMP®-350/1 (P/N 638100-Y-350)

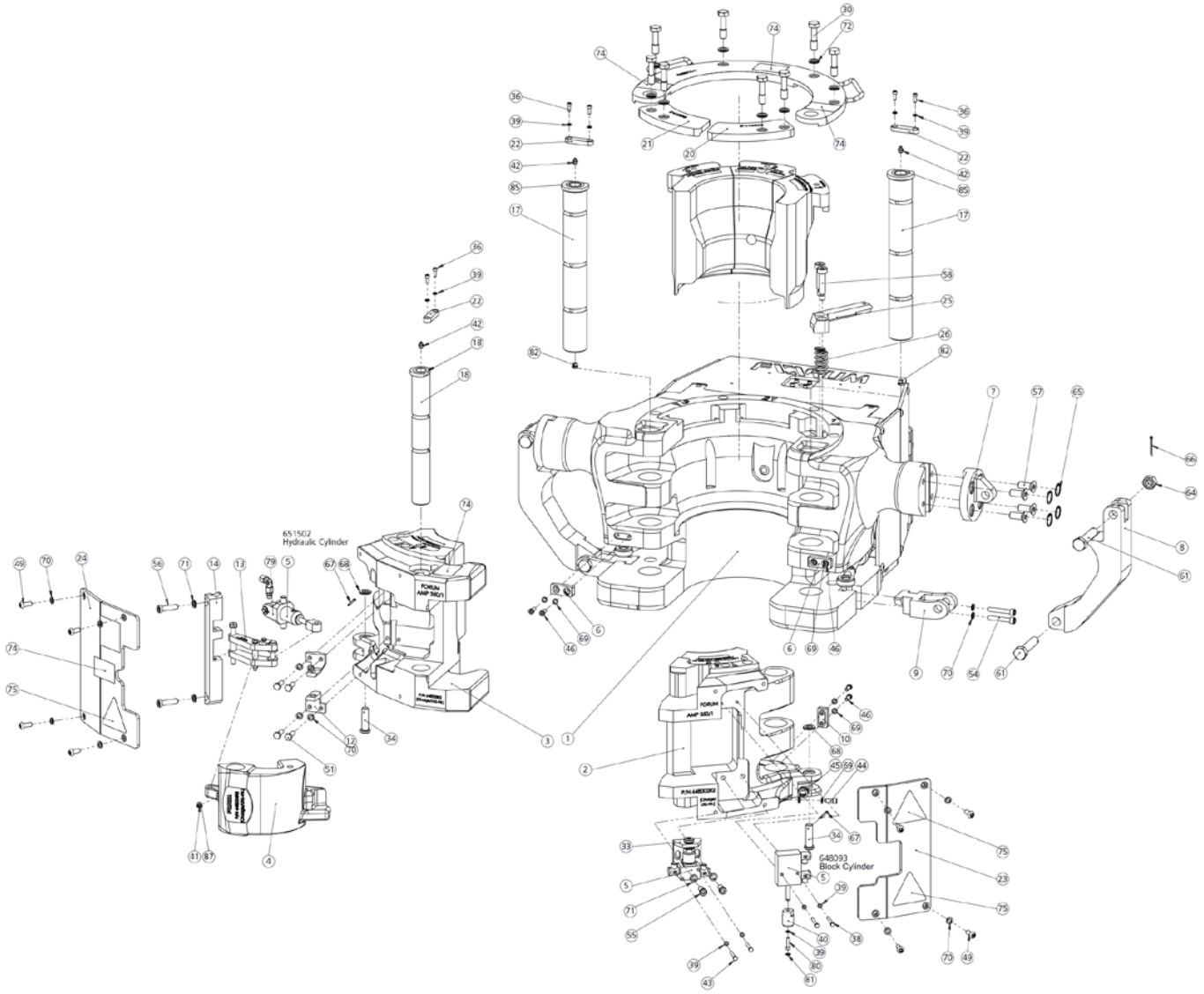

Fig. 58: 638100-Y-350 (AMP®-350/1) Drawing I

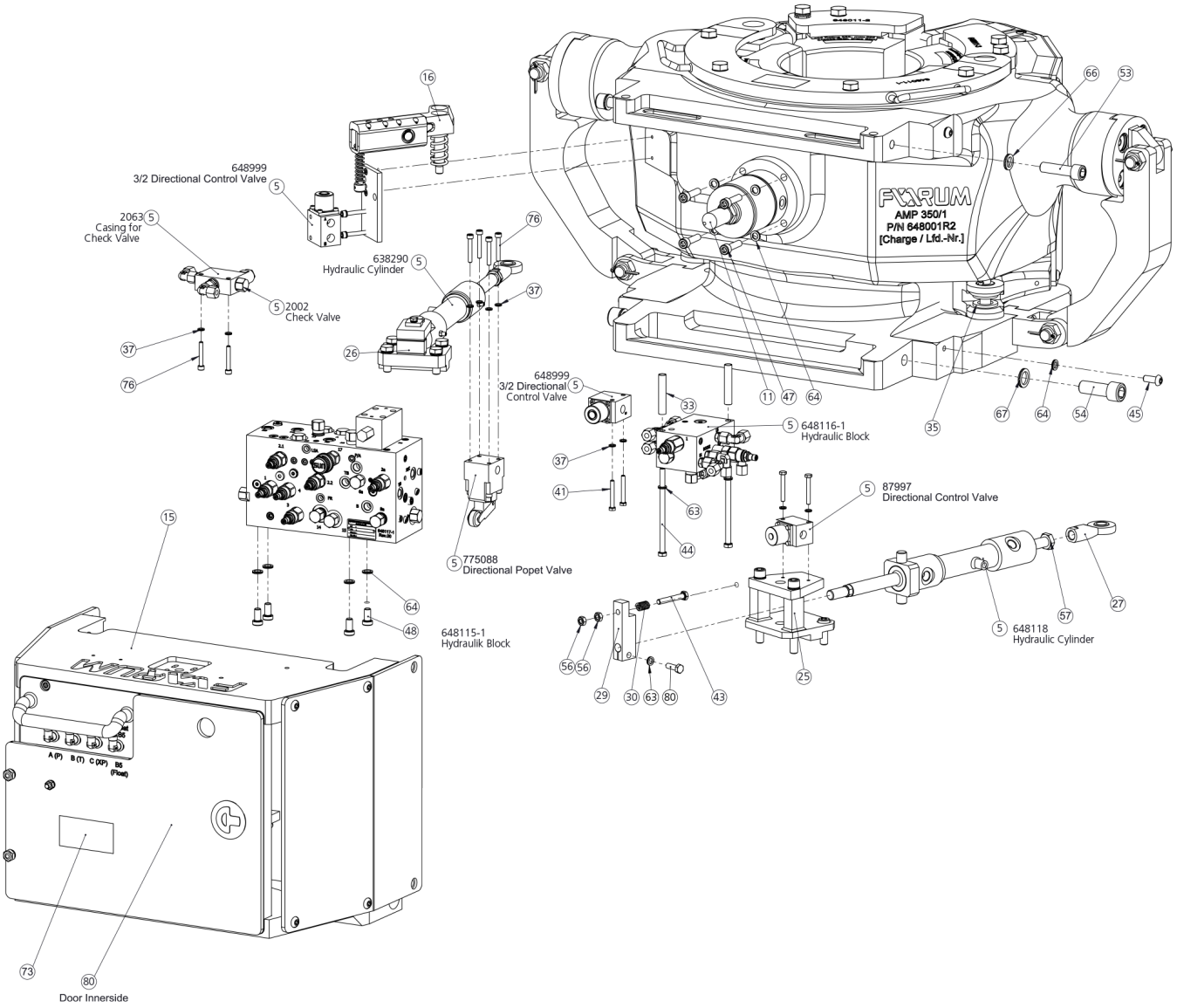

Fig. 59: 638100-Y-350 (AMP®-350/1) Drawing II

Parts List for 638100-Y-350 (AMP®-350/1)

Pos.	Qty.	P/N	Description
1	1	648001-350-BF	Body
2	1	648002-BF	Door, Right
3	1	648003-BF	Door, Left
4	1	648004-BF	Latch
5	1	648009	Hydraulic Assembly
6	2	648085	Arrester Plate 2
7	2	648182-375	Link Block Adapter
8	2	648080-375	Link Block, Part 1
9	2	648081	Link Block, Part 2
10	1	648084	Arrester Plate
11	1	648162	Trigger Assembly
12	2	648292-2	Cylinder Flange
13	1	648055	Latch Mechanism Assembly
14	1	648055-2	Latch Mechanism Flange
15	1	648050	Hydraulic Box
16	1	648065	Load Sensor Assembly
17	2	648077	Door Pin
18	1	648078	Latch Pin
19	1	648011-1	Bushing Retainer (Body)
20	1	648011-2	Bushing Retainer (Door)
21	1	648011-3	Bushing Retainer (Door)
22	3	648079	Pin Securing Plate
23	1	648083-1	Door Cover, Right
24	1	648083-2	Door Cover, Left
25	1	648068	Load Ring Segment
26	2	648053	Spring
27	1	638250	Cylinder Console Assembly
28	1	638270	Cylinder Console Assembly
29	2	648087	Pivot
30	8	688067	Retainer Bolt
31	1	648153	Latch Valve Actuating Block
32	1	752219	Overload Spring
33	1	688040	Feedback Valve Assembly
34	2	638276	Cylinder Pin
35	2	648051	Distance Pipe
36	6	613884	Screw
37	4	774312	Washer
38	2	710651	Screw
39	21	792111	Washer
40	1	648093-1	Verification Pin
41	1	756790	Grease Fitting
42	3	70064	Grease Fitting
43	6	87805	Screw
44	1	613640	Screw
45	1	688059-HS	Rubber-Lined Connecting Clamps
46	6	774610	Hexagon Socket
47	1	675055	Screw
48	2	648119	Screw
49	12	688099	Screw
50	1	645198	Screw
51	4	645195	Screw
52	4	752832	Screw
53	4	612576	Screw
54	4	645649	Screw
55	2	613548	Screw
56	2	737025	Screw
57	8	645620	Screw
58	2	648269	Screw
59	2	725467	Screw
60	2	615152	Screw
61	4	613623-11	Screw

Pos.	Qty.	P/N	Description
62	2	613633	Nut
63	2	710348	Nut
64	4	613556-41	Nut
65	8	645697	Retaining Ring
66	4	752339	Cotter Pin
67	2	725274	Cotter Pin
68	2	615879	Washer
69	10	792112	Washer
70	29	792103	Washer
71	4	792104	Washer
72	10	792106	Washer
73	2	792108	Washer
74	5	671642	Warning Sign Grease Daily
75	3	671641	Warning Sign "Squeeze Danger"
76	1	671639	Danger Automatic Close System
77	1	671638	Warning Sign
78	1	613129	Technical Support
79	1	648040	Assembly Latch Microcylinder
80	1	651539-10	Screw
81	1	648088	Retaining Rings
82	2	710642	Locking Screw
83	6	612672	Screw
84	1	613723	Screw
85	2	612530-1	Marking Point
86	1	612530-3	Marking Point
87	1	612530-9	Marking Point

5.3.1.2 Drawings and Parts List for AMP®-375/1 (P/N 638100-Y-375)

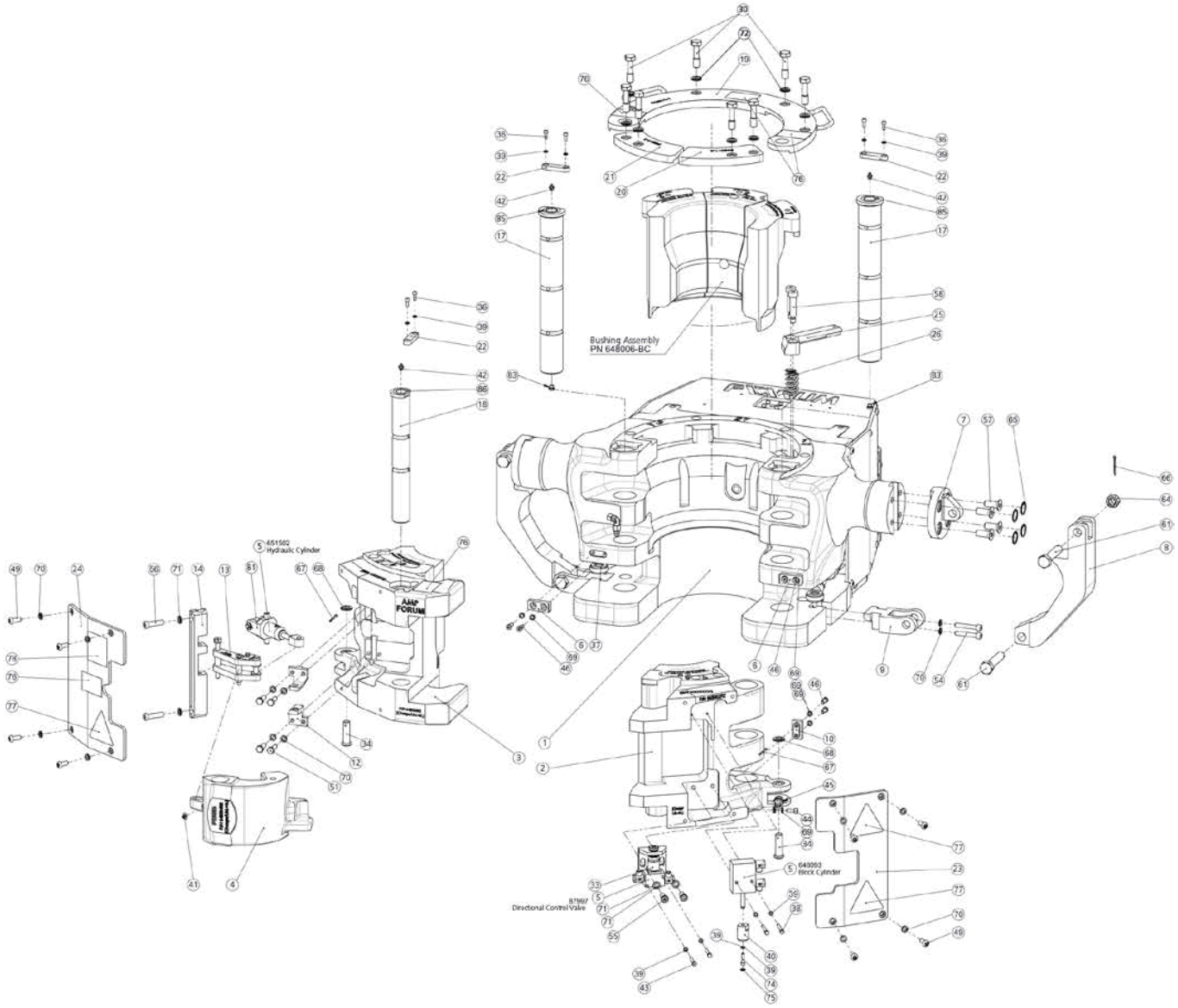

Fig. 60: 638100-Y-375 (AMP®-375/1) - Drawing I

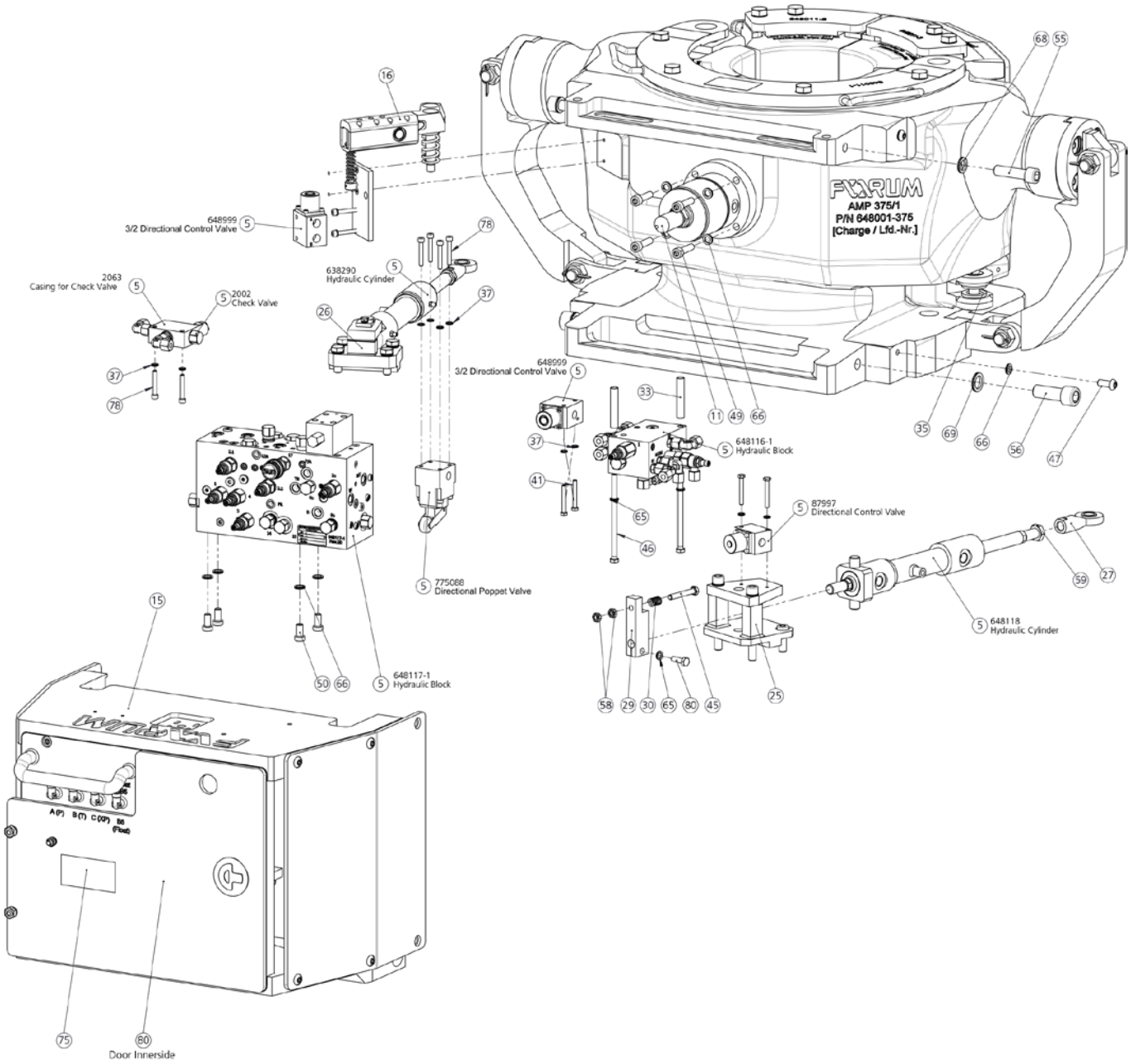

Fig. 61: 638100-Y-375 (AMP®-375/1) Drawing II

Parts List for 638100-Y-375 (AMP®-375/1)

Pos.	Qty.	P/N	Description
1	1	648001-375-BF	Body
2	1	648002-BF	Door, Right
3	1	648003-BF	Door, Left
4	1	648004-BF	Latch
5	1	648009	Hydraulic Assembly
6	2	648085	Arrester Plate 2
7	2	648182-375	Link Block Adapter
8	2	648080-375	Link Block, Part 1
9	2	648081	Link Block, Part 2
10	1	648084	Arrester Plate
11	1	648162	Trigger Assembly
12	2	648292-2	Cylinder Flange
13	1	648055	Latch Mechanism Assembly
14	1	648055-2	Latch Mechanism Flange
15	1	648050	Hydraulic Box
16	1	648065	Load Sensor Assembly
17	2	648077	Door Pin
18	1	648078	Latch Pin
19	1	648011-1	Bushing Retainer (Body)
20	1	648011-2	Bushing Retainer (Door)
21	1	648011-3	Bushing Retainer (Door)
22	3	648079	Pin Securing Plate
23	1	648083-1	Door Cover, Right
24	1	648083-2	Door Cover, Left
25	1	648068	Load Ring Segment
26	2	648053	Spring
27	1	638250	Cylinder Console Assembly
28	1	638270	Cylinder Console Assembly
29	2	648087	Pivot
30	8	688067	Retainer Bolt
31	1	648153	Latch Valve Actuating Block
32	1	752219	Overload Spring
33	1	688040	Feedback Valve Assembly
34	2	638276	Cylinder Pin
35	2	648051	Distance Pipe
36	6	613884	Screw
37	4	774312	Washer
38	2	710651	Screw
39	21	792111	Washer
40	1	648093-1	Verification Pin
41	1	756790	Grease Fitting
42	3	70064	Grease Fitting
43	6	87805	Screw
44	1	613640	Screw
45	1	688059-HS	Rubber-Lined Connecting Clamps
46	6	774610	Hexagon Socket
47	1	675055	Screw
48	2	648119	Screw
49	12	688099	Screw
50	1	645198	Screw
51	4	645195	Screw
52	4	752832	Screw
53	4	612576	Screw
54	4	645649	Screw
55	2	613548	Screw
56	2	737025	Screw
57	8	645620	Screw
58	2	648269	Screws
59	2	725467	Screw
60	2	615152	Screw
61	4	613623-11	Screw

Pos.	Qty.	P/N	Description
62	2	613633	Nut
63	2	710348	Nut
64	4	613556-41	Nut
65	8	645697	Retaining Ring
66	4	752339	Cotter Pin
67	2	725274	Cotter Pin
68	2	615879	Washer
69	10	792112	Washer
70	29	792103	Washer
71	4	792104	Washer
72	10	792106	Washer
73	2	792108	Washer
74	1	651539-10	Screw
75	1	648088	Retaining Rings
76	5	671642	Warning Sign Grease Daily
77	3	671641	Warning Sign "Squeeze Danger"
78	1	671639	Danger Automatic Close System
79	1	671638	Warning Sign
80	1	613129	Technical Support
81	1	648040	Assembly Latch Microcylinder
82	6	612672	Screw
83	2	710642	Locking Screw
84	1	613723	Screw
85	2	612530-1	Marking Point
86	1	612530-3	Marking Point
87	1	612530-9	Marking Point

5.3.1.3 Drawings and Parts List for AMP®-350/2 (P/N 638200-Y)

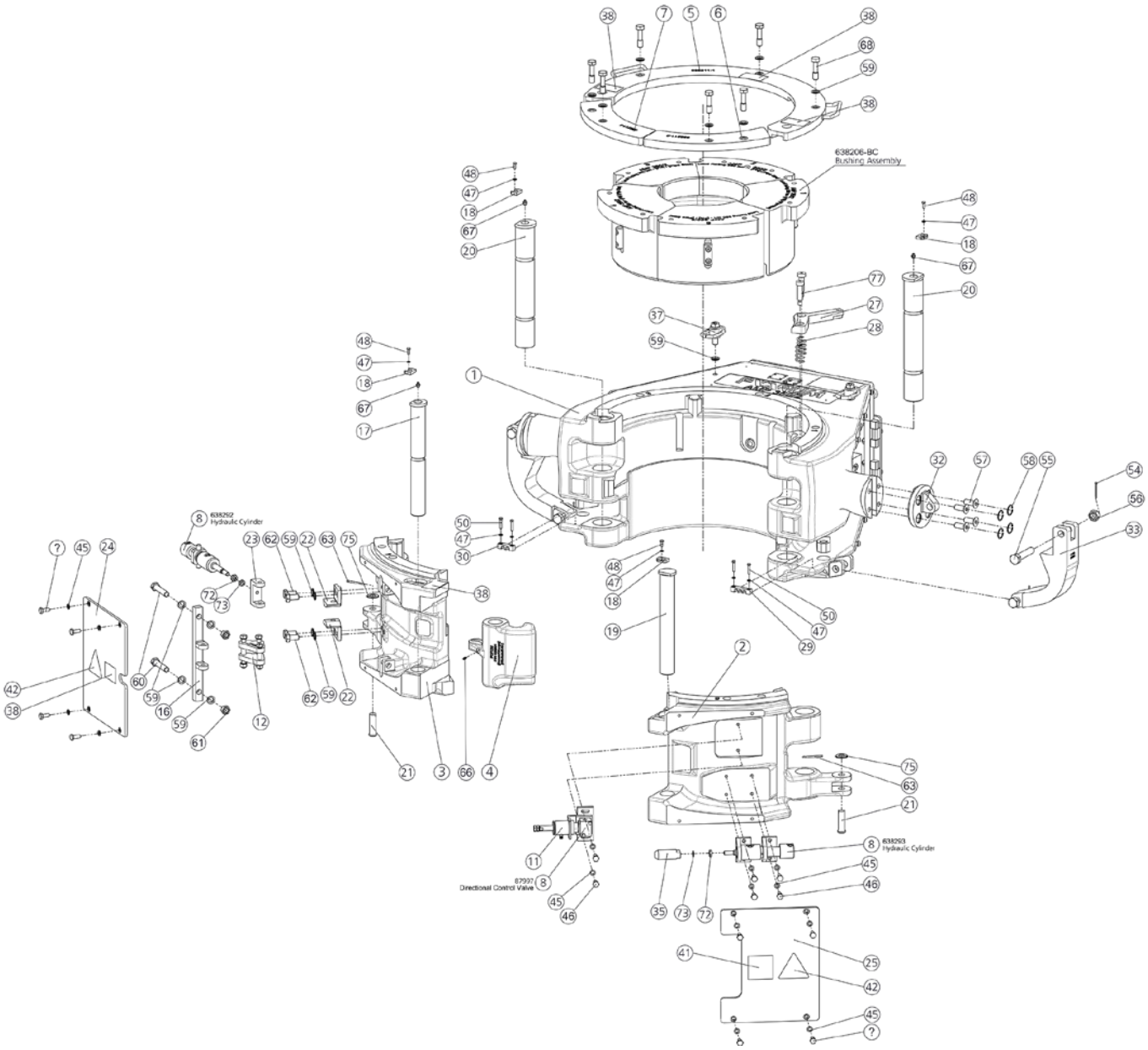

Fig. 62: 638200-Y AMP®-350/2 Drawing I

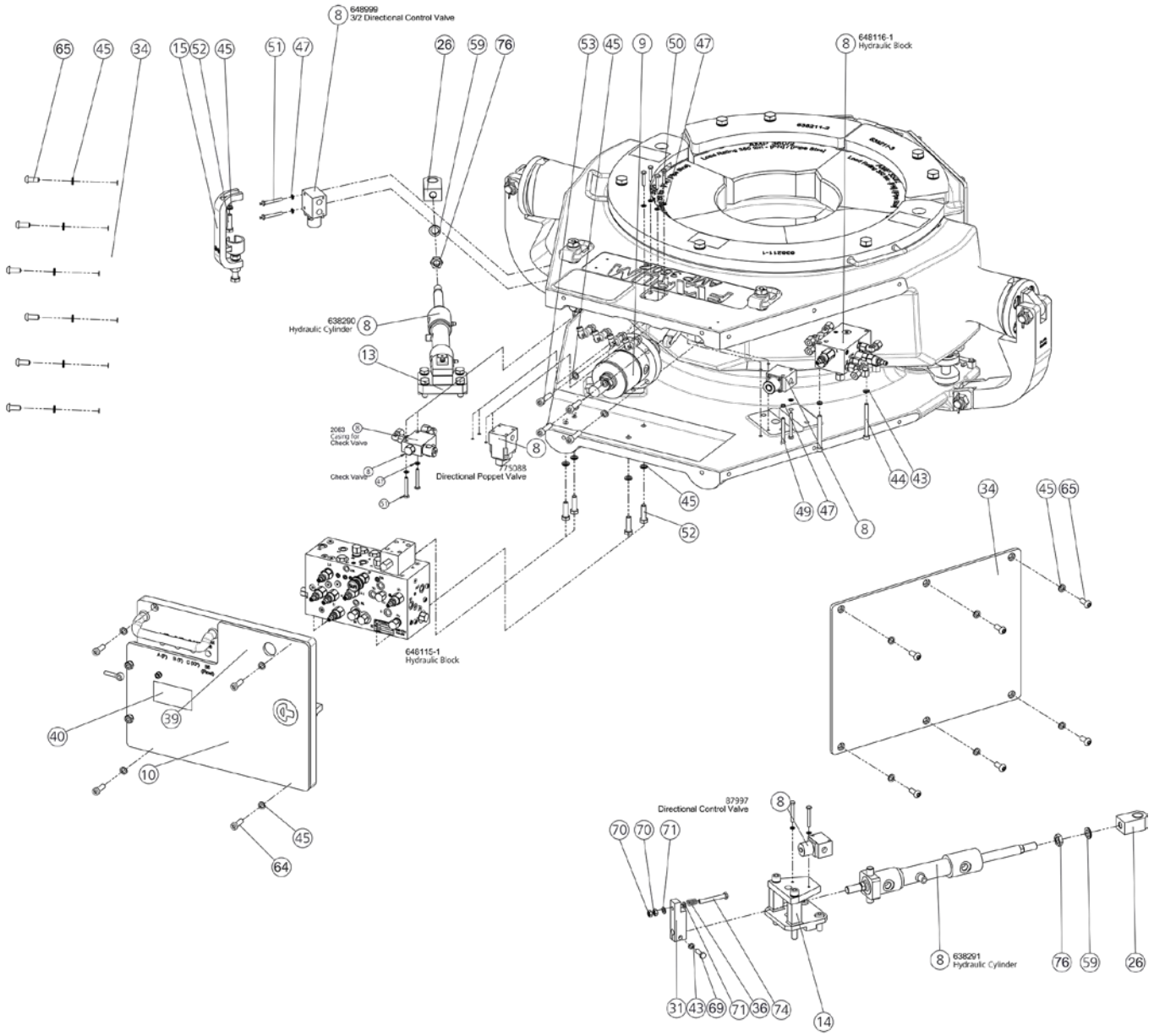

Fig. 63: 638200-Y AMP®-350/2 Drawing II

Parts List for 638200-Y AMP®-350/2

Pos.	Qty.	P/N	Description
1	1	638201-BF	Body
2	1	638202-BF	Door, right
3	1	638203-BF	Door, left
4	1	638204-BF	Latch
5	1	638211-1	Bushing Retainer (Body)
6	1	638211-2	Bushing Retainer (door, right)
7	1	638211-3	Bushing Retainer (door, left)
8	1	638209	Hydraulic Assembly
9	1	648162	Trigger Assembly
10	1	648184	Rear Door Assembly
11	1	651538	Pestle Assembly
12	1	638255	Latch Mechanism Assembly
13	1	638270	Cylinder Console No.1
14	1	638250	Cylinder Console No.2
15	1	648060	Load Sensor Assembly
16	1	638255-2	Latch Mechanism Flange
17	1	638278	Latch Pin
18	4	648179	Pin Securing Plate
19	1	638278-1	Door Pin
20	2	638277	Hinge Pin
21	2	638276-1	Cylinder Pin
22	2	638292-2	Cylinder Flange
23	1	638292-1	Cylinder Fork
24	1	638283-2	Door Cover, left
25	1	638283-1	Door Cover, right
26	2	638290-1	Pivot
27	1	638268	Load Ring Segment
28	2	645655	Spring for Load Safety Device
29	1	638296	Clamp (three 8mm hoses)
30	1	638295	Clamp (two 8mm hoses)
31	1	648153	Latch Valve Actuating Block
32	2	638282	Link Block Adapter
33	2	638280	Link Block
34	2	638283	Cover Sheet
35	1	638293-1	Verification Pin
36	1	752219	Overload Spring
37	2	553468	Lifting eye
38	5	671642	Warning sign "GREASE DAILY"
39	1	613129	Sticker Hotline
40	1	671638	Warning sign
41	1	671639	Warning sign "Automatic"
42	2	671641	Warning sign "squeeze danger"
43	1	792112	Washer
44	2	645670-6	Screw
45	39	792103	Washer
46	6	89126	Screw
47	16	792111	Washer
48	4	612671	Screw
49	2	645136	Screw
50	8	710727	Screw
51	2	87805	Screw
52	3	87724	Screw
53	4	752832	Screw
54	4	752339	Split Pin
55	4	613623-11	Screw
56	4	613556-41	Nut
57	8	645620	Screw
58	8	645697	Retaining ring
59	17	792106	Washer
60	2	645672	Screw
61	2	755137	Nut

Pos.	Qty.	P/N	Description
62	4	617519	Screw
63	8	725461	Screw
64	2	70263	Split Pin
65	4	648197	Screw
66	12	688099	Flat head screw
67	1	756790	Lubricating nipples
68	3	70064	Lubrication Fitting
69	5	688067	Retainer Bolt
70	2	710723	Screw
71	1	735852	Screw
72	2	613633	Nut
73	2	645683	Washer
74	2	660568	Nut
75	2	792104	Washer
76	1	613786	Screw
77	2	612679	Washer

5.3.1.4 Drawings and Parts List for AMP®-500/1 (P/N 648100-Y)

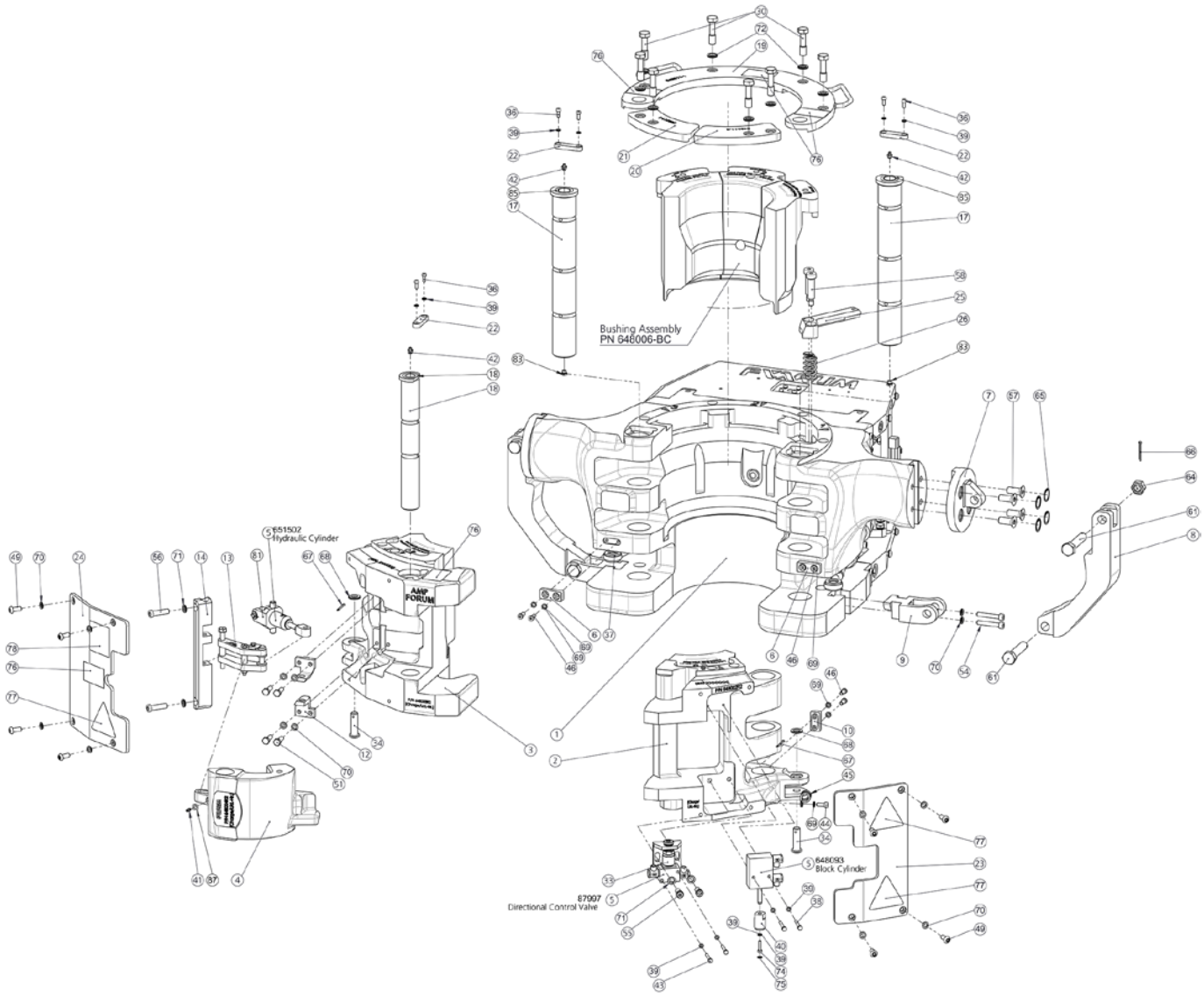

Fig. 64: 648100-Y AMP®-500/1 Drawing I

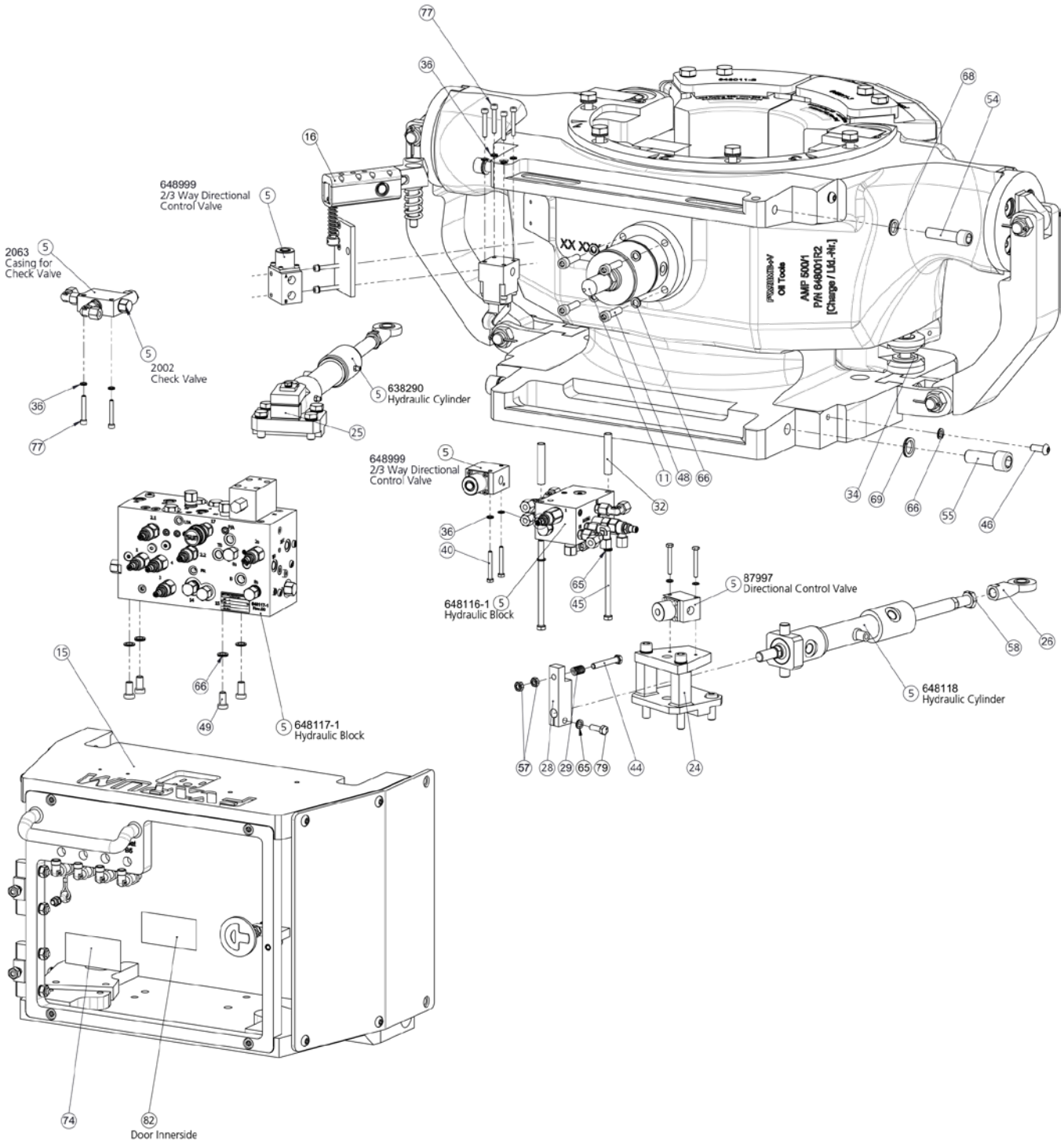

Fig. 65: 648100-Y AMP®-500/1 Drawing II

Parts List for 648100-Y AMP®-500/1

Pos.	Qty.	P/N	Description
1	1	648001-BF	Body
2	1	648002-BF	Door, right
3	1	648003-BF	Door, left
4	1	648004-BF	Latch
5	1	648009	Hydraulic Assembly
6	2	648085	Arrester Plate 2
7	2	648182	Link Block Adapter
8	2	648080	Link Block, Part 1
9	2	648081	Link Block, Part 2
10	1	648084	Arrester Plate
11	1	648162	Trigger Assembly
12	2	648292-2	Cylinder Flange
13	1	648055	Latch Mechanism Assembly
14	1	648055-2	Latch Mechanism Flange
15	1	648050	Hydraulic Box
16	1	648065	Load Sensor Assembly
17	2	648077	Door Pin
18	1	648078	Latch Pin
19	1	648011-1	Bushing Retainer (body)
20	1	648011-2	Bushing Retainer (door)
21	1	648011-3	Bushing Retainer (door)
22	3	648079	Pin Securing Plate
23	1	648083-1	Door Cover, Right
24	1	648083-2	Door Cover, Left
25	1	648068	Load Ring Segment
26	2	648053	Spring
27	1	638250	Cylinder Console Assembly
28	1	638270	Cylinder Console Assembly
29	2	648087	Pivot
30	8	688067	Retainer Bolt
31	1	648153	Latch Valve Actuating Block
32	1	752219	Overload Spring
33	1	688040	Feedback Valve Assembly
34	2	638276	Cylinder Pin
35	2	648051	Distance Pipe
36	6	613884	screw
37	4	774312	Washer
38	2	710651	Screw
39	21	792111	Washer
40	1	648093-1	Verification Pin
41	1	756790	Grease Fitting
42	3	70064	Grease Fitting
43	6	87805	Screw
44	1	613640	Screw
45	1	688059-HS	Rubber-lined connecting clamps
46	6	774610	Hexagon socket
47	1	675055	Screw
48	2	648119	Screw
49	12	688099	Screw
50	1	645198	Screw
51	4	645195	Screw
52	4	752832	Screw
53	4	612576	Screw
54	4	645649	Screw
55	2	613548	Screw
56	2	737025	Screw
57	8	645620	Screw
58	2	648269	Screws
59	2	725467	Screw
60	2	615152	Screw
61	4	613623-11	Screw

Pos.	Qty.	P/N	Description
62	2	613633	Nut
63	2	710348	Nut
64	4	613556-41	Nut
65	8	645697	Retaining ring
66	4	752339	Cotter pin
67	2	725274	Cotter Pin
68	2	615879	Washer
69	10	792112	Washer
70	29	792103	Washer
71	4	792104	Washer
72	10	792106	Washer
73	2	792108	Washer
74	1	651539-10	Screw
75	1	648088	Retaining rings
76	5	671642	Warning sign Grease Daily
77	3	671641	Warning sign "squeeze danger"
78	1	671639	Danger Automatic close system
79	1	671638	Warning sign
80	1	613129	Technical Support
81	1	648040	"Assembly Latch Microzylinder"
82	6	612672	Screw
83	2	710642	Locking Screw
84	1	613723	Screw
85	2	612530-1	Marking Point
86	1	612530-3	Marking Point
87	1	612530-9	Marking Point

5.3.1.5 Drawings and Parts List for AMP®-500/2 (P/N 648200-Y)

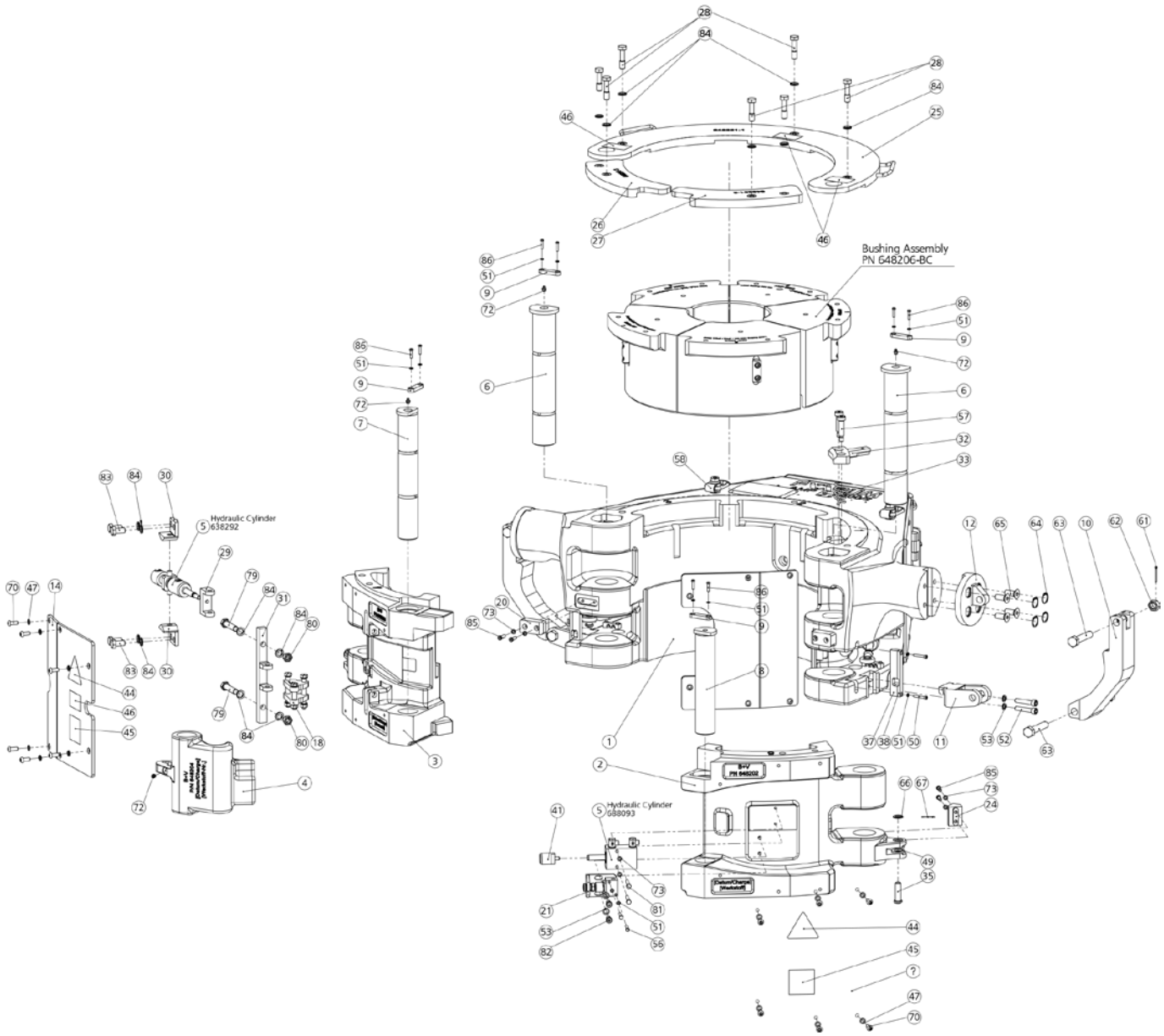

Fig. 66: 648200-Y AMP®-500/2 Drawing I

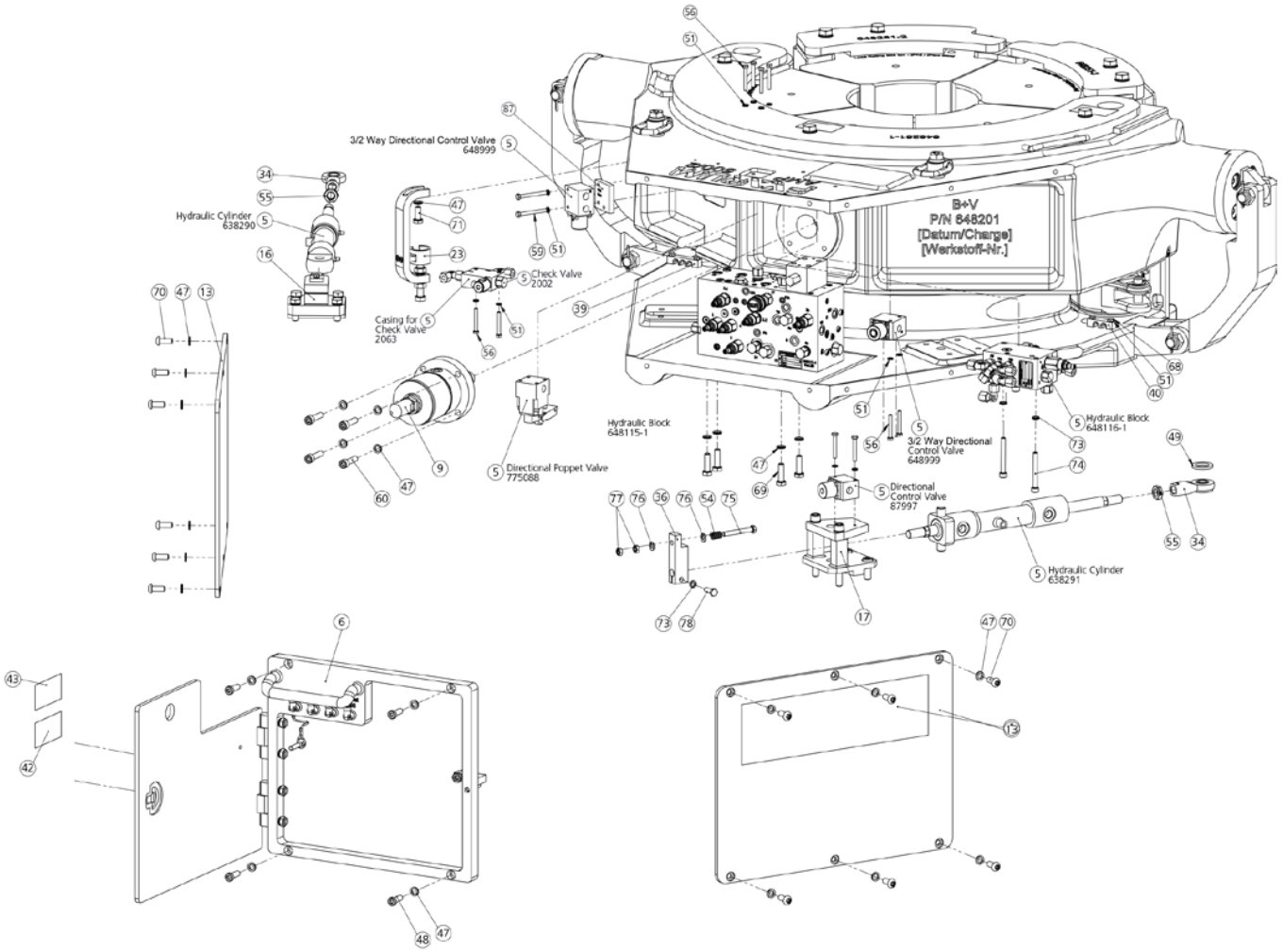

Fig. 67: 648200-Y AMP®-500/2 Drawing II

Parts List for 648200-Y AMP®-500/2

Pos.	Qty.	P/N	Description
1	1	648201-BF	Body
2	1	648202-BF	Door, Right
3	1	648203-BF	Door, Left
4	1	648204-BF	Latch
5	1	648209	Hydraulic Assembly
6	2	648277	Hinge Pin
7	1	648278	Latch Pin
8	1	648278-1	Latch Retaining Pin
9	4	648079	Pin Securing Plate
10	2	648080	Link Block, Part 1
11	2	648281	Link Block, Part 2
12	2	648182	Link Block Adapter
13	2	648283	Cover Sheet Body
14	1	648283-1	Cover Sheet Door Lh
15	1	648283-2	Cover Sheet Door Rh
16	1	638270	Cylinder Console Assembly
17	1	638250	Cylinder Console Assembly
18	1	648253	Latch Mechanism Assembly
19	1	648284	Rear Door Assembly
20	2	648254	Arrester Plate 1
21	1	688040	Feedback Valve Assembly
22	1	648262	Trigger Assembly
23	1	648060	Load Sensor Assembly
24	1	648255	Arrester Plate 2
25	1	648251-1	Bushing Retainer (Body)
26	1	648251-3	Bushing Retainer (Door Left)
27	1	648251-2	Bushing Retainer (Door Right)
28	7	688067	Retainer Bolt
29	1	638292-1	Cylinder Fork
30	2	638292-2	Cylinder Flange
31	1	648261	Latch Mechanism Flange
32	1	648268	Load Ring Segment
33	2	648052	Spring
34	2	648087	Pivot
35	2	638276	Cylinder Pin
36	1	648153	Latch Valve Actuating Block
37	2	648263	Cable Routing
38	2	648263-1	Cable Routing
39	1	638296	Clamp, (Three 8Mm Hoses)
40	1	638295	Clamp (Two 8Mm Hoses)
41	1	688093-2	Verification Pin
42	1	613129	Technical Support
43	1	671638	Warning Sign
44	2	671641	Warning Sign "Squeeze Danger"
45	2	671639-1	Danger Automatic Close System
46	5	671642	Warning Sign Grease Daily
47	37	792103	Washer
48	4	648197	Screw
49	4	774312	Washer
50	4	612672	Screw
51	28	792111	Washer
52	4	775967	Screw
53	6	792104	Washer
54	1	752219	Overload Spring
55	2	710348	Nut
56	10	87805	Screw
57	2	648169	Screws
58	2	553468	Lifting Eye
59	2	645136	Screw
60	4	752832	Screw
61	4	752339	Cotter Pin

Pos.	Qty.	P/N	Description
62	4	613556-41	Nut
63	4	613623-11	Screw
64	8	645697	Retaining Ring
65	8	645620	Screw
66	2	615879	Washer
67	2	660416	Cotter Pin
68	4	710727	Screw
69	4	87724	Screw
70	24	688099	Screw
71	1	725461	Screw
72	4	70064	Grease Fitting
73	11	792112	Washer
74	2	645670-7	Cylinder Screw
75	1	613786	Screw
76	2	645683	Washer
77	2	613633	Nut
78	1	735852	Screw
79	2	645682	Screw
80	2	792317	Hexagon Nuts
81	2	612588	Screw
82	2	613548	Screw
83	4	617519	Screw
84	15	792106	Washer
85	6	792134	Screw
86	8	88233	Screw
87	1	648114	Distance Plate

5.3.1.6 Drawings and Parts List for AMP®-750/1 (P/N 678100-Y) and AMP®-1000/1 (P/N 618100-Y)

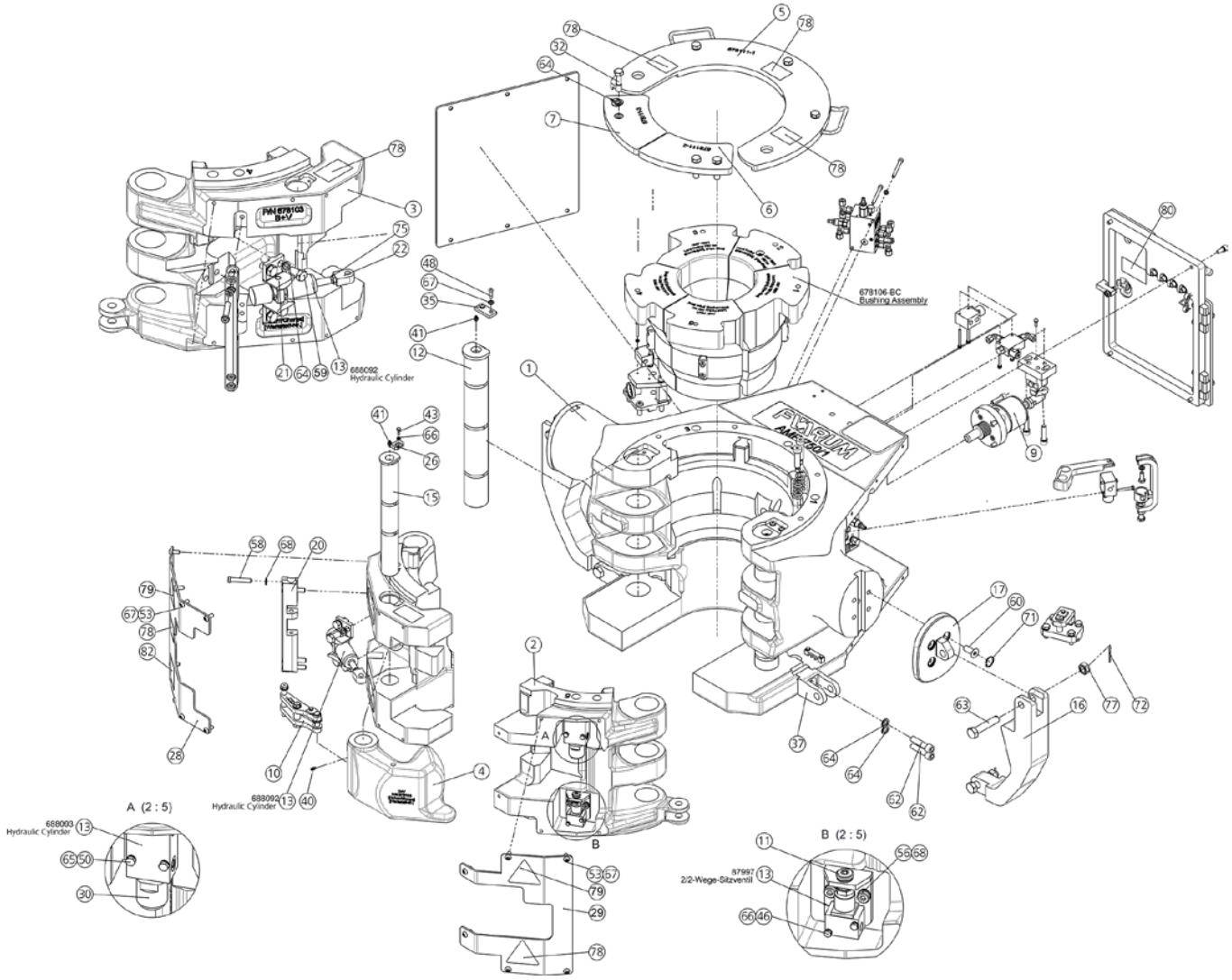

Fig. 68: 678100-Y AMP®-750/1 and 618100-Y AMP®-1000/1 Drawing I

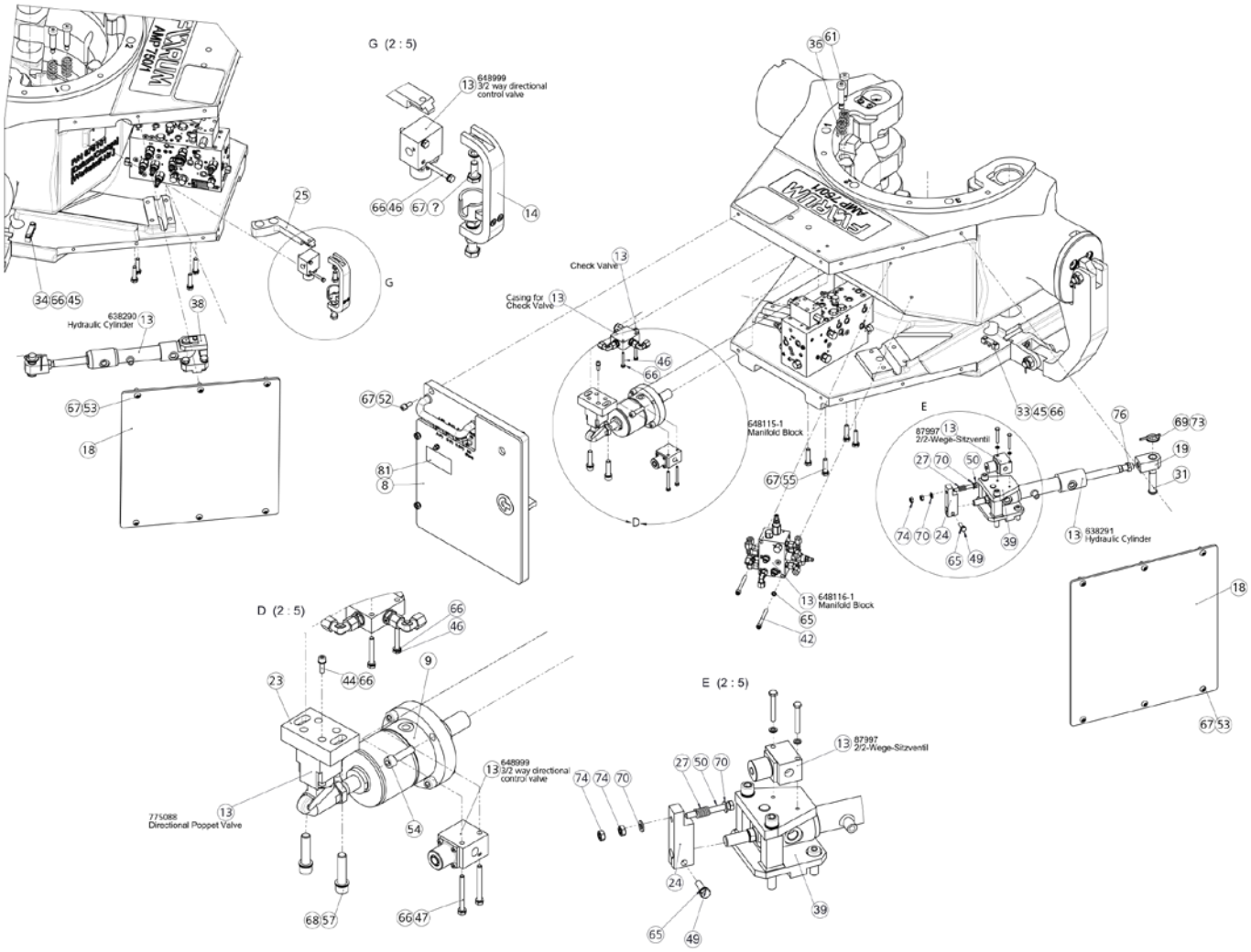

Fig. 69: 678100-Y AMP®-750/1 and 618100-Y AMP®-1000/1 Drawing II

Parts List for 678100-Y AMP®-750/1 and 618100-Y AMP®-1000/1

Pos.	Qty.	P/N	Description
1	1	678101-BF	Body
2	1	678102-BF	Door, right
3	1	678103-BF	Door, left
4	1	678104-BF	Latch
5	1	678111-1	Bushing Retainer (body)
6	1	678111-2	Bushing Retainer (right door)
7	1	678111-3	Bushing Retainer (left door)
8	1	678184	Rear Door Assembly
9	1	678162	Trigger Assembly
10	1	678155	Latch Mechanism Assembly
11	1	688040	Feedback Valve Assembly
12	2	678177	Hinge Pin
13	1	678109	Hydraulic Assembly
14	1	648060	Load Sensor Assembly
15	1	678178	Latch Pin
16	2	678180	Link Block
17	2	678182	Link Block Adapter
18	2	678183	Cover Sheet
19	2	638290-1	Pivot
20	1	688055-2	Latch Mechanism Flange
21	2	638292-2	Cylinder Flange
22	1	688092-1	Pivot
23	1	678154	Valve Adapter Block
24	1	648153	Latch Valve Actuating Block
25	1	678168	Load Ring Segment
26	1	648179	Pin Securing Plate
27	1	752219	Overload Spring
28	1	678183-2	Door Cover, left
29	1	678183-1	Door Cover, right
30	1	688093-1	Verification Pin
31	2	638276-1	Cylinder Pin
32	7	688067	Retainer Bolt
33	1	638295	Clamp (two 8mm hoses)
34	1	638296	Clamp, (three 8mm hoses)
35	2	641512	Safety Plate
36	2	648052	Spring
37	2	678181	Link Block, Part 2
38	1	638270	Cylinder Console Assembly
39	1	638250	Cylinder Console Assembly
40	1	756790	Grease Fitting
41	3	70064	Grease Fitting
42	2	645670-6	Screws
43	1	612671	Hexagon Screw
44	4	612597	Screw
45	4	710727	Screw
46	6	87805	Screw
47	2	645136	Screw
48	4	772878	Screw
49	1	735852	Screw
50	3	613786	Screw
51	1	89126	Screw
52	4	612676	Screw
53	26	688099	Screw
54	4	752832	Screw
55	4	753049	Screw
56	2	613548	Screw
57	2	671056	Screw
58	4	757410	Screw
59	4	617519	Screw
60	8	645620	Screw
61	2	648269	Screws

Pos.	Qty.	P/N	Description
62	4	775435	screw
63	4	613623-11	Screw
64	15	792106	Washer
65	5	792112	Washer
66	17	792111	Washer
67	40	792103	Washer
68	8	792104	Washer
69	2	612679	Washer
70	2	645683	Washer
71	8	645697	Retaining ring
72	4	752339	Cotter pin
73	2	70263	Cotter Pin
74	2	613633	Nut
75	1	660568	Nut
76	2	710348	Nut
77	4	613556-41	Nut
78	6	671640	Warning sign "Hands"
79	2	671641	Warning sign "squeeze danger"
80	1	613129	Technical Support
81	1	671638	Warning sign
82	1	671639	Danger Automatic close system

5.3.1.7 Drawing and Parts List for AMP®-1250/1 (P/N 688000-Z)

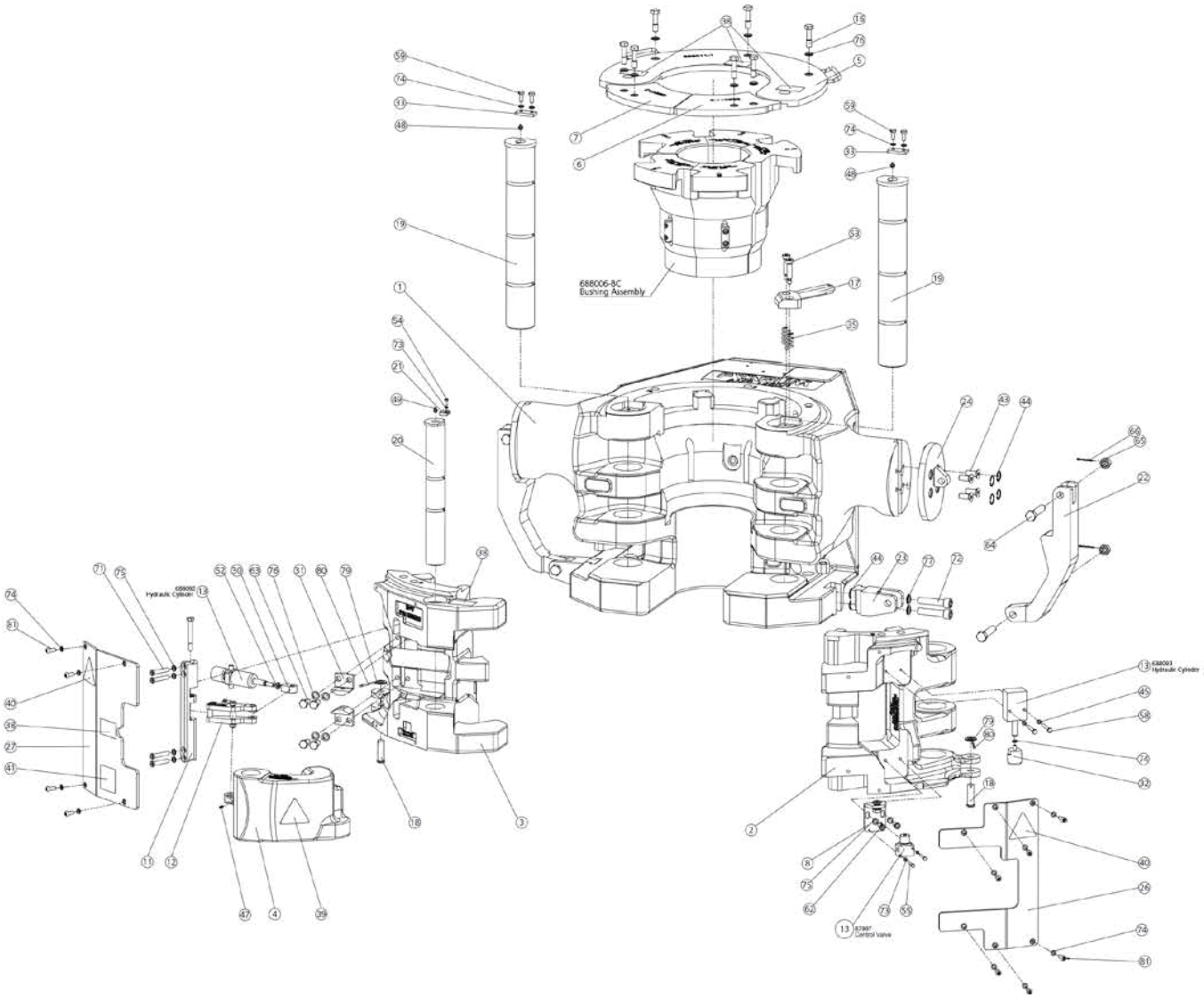

Fig. 70: 688000-Z AMP®-1250/1 Drawing I

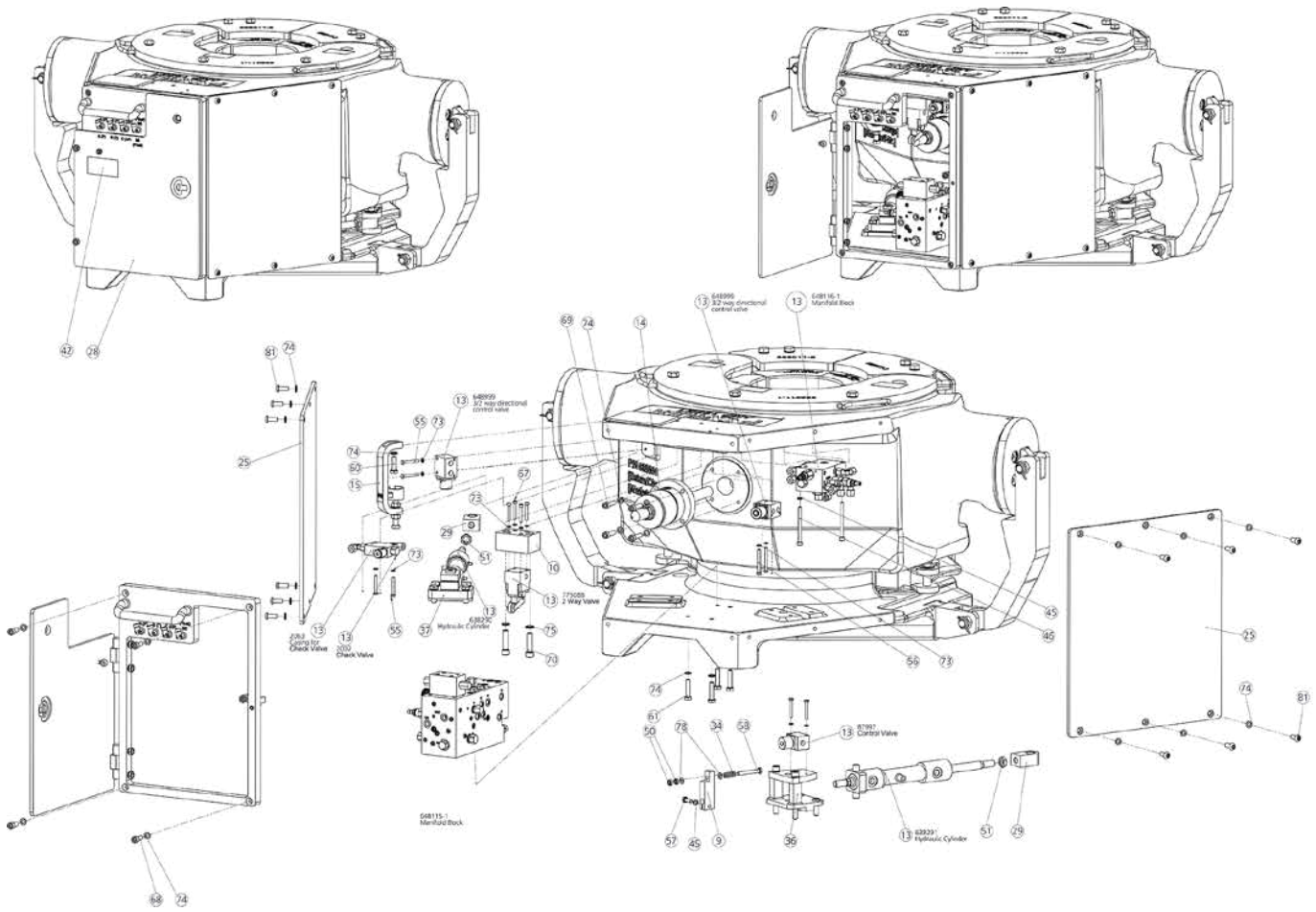

Fig. 71: 688000-Z AMP®-1250/1 Drawing II

Parts List for 688000-Z AMP®-1250/1

Pos.	Qty.	P/N	Description
1	1	688001-BF	Body
2	1	688002-BF	Door, Right
3	1	688003-BF	Door, Left
4	1	688004-BF	Latch
5	1	688011-1	Bushing Retainer
6	1	688011-2	Bushing Retainer
7	1	688011-3	Bushing Retainer
8	1	688040	Feedback Valve Assembly
9	1	648153	Latch Valve Actuating Block
10	1	688054	Valve Adapter Block
11	1	688055-2	Latch Mechanism Flange
12	1	688055	Latch Mechanism Assembly
13	1	688009	Hydraulic Assembly
14	1	688062	Trigger Assembly
15	1	648060	Load Sensor Assembly
16	7	688067	Retainer Bolt
17	1	688068	Load Ring Segment
18	2	638276-1	Cylinder Pin
19	2	688077	Hinge Pin
20	1	688078	Latch Pin
21	1	648179	Pin Securing Plate
22	2	688080	Link Block
23	2	688081	Link Block, Part 2
24	2	688082	Link Block Adapter
25	2	688083	Cover Sheet
26	1	688083-1	Door Cover, Right
27	1	688083-2	Door Cover, Left
28	1	688084	Rear Door Assembly
29	2	638290-1	Pivot For Hydraulic Cylinder
30	1	688092-1	Pivot For Hydraulic Cylinder
31	2	638292-2	Cylinder Flange
32	1	688093-1	Verification Pin
33	2	641512	Safety Plate
34	1	752219	Overload Spring
35	2	648052	Spring
36	1	638250	Cylinder Console No.2
37	1	638270	Cylinder Console No.1
38	5	671642	Warning Sign "Grease Daily"
39	1	671640	Warning Sign "Hands" - Sticker
40	2	671641	Warning Sign "Squeeze Danger"
41	1	671639	Warning Sign "Automatic"
42	1	671638	Sign Forum
43	8	645620	Screw
44	12	645697	Retaining Ring
45	5	792112	Washer
46	2	755328	Screw
47	1	756790	Lubricating Nipples
48	2	612515	Grease Nipple
49	1	70064	Grease Nipple
50	2	613633	Nut
51	2	710348	Nut
52	1	660568	Nut
53	2	648169	Shoulder Screw
54	1	612671	Screw
55	6	87805	Screw
56	2	645136	Screw
57	1	735852	Screw
58	3	613786	Screw
59	4	89126	Screw
60	1	87724	Screw
61	4	753049	Screw

Pos.	Qty.	P/N	Description
62	2	613548	Screw
63	4	617519	Screw
64	4	613623-11	Screw
65	4	613556-41	Nut
66	4	752339	Split Pin
67	4	612672	Screw
68	4	612676	Screw
69	4	752832	Screw
70	2	671056	Screw
71	4	757410	Screw
72	4	675108	Screw
73	13	792111	Washer
74	40	792103	Washer
75	8	792104	Washer
76	9	792106	Washer
77	4	792108	Washer
78	2	645683	Washer
79	2	612679	Washer
80	2	70263	Split Pin
81	22	688099	Flat Head Screw

5.3.2 Drawing and Parts Lists for Bushing Assembly

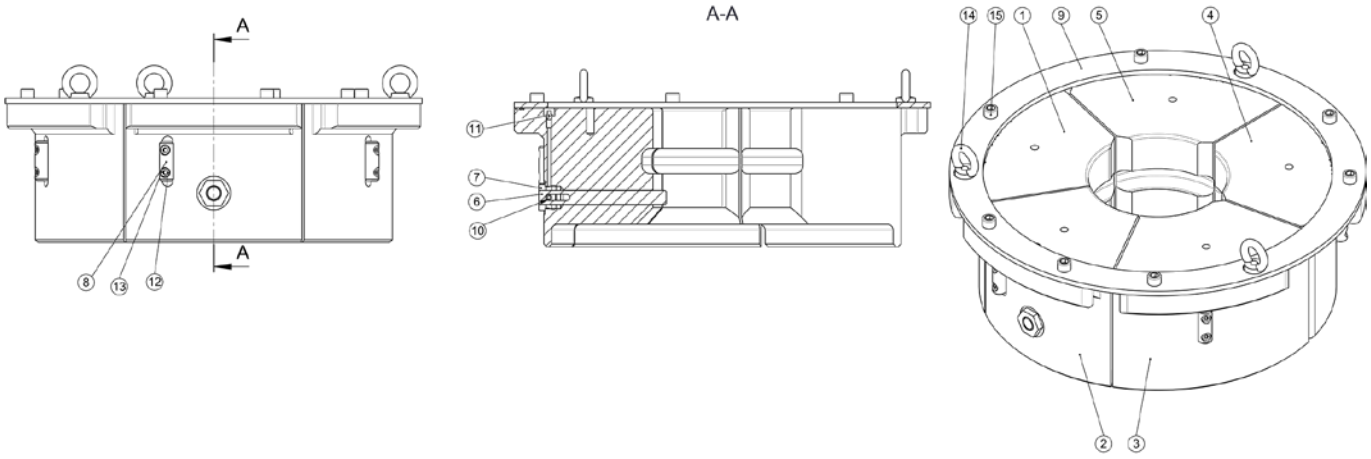

Fig. 72: Illustration of a Bushing Assembly

Parts Lists for Bushing Assembly

Pos.	Qty.	AMP®-350/1, AMP®-375/1 P/N 638106-BC	AMP®-350/2 P/N 638206-BC	AMP®-500/1 P/N 648006-BC	AMP®-500/2 P/N 648206-BC	Description
1	1	638106-1	638206-1	648006-1	648206-1	Body Bushing Segment (Right)
2	1	638106-2	638206-2	648006-2	648206-2	Body Bushing Segment (Center)
3	1	638106-3	638206-3	648006-3	648206-3	Body Bushing Segment (Left)
4	1	638106-4	638206-4	648006-4	648206-4	Door Bushing Segment (Left)
5	1	638106-5	638206-5	648006-5	648206-5	Door Bushing Segment (Right)
6	1	648175-BC	638275-BC	678075-BC	648275-BC	Trigger Pin
7	1	648110	648110	648110	648110	Insert Nut
8	5	648112	648112	648113	648112	Guide Pin
9	1	638233	638233	648135	-	Transport Tool
9	1	-	-	-	648232	Transport Ring (AMP®-500/2 only)
10	1	621109	621109-2	621109	621109-2	Dowel Pin
11	1	70064	70064	70064	70064	Grease Fitting
12	10	648197	648197	648197	648197	Screw
13	10	792103	792103	792103	792103	Washer
14	3	-	-	-	755402	Ring Bolt
15	7	-	-	-	735324	Cap Screw

Pos.	Qty.	AMP®-750/1 P/N 678106-BC	AMP®-1000/1 P/N 618106-BC	AMP®-1250/1 P/N 688006-BC	Description
1	1	678106-1	618106-1	688006-1	Body Bushing Segment (Right)
2	1	678106-2	618106-2	688006-2	Body Bushing Segment (Center)
3	1	678106-3	618106-3	688006-3	Body Bushing Segment (Left)
4	1	678106-4	618106-4	688006-4	Door Bushing Segment (Left)
5	1	678106-5	618106-5	688006-5	Door Bushing Segment (Right)
6	1	648275-BC	678075-BC	688075-BC	Trigger Pin
7	1	648110	648110	648110	Insert Nut
8	5	648112	648112	648112	Guide Pin
9	1	678133	678113	688033	Transport Tool
10	1	621109	621109	621109	Dowel Pin
11	1	70064	70064	70064	Grease Fitting
12	10	648197	648197	648197	Screw
13	10	792103	792103	792103	Washer
14	3	-	-	-	Ring Bolt
15	7	-	-	-	Cap Screw

5.3.3 Component Size - Bushing Assemblies

The following charts apply for all Bushing Assemblies. Other Sizes and tubular types are available on request. Please follow this example to find the corresponding Part Nummber:

Basic PartNo of AMP® + Bore Code --> 648006-101
represents an AMP®-500/1 Bushing Assembly for a 2 3/8" Drill Pipe (External Upset) Bore Codes

18° DP (Drillpipe)

Size	Bore Code
2.3/8" EU	101
2.7/8" IU	102
2.7/8" EU	103
3.1/2" IU	104
3.1/2" EU	105
4" IU	106
4" EU	107
4.1/2" IU + EU	107
4.1/2" EU	109
5" IEU	109
5" IEU	109 HB
6.7/8"	110
5.1/2" IEU	111
6.906"	112
6.5/8" IEU	113
8.1/4" TJ	113
6.5/8" IEU	114
8.1/2" TJ	114
6.5/8" IEU	114 HB
8.7/8" TJ	114 HB
5.7/8"	115
5.68" HWDP	117
5.1/2"	118
S150 DP	118
6.5/8"	119
6"	120
6.5/8" Knobby	121
6.5/8" HWDP	170 HB
6.5/8" EU (max. 8.1/2" TJ)	171
5.3/4" IEU Sonder BC	172
6.5/8" HW Sonder BC	173 HB
5.1/2" SK Sonder BC	174
4" SH Sonder BC	175
4.1/2" SH Sonder BC	176
6.5/8" EU GTM69 TJ	177
6.3/8" Sonder BC	178
4.1/2" EU + 5" IEU	109-S
5.1/2" IEU (max. 8.1/4" TJ)	111-S
6.5/8" IEU (max. 9.1/4" TJ)	114-S

90° DP (Drillpipe)

Size	Bore Code
1.050" P	121
1.050" U	122
1.315" P	123
1.315" U	124
1.660" P	125
1.660" U	126
1.900" P	127
1.900" U	128
2.3/8" P	129
2.3/8" U	130
2.7/8" P	131
2.7/8" U	132
3.1/2" P	133
3.1/2" U	134
4"	135
4"	136
4.1/2" P	137
4.1/2" U	138
5"	139
5"	140
5.1/2" P	141
3"	142
2.3/8" IU	151
2.3/8" EU	152
2.7/8" IU	153
2.7/8" EU	154
3.1/2" IU	155
3.1/2" EU	156
4" IU	157
4" EU	158
4.1/2" IU + IEU	158
4.1/2" EU	159
5" IEU	159
5.1/2" IEU	160
6.5/8" IEU	161

90° CSG (Casing)

Size	Bore Code
3.1/2"	219
4"	220
4.1/2"	221
4.3/4"	222
5"	223
5.1/2"	224
5.3/4"	225
6"	226
6.1/4"	227
6.5/8"	228
7"	229
7.1/4"	230
7.5/8"	231
8"	232
8.1/4"	233
8.5/8"	234
9"	235
9.5/8"	236
10"	237
10.3/4"	238
11.3/4"	239

12"	240
12.3/4"	241
13"	242
13.3/4"	243
14.3/4"	244
16"	245
16.3/4"	246
18"	247
18.5/8"	248
20"	249
21.1/2"	250
24.1/2"	251
26"	252
30"	253
24"	254
14"	255
28"	256
36"	257
32"	258
13.5/8"	259
12.7/8"	260
22"	261
11.7/8"	262
8.3/4"	263
15"	264
9.7/8"	265
8.1/8"	266
17"	267
5.5/7"	268
7.3/4"	269
13.1/2"	270
16.1/3"	311
9.3/8"	312
27"	313
3.3/4"	400
29"	403
18.3/4"	404
17.7/8"	405
13.7/8"	406
14.7/8"	407
42"	408
10.3/8"	409
16.5/8"	410
11"	412
16.7/9"	413
17.1/5"	414
7.1/2"	415

Drill Collar WZG

Collar Ø	Bore Code
4.1/8"	181
4.3/4"	182
5.1/4"	183
5.1/2"	184
5.3/4"	185
6"	186
6.1/4"	187
6.1/2"	188
6.3/4"	189
7"	190
7.1/4"	191
7.1/2"	192
7.3/4"	193
8"	194
8.1/4"	195
8.1/2"	196
8.3/4"	197
9"	198
9.1/2"	199
9.5/8"	200
11.3/4"	201
10"	202
9.3/4"	203
	204
	205
3.1/8"	206
3.3/8"	207
3.1/2"	208
4.1/4"	210
4.1/2"	211
14"	212
10.3/4"	213
7.5/8"	214

Drill Collar WOZG

Collar Ø	Bore Code
3.1/4"	271
3.1/2"	272
4"	273
4.1/8"	274
4.1/2"	275
4.3/4"	276
5"	277
5.1/8"	278
5.1/4"	279
5.1/2"	280
5.3/4"	281
6"	282
6.1/8"	283
6.1/4"	284
6.3/8"	285
6.1/2"	286
6.3/4"	287
7"	288
7.1/4"	289
7.3/8"	290
7.1/2"	291
7.3/4"	292
8"	293
8.1/8"	294
8.1/4"	295
8.1/2"	296
9"	297
9.1/2"	298
9.5/8"	299
9.3/4"	300
10"	301
10.1/8"	302
10.3/4"	303
11"	304
11.1/4"	305
11.3/4"	306
12"	307
3.1/8"	308
3.3/8"	309
8.3/4"	310
7.5/8"	311

5.3.4 Tool Kit for AMP®

Parts List for 648100-TK - Elevator Tool Kit

Pos.	Qty.	P/N	Description
1	2	645234	Lifting Handle for Bushing
2	1	675170	Set of Hydraulic Hoses
3	10	612943	Cablebinder for Hydraulic Assembly
4	2	755368	Equal Tee
5	2	755367	L-Adapter
6	1	775814	Case for Hook up Kit equipment
7	2	755402	Lifting eye bolt
8	1	675162	Toolset for SD Elevators & Power Slips
9	1	675163	Wire Rotator Tong
10	1	757121	Manometer
11	1	757122	Hose
12	1	757123	Adapter
13	2	645833	Coupling, Flat Face
14	2	645834	Coupling, Flat Face
15	4	755374	Straight Male Stud Coupling
16	2	531200	Balancing Strap Assembly for 2.1/4" und 3.1/2"
17	2	543400	Balancing Strap Assembly for 4.3/4" Links
18	2	752203	Shackle
19	2	553468	Lifting eye

Parts List for 648100-HUK Elevator Hook Up Kit

Pos.	Qty.	P/N	Description
1	2	645234	Lifting Handle for Bushing
2	1	675170	Set of Hydraulic Hoses
3	10	612943	Cablebinder for Hydraulic Assembly
4	2	755368	Equal Tee
5	2	755367	L-Adapter
6	1	775814	Case for Hook up Kit tools
7	2	755402	Lifting eye bolt
8	1	675162	Toolset for SD Elevators & Power Slips
9	1	675163	Wire Rotator Tong
10	1	757121	Manometer
11	1	757122	Hose
12	1	757123	Adapter
13	2	645833	Coupling, Flat Face
14	2	645834	Coupling, Flat Face
15	4	755374	Straight Male Stud Coupling
16	2	531200	Balancing Strap Assembly for 2.1/4" und 3.1/2"
17	2	543400	Balancing Strap Assembly for 4.3/4" Links
18	2	752203	Shackle
19	2	553468	Lifting eye

5.3.5 Mechanic Assemblies - Drawing and Parts Lists

5.3.5.1 Trigger Assembly

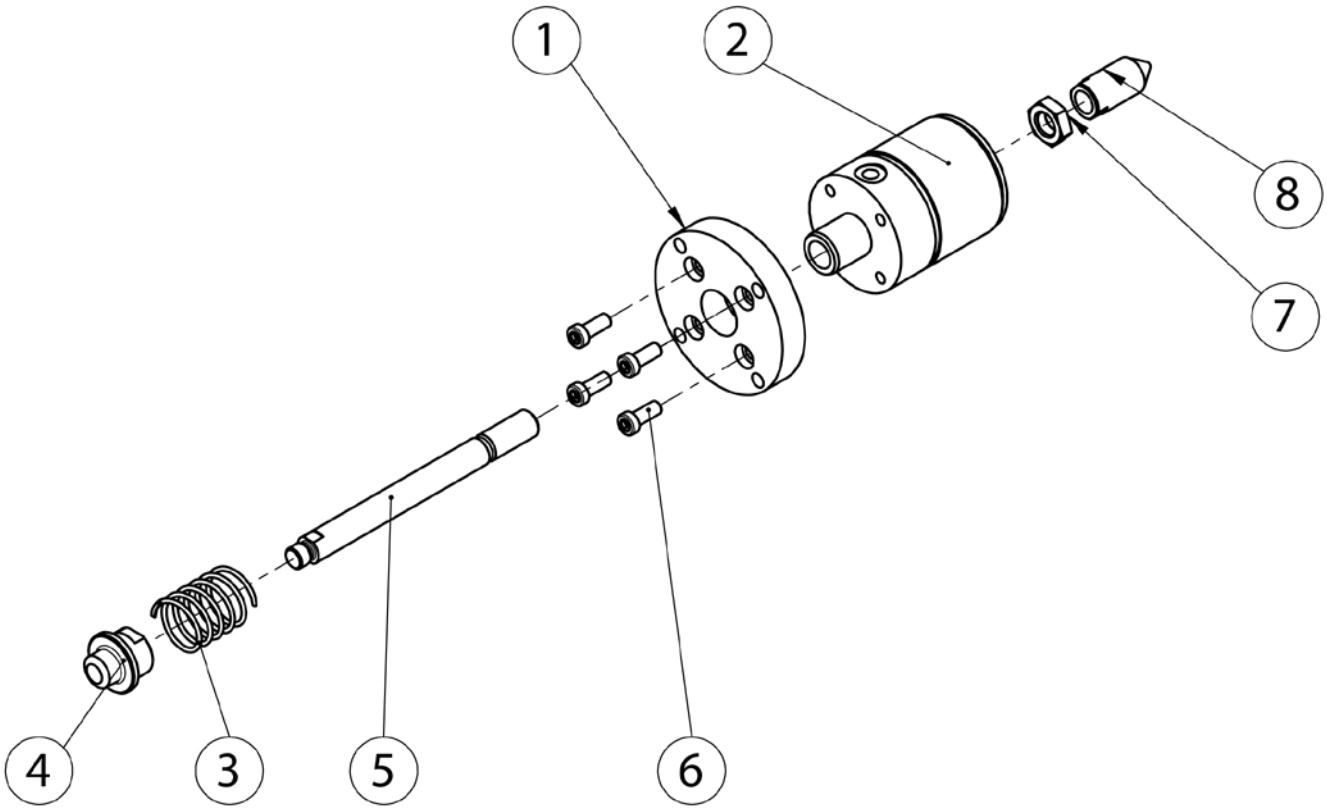

Fig. 73: Trigger Assembly

Parts List for Trigger Assembly

Pos.	Qty.	P/N 648162 AMP®-375/1, AMP®-350/1, AMP®-350/2, AMP®-500/1	P/N 648262 AMP®-500/2	P/N 678162 AMP®-750/1, AMP®-1000/1	P/N 688062 AMP®-1250/1	Description
1	1		648189			Cylinder Equipment Flange
2	1		648188			Hollow Piston Cylinder
3	1		648174			Trigger Spring
4	1	648171	648271	678171	688071	Trigger Actuating Bolt 1
5	1	648172	648172	648172	648172	Trigger Actuating Bolt 2
6	1	648173	648173	648173	648173	Trigger Activity Bolt 3
7	4		612577			Screw
8	1		725415			Nut

5.3.5.2 Cylinder Console No. 1

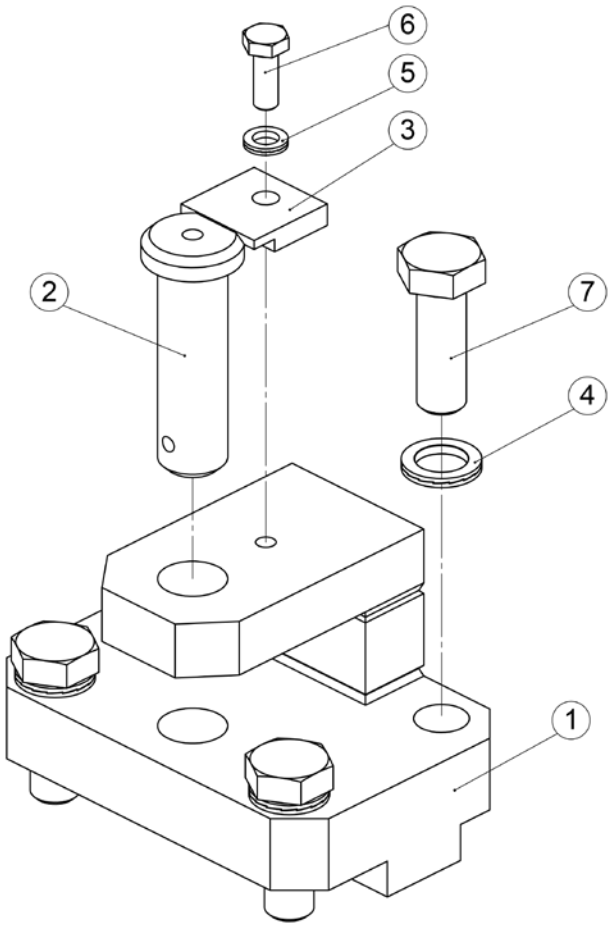

Fig. 74: Cylinder Console

Parts List for 638270 Cylinder Console No. 1

Pos.	Qty.	P/N	Description
1	1	638260	Cylinder Console 2
2	1	638276	Cylinder Pin
3	4	648161	Securing sheet
4	2	792104	Washer
5	2	792111	Washer
6	2	612671	Screw
7	2	660582	Screw

5.3.5.3 Cylinder Console No. 2

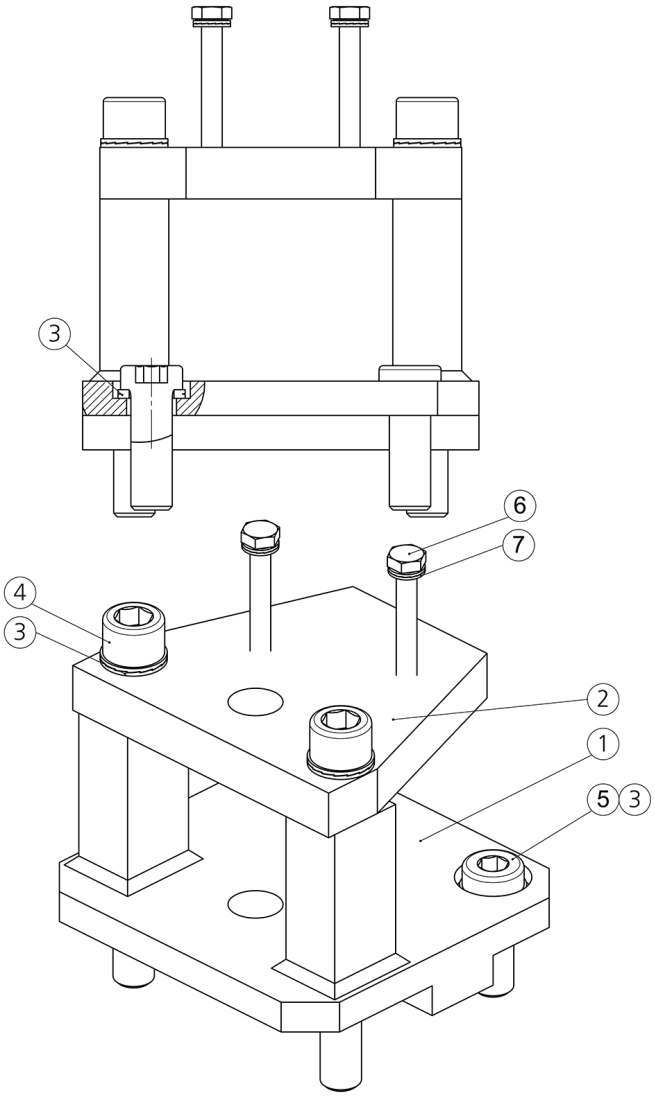

Fig. 75: Cylinder Console

Parts List for 638250 Cylinder Console No. 2

Pos.	Qty.	P/N	Description
1	1	638251	Cylinder Console 1
2	1	638252	Top Plate
3	4	792104	Washer
4	2	645027	Screw
5	2	559213	Screw
6	2	87805	Screw
7	2	792111	Washer

5.3.5.4 Pestle Assembly (P/N 651538) for AMP®-350/2

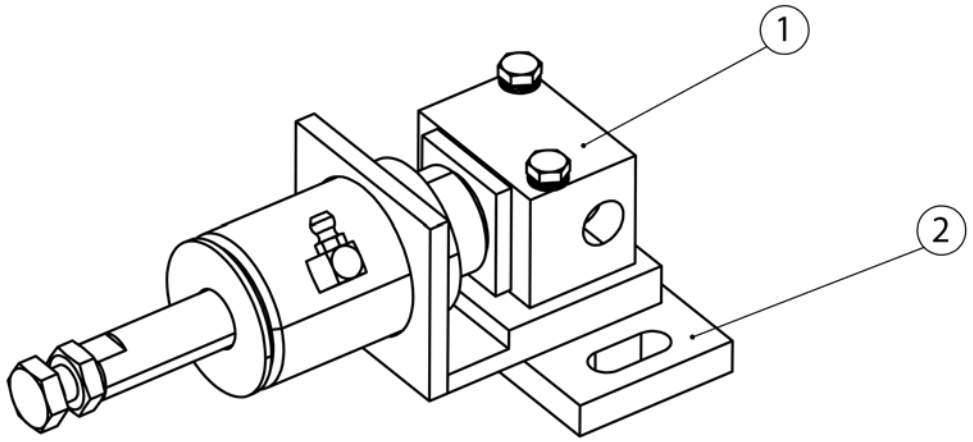

Fig. 76: 651538 Pestle Assembly incl. welding plate

Parts List for 651538 Pestle Assembly incl. welding plate X

Pos.	Qty.	P/N	Description
1	1	642518	Pestle Assembly
2	1	651538-1	Welding Plate

5.3.5.5 Pestle Assembly P/N 642518

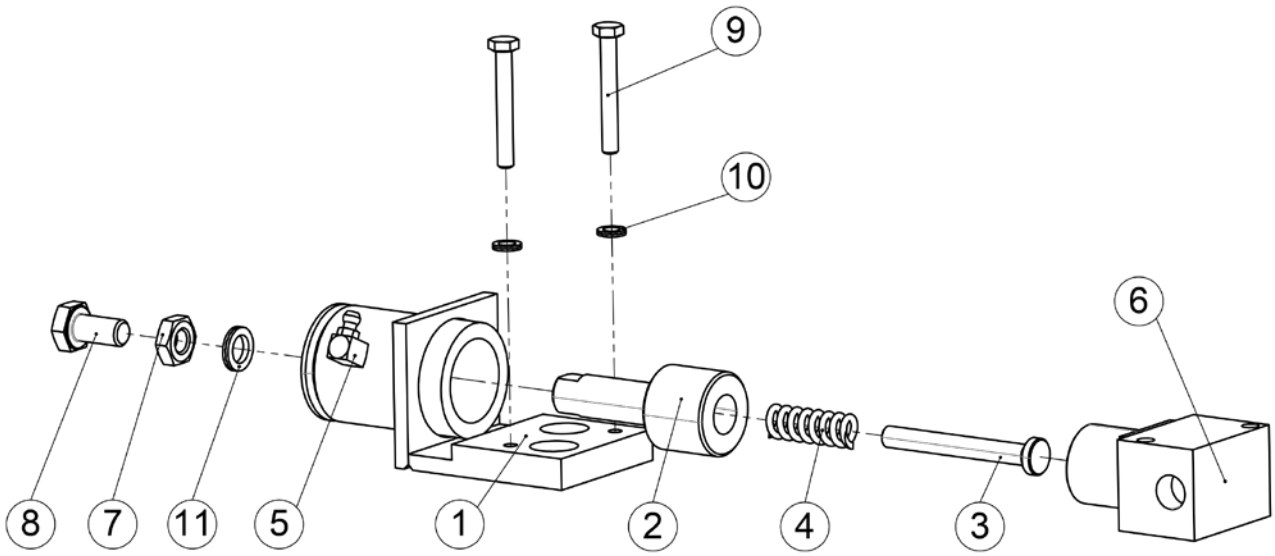

Fig. 77: 642518 Pestle Assembly

Parts List for 642518 Pestle Assembly

Pos.	Qty.	P/N	Description
1	1	642518-1	Welding console
2	1	642518-2	Piston
3	1	642518-3	Pestle
4	1	752219	Overload Spring
5	1	756791	Lubricating nipples
6	1	87997	Directional control Valve
7	1	641576	Nut
8	1	645198	Screw
9	2	726009	Screw
10	2	792111	Washer
11	1	792103	Washer

5.3.5.6 Latch Mechanism Assembly for AMP®-350/2 (P/N 638255)

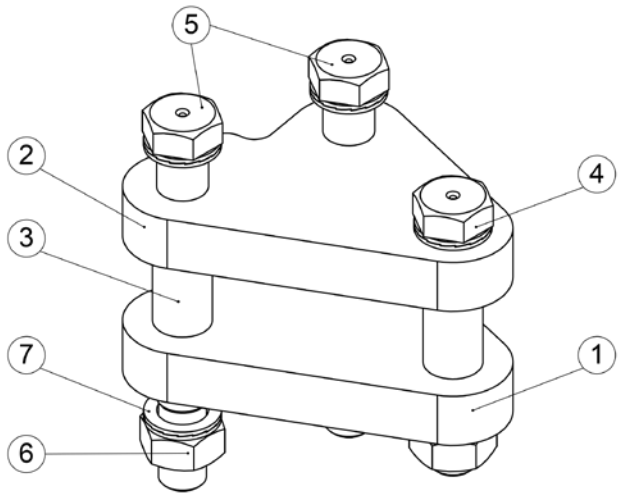

Fig. 78: 638255 Latch Mechanism Assembly

Parts List for 638255

Pos.	Qty.	P/N	Description
1	1	638256 1	Latch Mechanism Plate 1
2	1	638256 2	Latch Mechanism Plate 2
3	3	638255 1	Distance Pipe
4	1	638222	Screw
5	2	638223	Screw
6	3	612690	Nut
7	6	792104	Washer

5.3.5.7 Latch Mechanism Assembly for AMP®-350/1, AMP®-375/1 and AMP®-500/1 (P/N 648055)

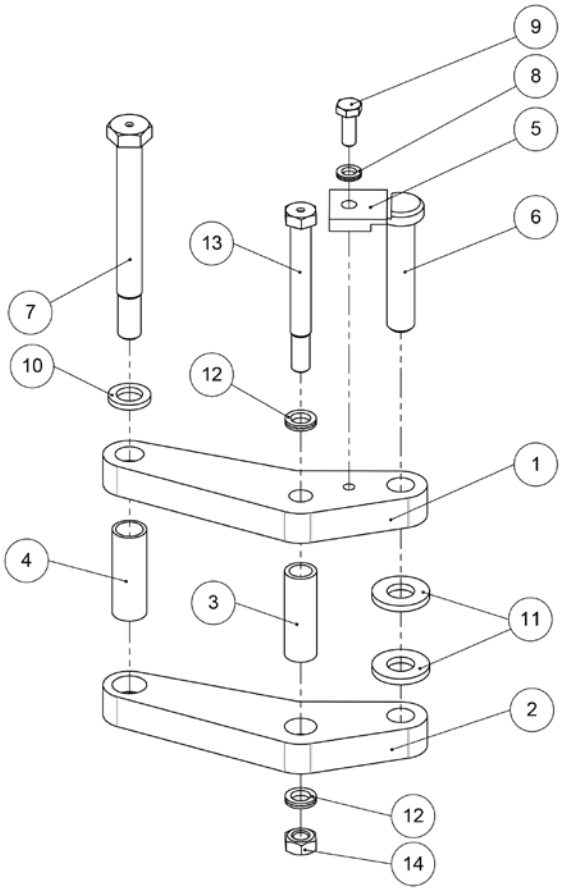

Fig. 79: 648055 Latch Mechanism Assembly

Parts List for 648055

Pos.	Qty.	P/N	Description
1	1	648056-1	Latch Mechanism Plate 1
2	1	648056-2	Latch Mechanism Plate 2
3	1	648055-1	Distance Pipe 2
4	1	648255-1	Distance Pipe 1
5	1	648161	Securing Sheet
6	1	688055-6	Bolt
7	1	648223	Screw
8	1	792111	Washer
9	1	612671	Screw
10	1	772884	Washer
11	2	774430	Washer for clevis pin
12	2	792112	Washer
13	1	648222	Screw
14	1	613633	Nut

5.3.5.8 Latch Mechanism Assembly for AMP®-500/2 (P/N 648253)

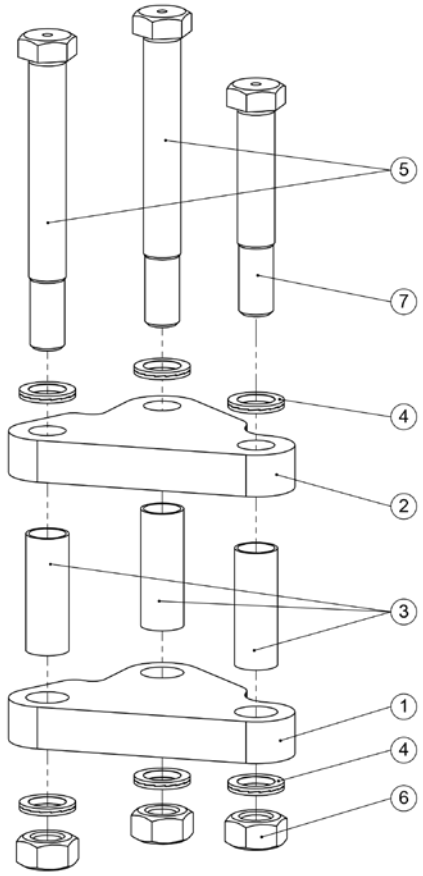

Fig. 80: 648253 Latch Mechanism Assembly for AMP®-500/2

Parts List for 648253

Pos.	Qty.	P/N	Description
1	1	648256-1	Latch Mechanism Plate 1
2	1	648256-2	Latch Mechanism Plate 2
3	3	638255-1	Distance Pipe 1
4	6	792104	Washer
5	2	638223	Screw
6	3	612690	Nut
7	1	638222	Screw

5.3.5.9 Latch Mechanism Assembly for AMP®-750/1 and AMP®-1000/1 (P/N 678155)

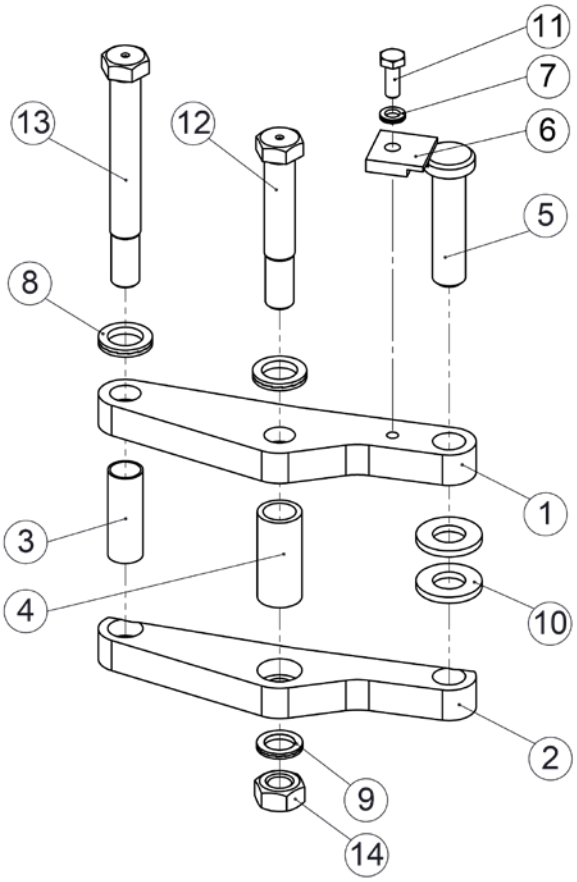

Fig. 81: 678155 Latch Mechanism Assembly for AMP®-750/1 and AMP®-1000/1

Parts List for 678155

Pos.	Qty.	P/N	Description
1	1	678156-1	Latch Mechanism Plate 1
2	1	678156-2	Latch Mechanism Plate 2
3	1	638255-1	Distance Pipe 1
4	1	688055-1	Distance Pipe
5	1	688055-6	Bolt
6	1	648161	Securing Sheet
7	1	792111	Washer
8	1	792104	Washer
9	2	792105	Washer
10	2	688055-4	Washer for clevis pin
11	1	612671	Screw
12	1	638222	Screw
13	1	638223	Screw
14	1	612690	Nut

5.3.5.10 Latch Mechanism Assembly for AMP®-1250/1 (P/N 688055)

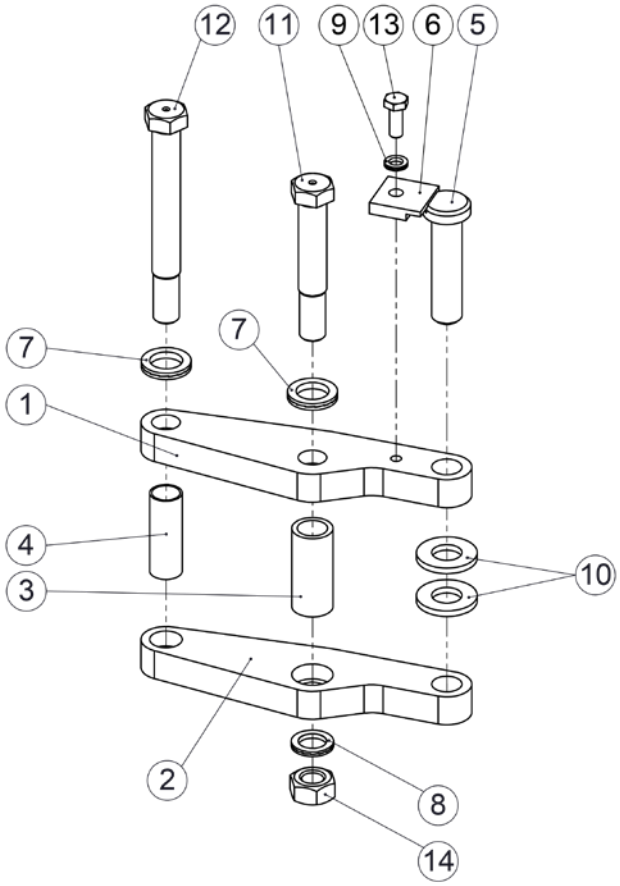

Fig. 82: 688055 Latch Mechanism Assembly for AMP®-1250/1

Parts List for 688055

Pos.	Qty.	P/N	Description
1	1	688056-1	Latch Mechanism Plate 1
2	1	688056-2	Latch Mechanism Plate 2
3	1	688055-1	Distance Pipe
4	1	638255-1	Distance Pipe 1
5	1	688055-6	Bolt
6	1	648161	Securing Sheet
7	2	792105	Washer
8	1	792104	Washer
9	1	792111	Washer
10	2	688055-4	Washer for clevis pin
11	1	638222	Screw
12	1	638223	Screw
13	1	612671	Screw
14	1	612690	Nut

5.3.5.11 Rear Door Assembly

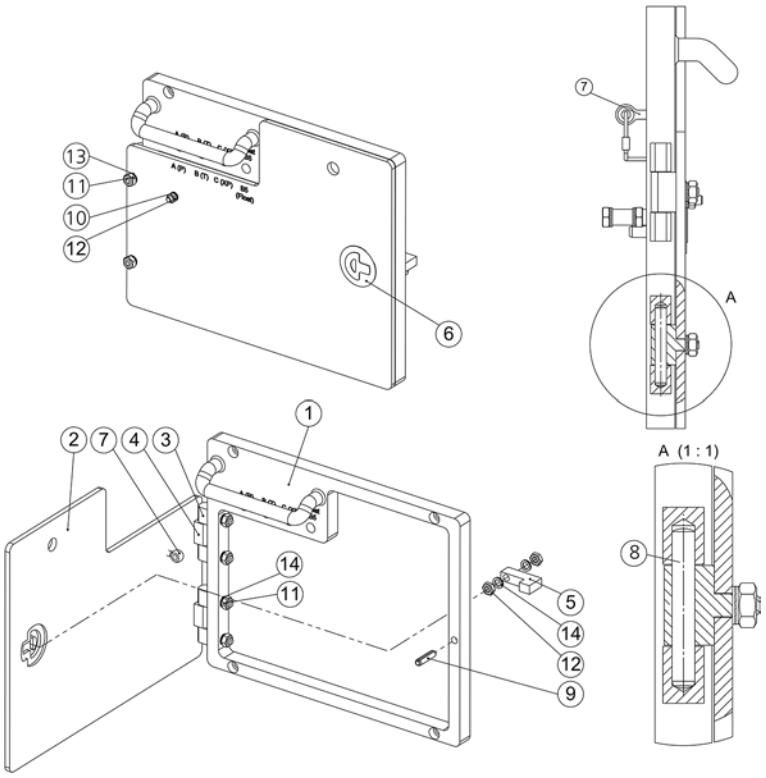

Fig. 83: Rear Door Assembly

Parts List for Rear Door Assembly

Pos.	Qty.	P/N 648162 AMP®-375/1, AMP®-350/1, AMP® -350/2, AMP®-500/1	P/N 648262 AMP®-500/2	P/N 678162 AMP®-750/1, AMP®-1000/1	P/N 688062 AMP®-1250/1	Description
1	1	648184-1	648284-1	678184-1	688084-1	Rear Frame
2	1	648184-2	648284-2	678184-2	688084-2	Rear Door
3	4	648184-3	648184-3	648184-3	648184-3	Hinge Part 1
4	2	648184-4	648184-4	648184-4	648184-4	Hinge Part 2
5	1	678184-5	688084-3	678184-5	678184-5	Closing Hook Amp Elevator
6	1	648164	648164	648164	648164	Closing Device
7	1	688084-3	678184-5	688084-3	688084-3	Safety Rope
8	2	645638	735846	645638	645638	Parallel Pin
9	1	621109	792103	621109	621109	Spring-Type Straight Pin
10	1	613633	645638	613633	613633	Nut
11	6	735846	792112	735846	735846	Nut
12	2	641576	613633	641576	641576	Nut
13	1	792112	621109	792112	792112	Washer
14	8	792103	641576	792103	792103	Washer

5.3.5.12 Hydraulic Box for AMP®-350/1, AMP®-375/1, AMP®-500/1 P/N 648050

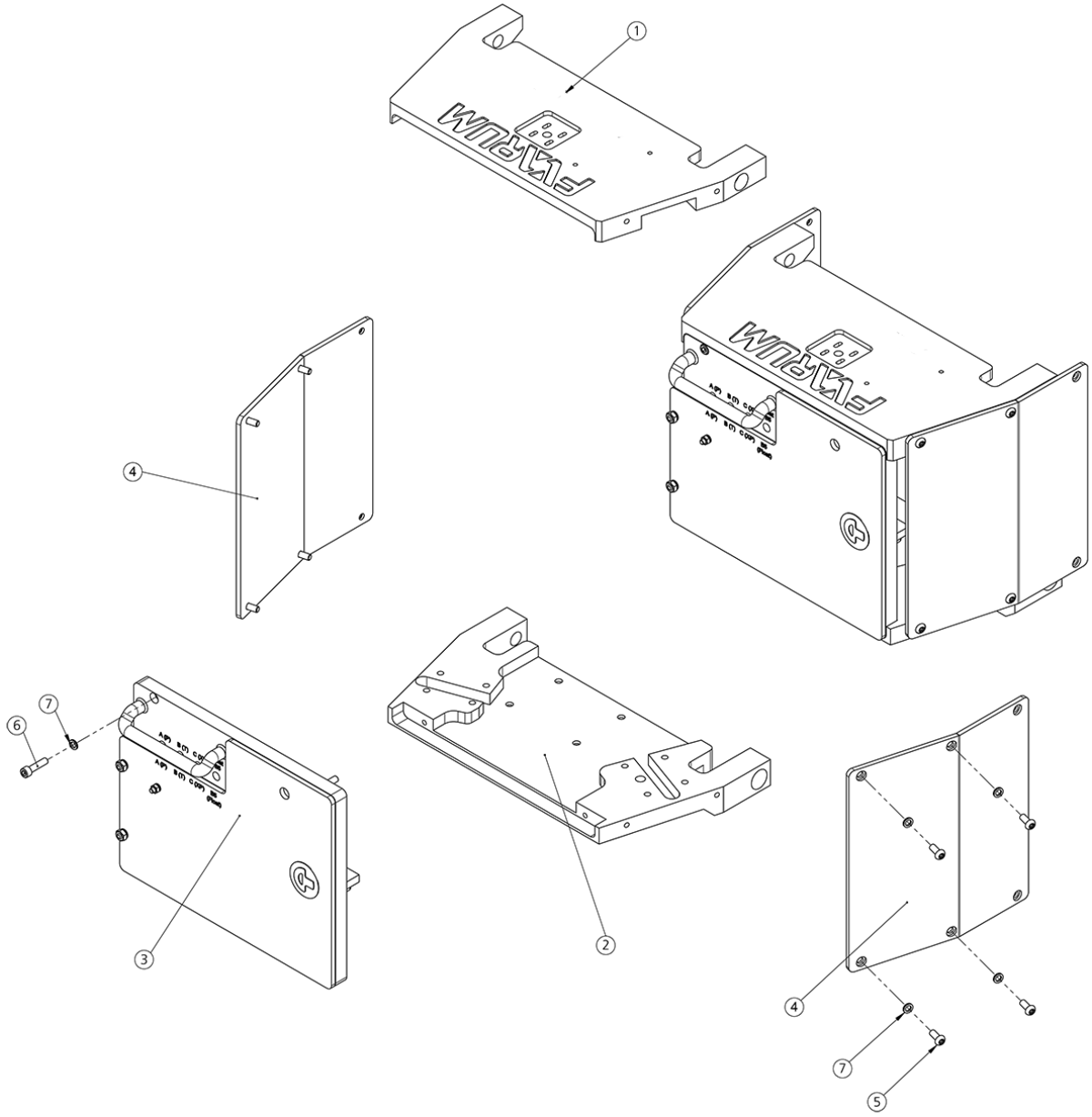

Fig. 84: Hydraulic Box

Parts List

Pos.	Qty.	P/N	Description
1	1	648050-1	Upper Plate Hydraulic Box
2	1	648050-2	Bottom Plate for Hydraulic Box
3	1	648184	Rear Door Assembly
4	2	648083	Cover Hydraulic Box
5	8	688099	Flat head screw
6	4	70614	Screw
7	12	792103	Washer

5.3.5.13 Load Sensor Assembly

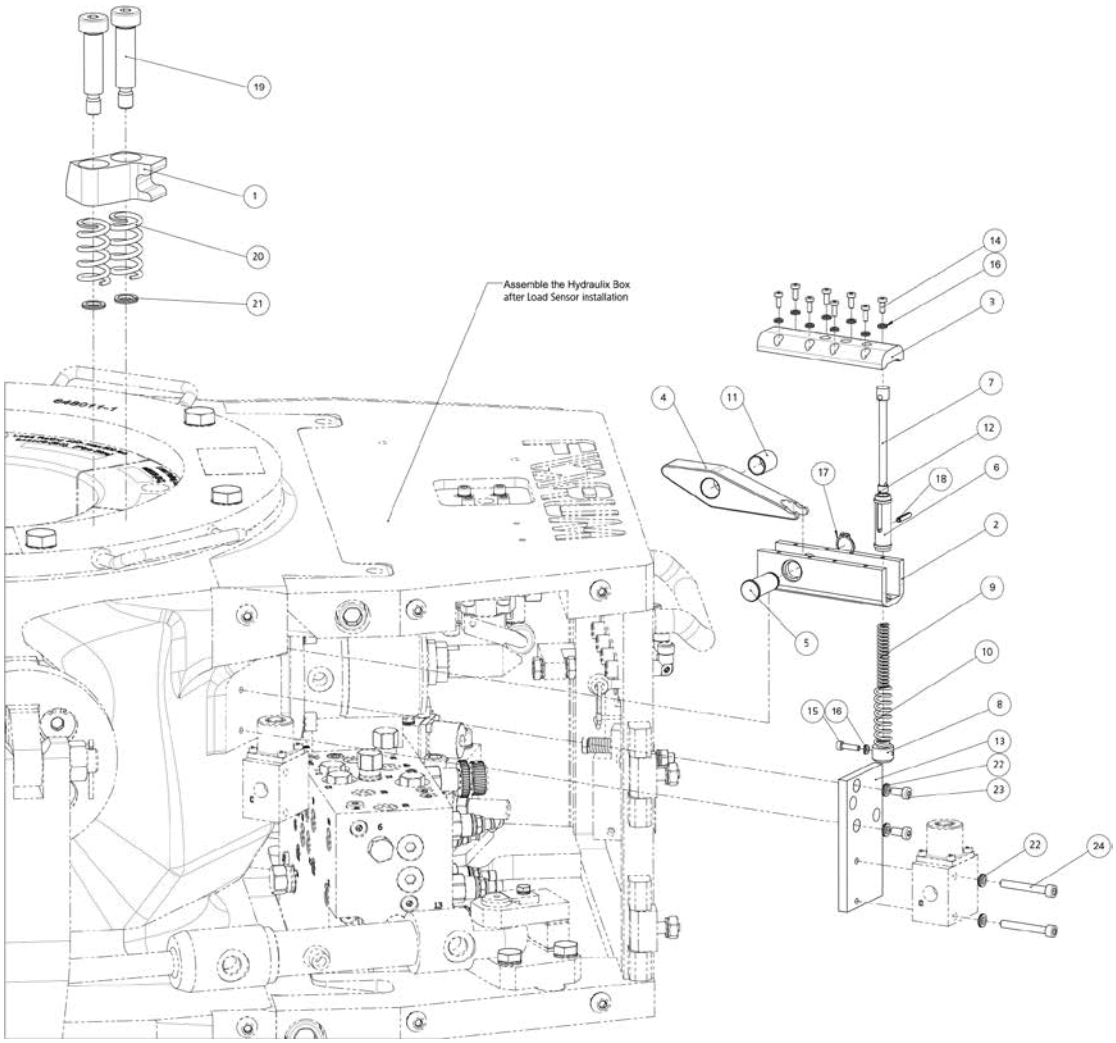

Fig. 85: Load Sensor Assembly

Parts List for 648065 Load Sensor Assembly for AMP®

Pos.	Qty.	P/N	Description
1	1	648068-1	Load Ring Segment
2	1	648065-1	Housing
3	1	648065-2	Housing Top Cover
4	1	648065-3	Trigger Lever
5	1	648065-4	Sensor Pin
6	1	648065-5	Valve Pin I
7	1	648065-6	Sensor Pin II
8	1	648065-7	Spring Cap
9	1	648065-8	Spring
10	1	648065-9	Spring
11	1	648065-10	Bushing
12	1	648065-11	Bushing
13	1	648065-12	Valve Adjustment Plate
14	8	648065-13	Screw
15	1	792174	Screw
16	9	792175	Washer
17	1	613721	Retaining Rings
18	1	641599	Dowel Pin
19	2	648269	Screw
20	2	648053	Spring
21	2	792104	Washer
22	4	792111	Washer
23	2	774034	Screw
24	2	612691	Screw

5.3.5.14 Assembly Latch Micro-Cylinder for AMP®-350/1, AMP®-375/1 and AMP®-500/1

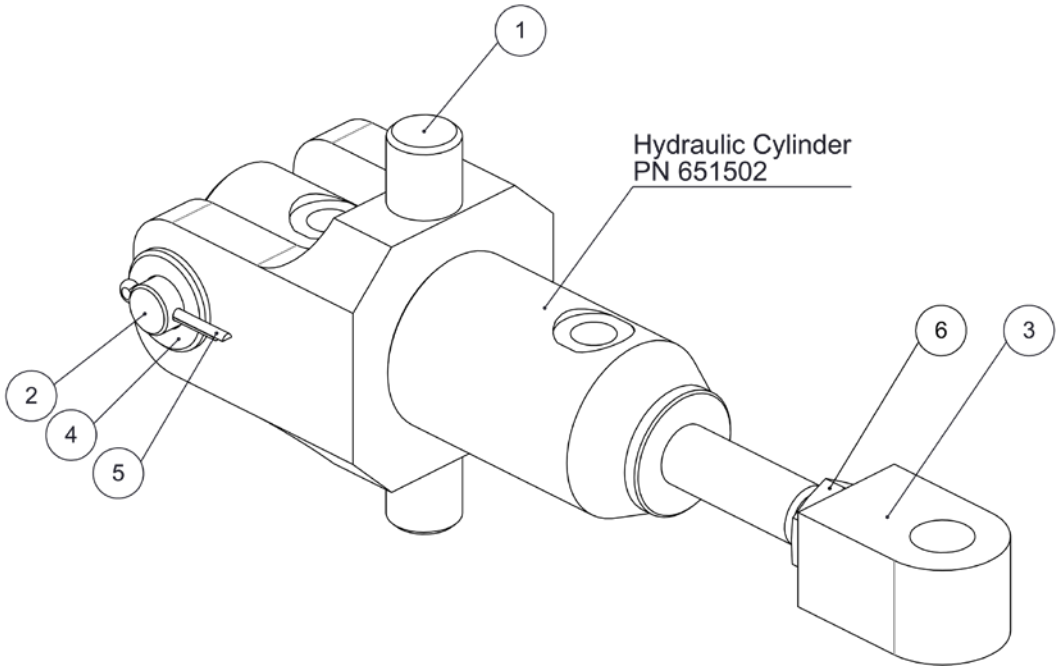

Fig. 86: Assembly Latch Micro-cylinder

Parts List for 648040 Assembly Latch Micro-cylinder AMP®-500/1

Pos.	Qty.	P/N	Description
1	1	648010	Flange for Micro-cylinder
2	1	651539-7	Bolt
3	1	648092-1	Pivot
4	1	725443	Washer
5	1	620609	Split Pin
6	1	641576	Nut

5.3.6 Hydraulic Assemblies - Drawings and Parts Lists

5.3.6.1 Hydraulic Manifold P/N 648117-1

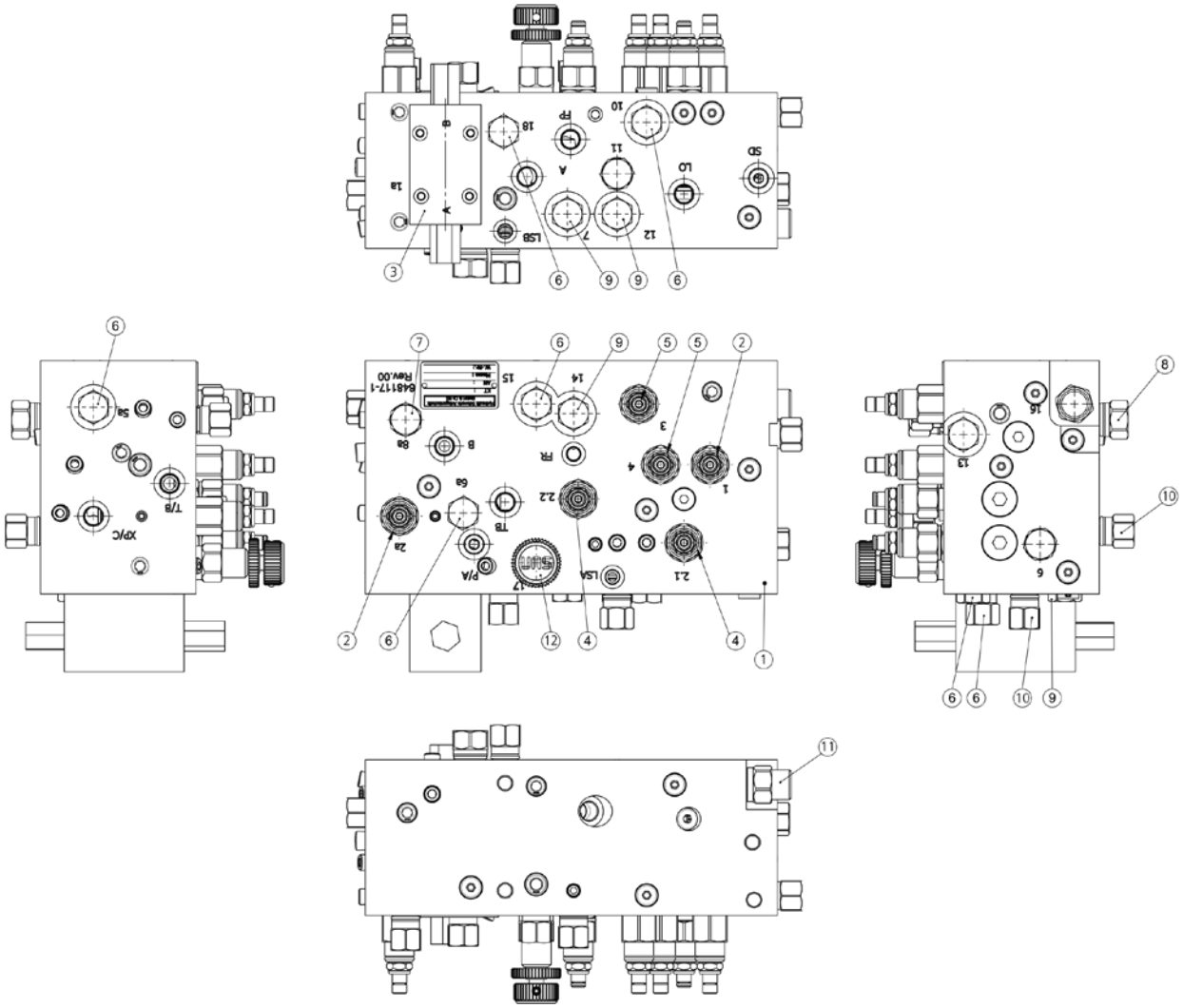

Fig. 87: 648187-4 Hydraulic Manifold Assembly

Parts List for 648117-1

Pos.	Qty.	P/N	Description
1	1	648117	Hydraulic Manifold Without Valves
2	2	2038	Directional Valve
3	1	2013	Control Valve
4	2	2010	Load-Lowering Valve
5	2	2017	Reducing/Relieving: 3 Port:direct Acting
6	6	2067	Free Flow Nose To Side Check Valve
7	1	2051	Pilot-To-Close Check Valve
8	1	2044	Shuttle Valve
9	4	2068	Pilot-To-Open Check Valve
10	2	2069	Pilot-To-Open Check Valve
11	1	2045	Shuttle Valve
12	1	2070	Fully Adjustable Needle Valve

5.3.6.2 Hydraulic Manifold P/N 648116-1

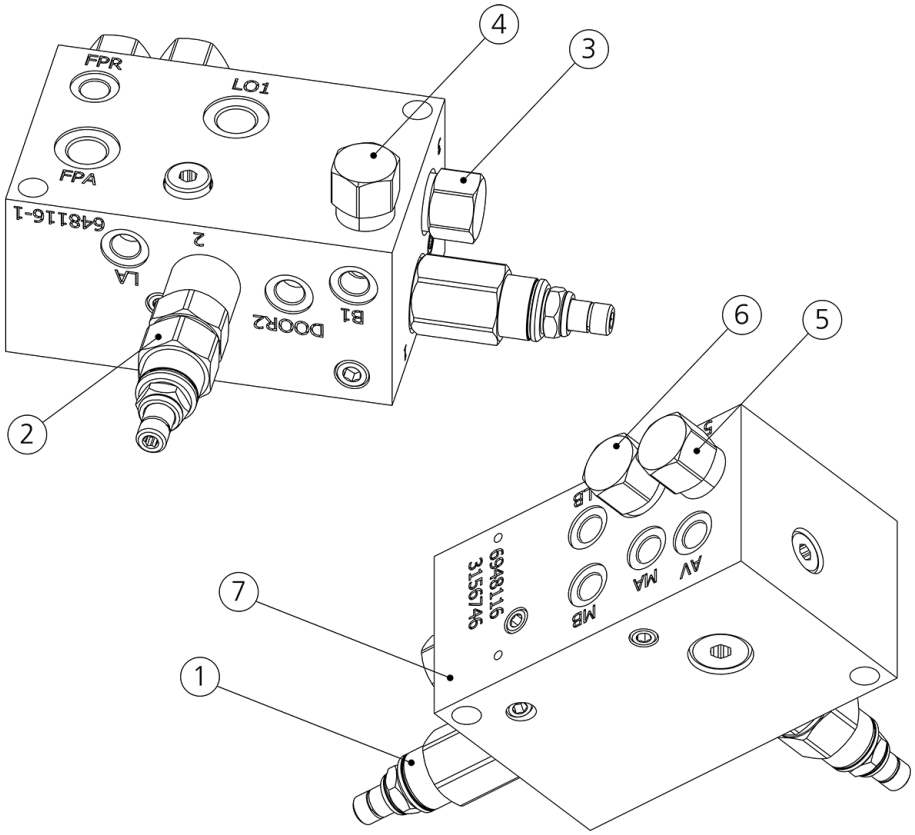

Fig. 88: 648116-1 Hydraulic Manifold

Parts List for 648116-1

Pos.	Qty.	P/N	Description
1	1	2038	Directional Valve
2	1	2037	Direct-active Relief Valve
3	1	2002	Pilot-to-Open Check 3-Port valve
4	1	612952-T	Check Valve
5	1	612952-T	Check Valve
6	1	2002	Pilot-to-Open Check 3-Port valve
7	1	648116	Hydraulic Manifold without valves

5.3.6.3 Feedback Valve Assembly P/N 688040

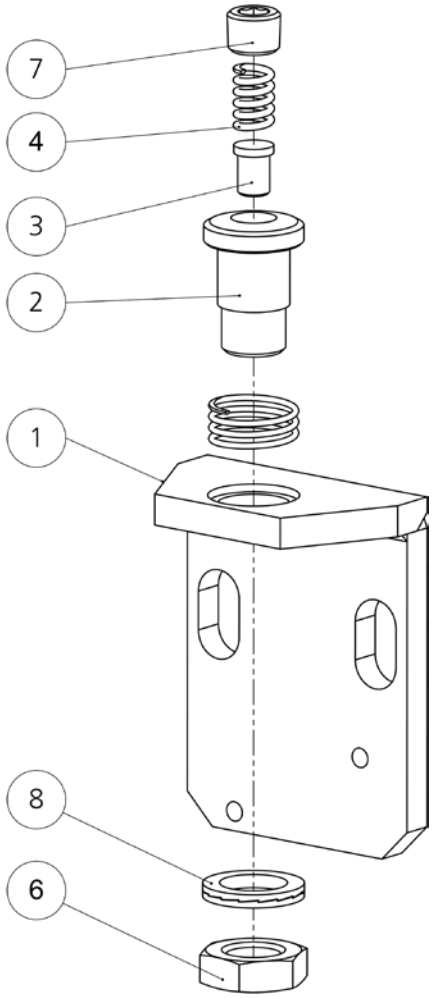

Fig. 89: Feedback Valve Assembly

Parts List for 688040

Pos.	Qty.	P/N	Description
1	1	688040-1	Mounting Plate
2	1	688040-3	Feedback Pin 1
3	1	688040-4	Feedback Pin 2
4	1	688040-2	Spring
5	1	688040-5	Spring
6	1	792106	Washer
7	1	710348	Nut
8	1	754098	Locking screw

5.3.6.4 Hydraulic diagram

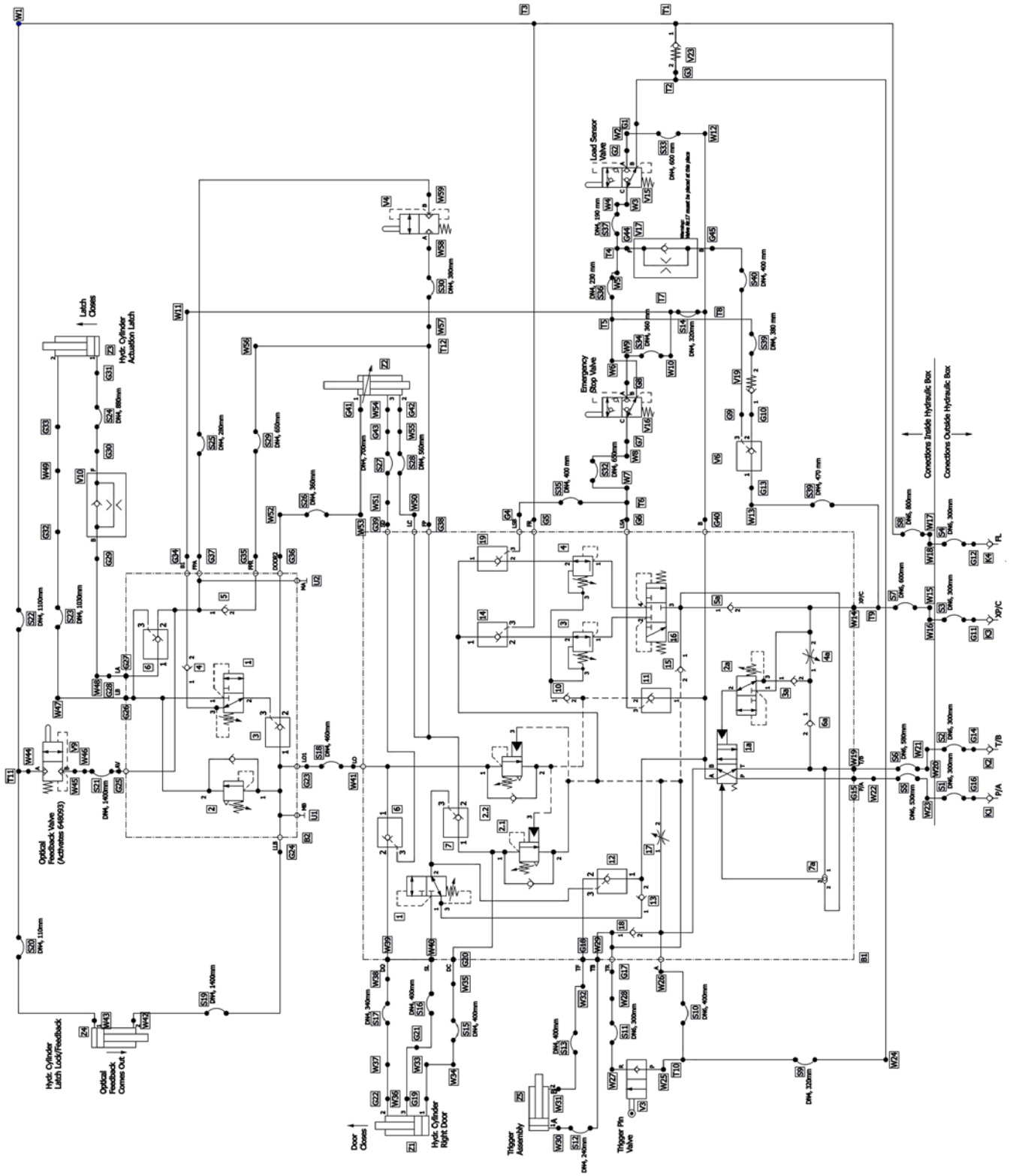

Fig. 90: 648009 Hydraulic Assembly

Parts List for Hydraulic Assembly

Pos.	Qty.	P/N 648009	638209	678109	688009	Description
6, 8	3		2047			Sequence Valve
G1,G2,G4,G5,G7,G8, G11, G13, G15,G17,G18, G20,G23,G31,G37, G40	19		612944			Straight Connection
G3, G28	2		612945			Straight Connection
G29, G30, G34, G36, G44, G45	2		710653			Straight Connection
G9, G10	2		613946			Straight Connection
G14, G16, G19, G22, G41, G42	6		613943			Straight Connection
G21, G32, G43	3		735112			Straight Connection
G33	1		671551-1			Straight Connection
K1	1		612936			Coupling, male
K2	1		612937			Coupling, female
K3	1		612965			Coupling, male
K4	1		612966			Coupling, female
S1	1	648009-A	638209-A	678109-A	688009-A	Hydraulic Hose Assembly "A"
S2	1	648009-B	638209-B	678109-B	688009-B	Hydraulic Hose Assembly "B"
S3	1	648009-C	638209-C	678109-C	688009-C	Hydraulic Hose Assembly "C"
S4	1	648009-D	638209-D	678109-D	688009-D	Hydraulic Hose Assembly "D"
S5	1	648009-P	638209-P	678109-P	688009-P	Hydraulic Hose Assembly "P"
S6	1	648009-T	638209-T	678109-T	688009-T	Hydraulic Hose Assembly "T"
S7	1	648009-XP	638209-XP	678109-XP	688009-XP	Hydraulic Hose Assembly "XP"
S8	1	648009-FL	638209-FL	678109-FL	688009-FL	Hydraulic Hose Assembly "FL"
S9	1	648009-A1	638209-A1	678109-A1	688009-A1	Hydraulic Hose Assembly "A1"
S10	1	648009-TP	638209-TP	678109-TP	688009-TP	Hydraulic Hose Assembly "TP"
S11	1	648009-TR	638209-TR	678109-TR	688009-TR	Hydraulic Hose Assembly "TR"
S12	1	648009-TB	638209-TB	678109-TB	688009-TB	Hydraulic Hose Assembly "TB"
S13	1	648009-TF	638209-TF	678109-TF	688009-TF	Hydraulic Hose Assembly "TF"
S14	1	648009-B1	638209-B1	678109-B1	688009-B1	Hydraulic Hose Assembly "B1"
S15	1	648009-DC	638209-DC	678109-DC	688009-DC	Hydraulic Hose Assembly "DC"
S16	1	648009-SL	638209-SL	678109-SL	688009-SL	Hydraulic Hose Assembly "SL"
S17	1	648009-DO	638209-DO	678109-DO	688009-DO	Hydraulic Hose Assembly "DO"
S18	1	648009-LO	638209-LO	678109-LO	688009-LO	Hydraulic Hose Assembly "LO"
S19	1	648009-LLB	638209-LLB	678109-LLB	688009-LLB	Hydraulic Hose Assembly "LLB"
S20	1	648009-AV1	638209-AV1	678109-A1	688009-AV1	Hydraulic Hose Assembly "AV1"
S21	1	648009-AV	638209-AV	678109-AV	688009-AV	Hydraulic Hose Assembly "AV"
S22	1	648009-AV2	638209-AV2	678109-AV2	688009-AV2	Hydraulic Hose Assembly "AV2"
S23	1	648009-LB	638209-LB	678109-LB	688009-LB	Hydraulic Hose Assembly "LB"
S24	1	648009-LA	638209-LA	678109-LA	688009-LA	Hydraulic Hose Assembly "LA"
S25	1	648009-FPA	638209-FPA	678109-FPA	688009-FPA	Hydraulic Hose Assembly "FPA"
S26	1	648009-D2	638209-D2	678109-D2	688009-D2	Hydraulic Hose Assembly "D2"
S27	1	648009-SD	638209-SD	678109-SD	688009-SD	Hydraulic Hose Assembly "SD"
S28	1	648009-LC	638209-LC	678109-LC	688009-LC	Hydraulic Hose Assembly "LC"
S29	1	648009-FPR	638209-FPR	678109-FPR	688009-FPR	Hydraulic Hose Assembly "FPR"
S30	1	648009-FP	638209-FP	678109-FP	688009-FP1	Hydraulic Hose Assembly "FP"
S32	1	648009-LR	638209-LR	678109-LR	688009-LR	Hydraulic Hose Assembly "LR"
S33	1	648009-V15_A	638209-V15_A	678109-V15_A	688009-V15_A	Hydraulic Hose Assembly "V15_A"
S34	1	648009-V16_A	638209-V16_A	678109-V16_A	688009-V16_A	Hydraulic Hose Assembly "V16_A"
S35	1	648009-LSB	638209-LSB	678109-LSB	688009-LSB	Hydraulic Hose Assembly "LSB"
S36	1	648009-V16_B	638209-V16_B	678109-V16_B	688009-V16_B	Hydraulic Hose Assembly "V16_B"
S37	1	648009-V15_C	638209-V15_C	678109-V15_C	688009-V15_C	Hydraulic Hose Assembly "V15_C"
S38	1	648009-V19	648009-V6	678109-V19	688009-V19	Hydraulic Hose Assembly "V19"
S39	1	648009-V6	638209-V19	678109-V6	688009-V6	Hydraulic Hose Assembly "V6"
S40	1	648009-V17_B	638209-V17_B	678109-V17_B	688009-V17_B	Hydraulic Hose Assembly "V17_B"
T1 - T12	12		645095			T-Connection
U1, U2	2		710642			Locking Screw
V3	1		775088			Feedback Valve
V4, V9	2		87997			Directional Control Valve
V6	1		2002			Pilot-to-Open Check 3-Port Valve
V10, V17	2		558074			Check Valve
V15, V16	2		648999			3/2 Way Valve
V19, V23	2		645110			Check Valve
W1, W2, W4 - W13, W15, W17,W20, W22, W24, W28, W32 - W35,W37, W38, W46 - W48, W51 - W53, W55, W56"	32		645096			L-Adapter
W3, W14, W19, W25 - W27, W29 - W31, W39 - W45, W50, W57 - W59	20		613945			L-Adapter

Pos.	Qty.	P/N 648009	638209	678109	688009	Description
W16, W18, W21, W23	4		645106			L-Adapter
W36, W54	2		775094-2			L-Adapter
W49	1		775094-3			L-Adapter
Z1	1		638290			Cylinder
Z2	1		638291			Cylinder
Z3	1		651502			Microcylinder
Z4	1		648093			Block Cylinder
Z5	1		648188			Hollow Piston Cylinder

5.3.6.5 Single Elevator Rotation System (double acting) P/N 678800

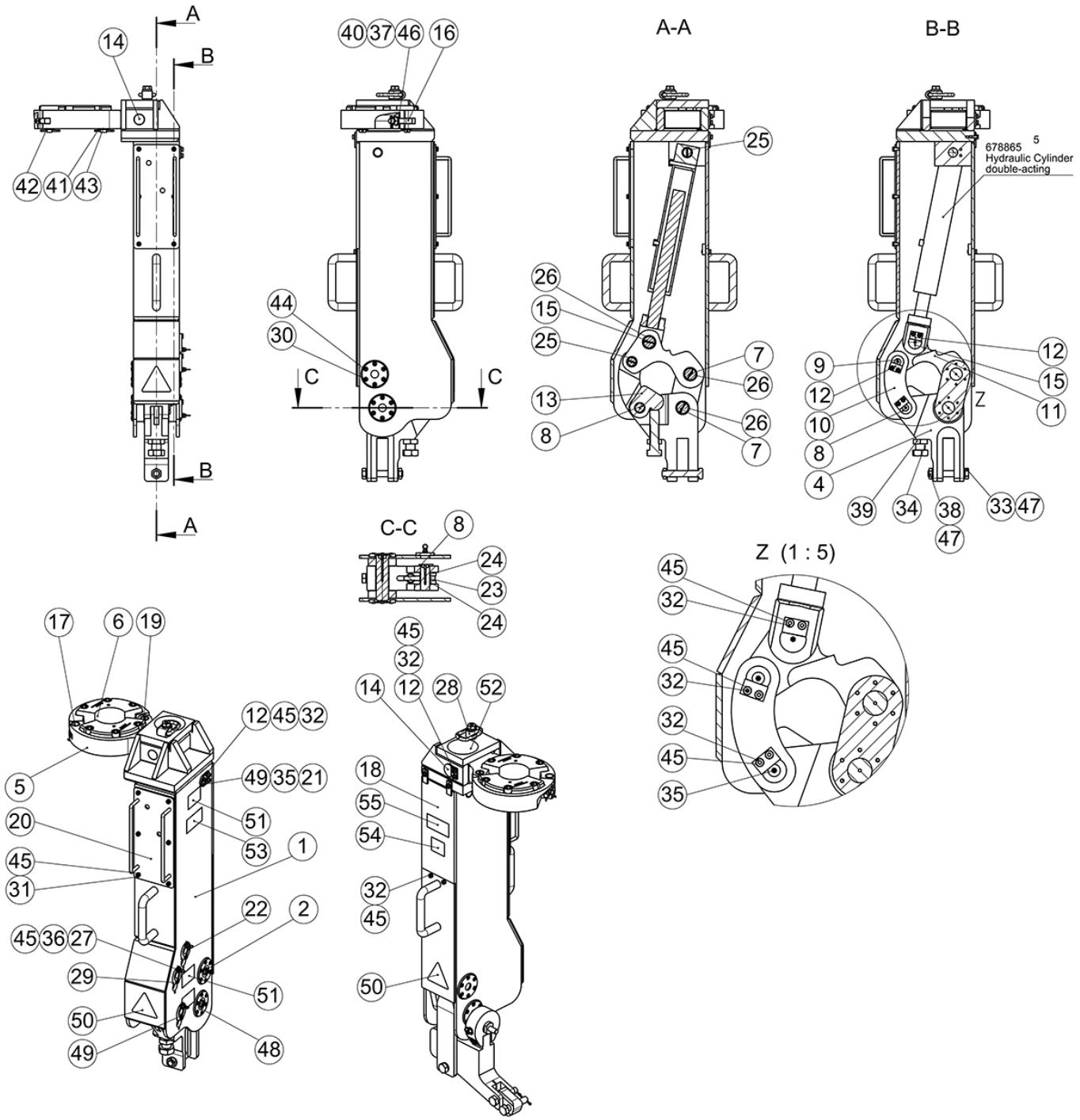

Fig. 91: 678800 Single Elevator Rotation System Drawing I

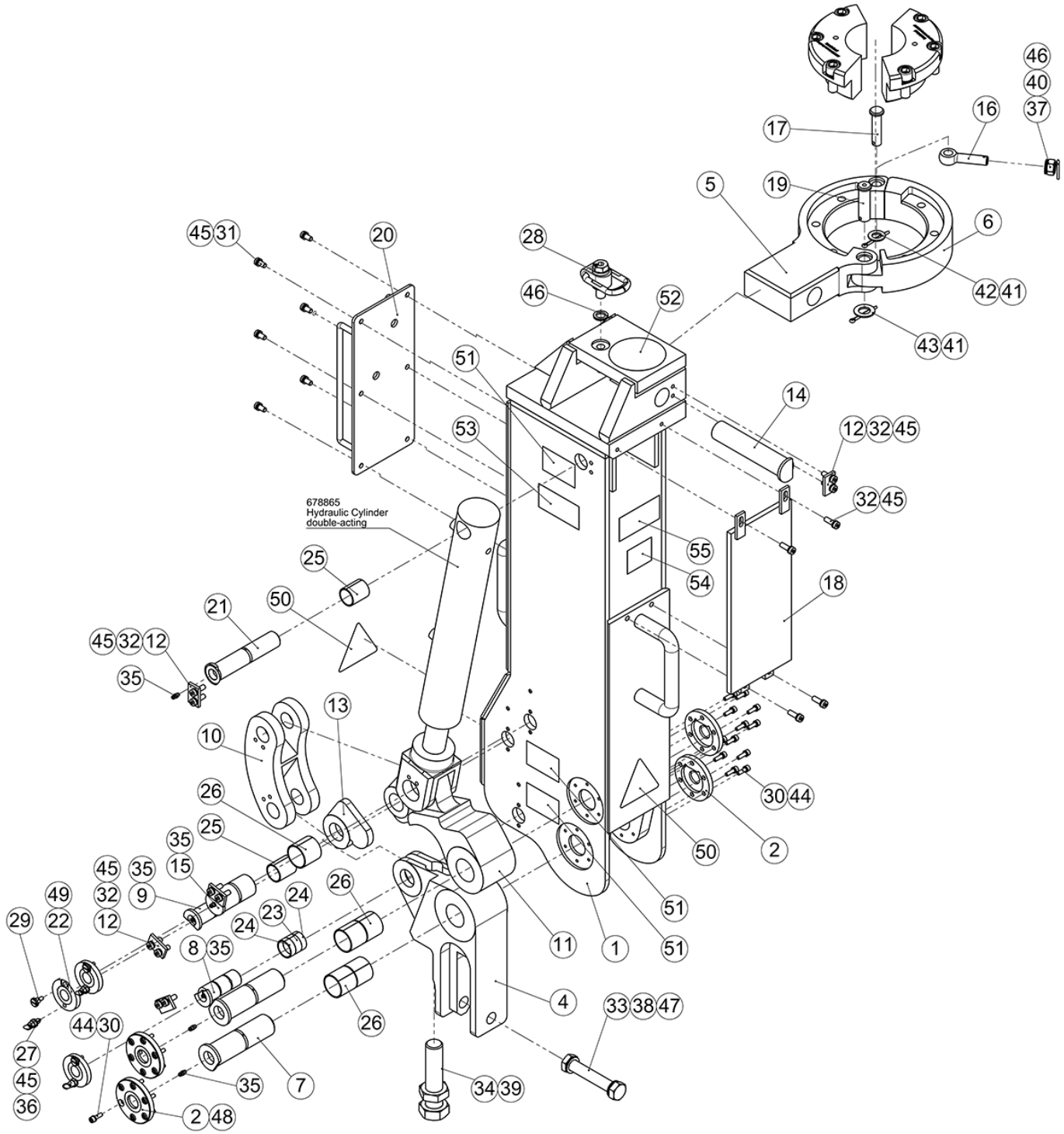

Fig. 92: 678800 Single Elevator Rotation System Drawing II

Parts List for 678800

Pos.	Qty.	P/N	Description
1	1	678810	Cover For Amp Rotator
2	4	678812	Cap
3	1	678800-H	Hydraulic Assembly
4	1	678813	Link Block Connector
5	1	678815	Link Clamp Fix
6	1	678817	Link Clamp Movable
7	2	678818	Pin
8	1	678854	Pin
9	1	678819	Pin
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
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
47	2	792108	Washer
48	2	612530-3	Marking Point
49	4	612530-5	Marking Point
50	2	671641	Warning Sign "Squeeze Danger"
51	3	671642	Warning Sign "Grease Daily"
52	1	671646-2	Sign "Lifting Point" - Sticker;Ø50mm
53	1	613129	Sticker Hotline
54	1	645814	Danger Sign
55	1	671638	Warning Sign Forum
56*	1	675170-D	Hose Assembly D
57*	1	675170-E	Hose Assembly E

* Not shown on Drawing I and II.

5.3.6.6 Single Elevator Rotation System (single acting) P/N 678801

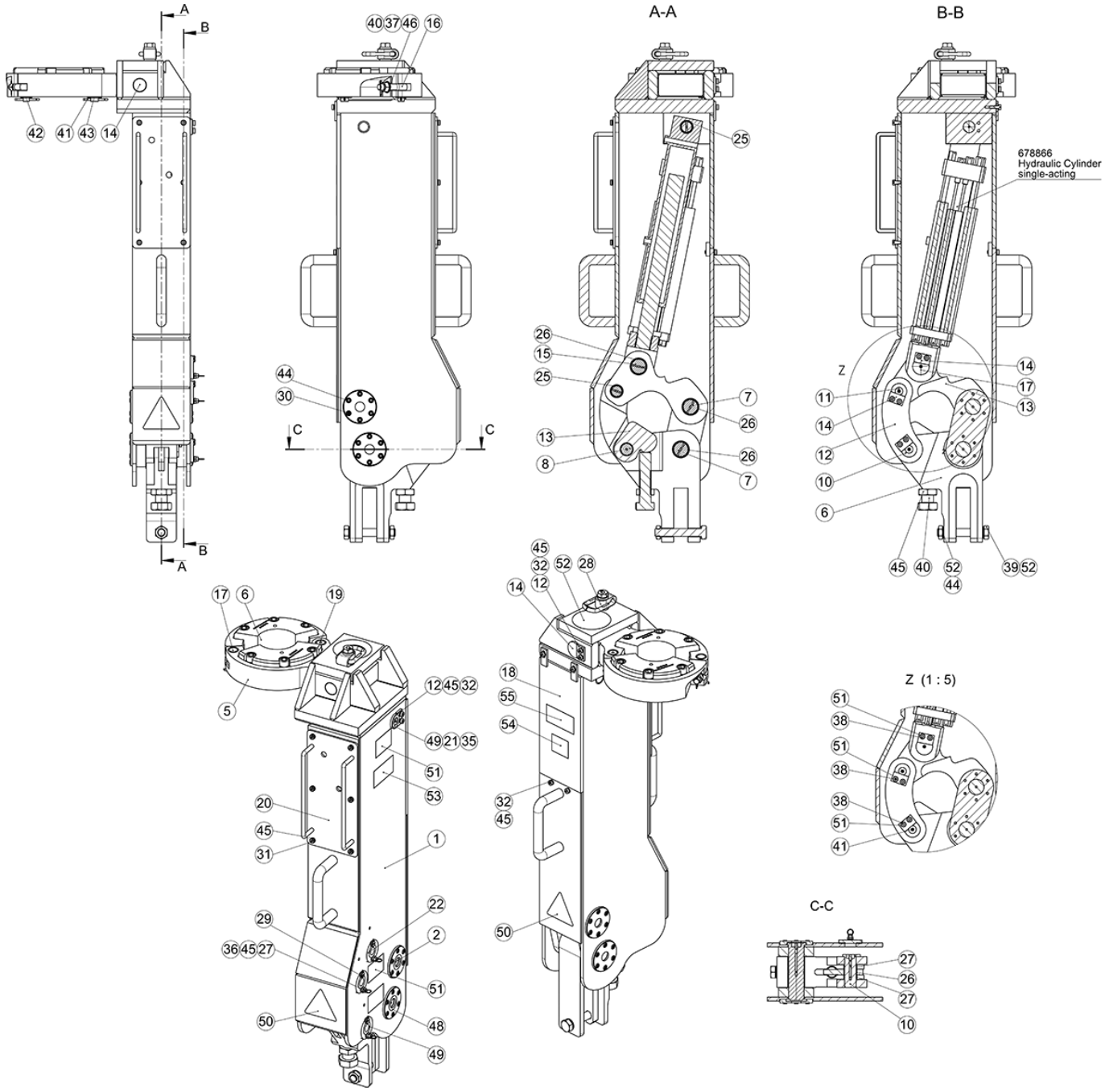

Fig. 93: 678801 Single Elevator Rotation System Drawing I

Parts List for 678801 Single Elevator Rotation System (single acting)

Pos.	Qty.	P/N	Description
1	1	678810	Cover For Amp Rotator
2	4	678812	Cap
3	1	678801-H	Hydraulic Assembly
4	1	678813	Link Block Connector
5	1	678815	Link Clamp Fix
6	1	678817	Link Clamp Movable
7	2	678818	Pin
8	1	678854	Pin
9	1	678819	Pin
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
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
47	2	792108	Washer
48	2	612530-3	Marking Point
49	4	612530-5	Marking Point
50	2	671641	Warning Sign "Squeeze Danger"
51	3	671642	Warning Sign "Grease Daily"
52	1	671646-2	Sign "Lifting Point"
53	1	613129	Sticker Hotline
54	1	645814	Danger Sign
55	1	671638	Warning Sign Forum
56*	1	675170-E	Hose Assembly E

* Not shown on Drawing I and II.

5.3.6.7 Adapter Kit AMP®-350/1, AMP®-350/2

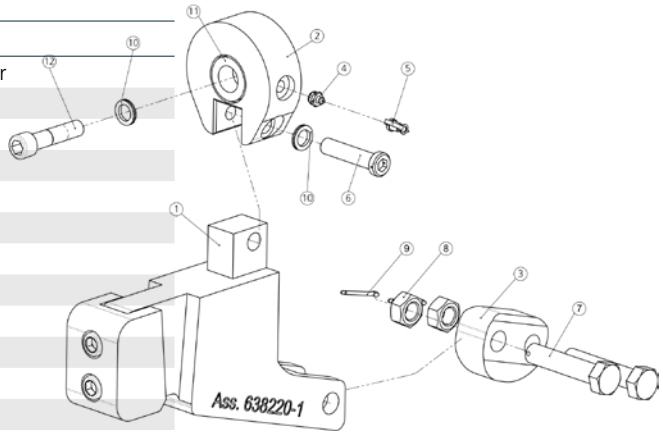

Fig. 94: 638220-1 Adapter Kit

Parts List for 638220-1

Pos.	Qty.	P/N	Description
1	1	638220-2	Link Block Assembly
2	1	638220-4	Bracket
3	1	678816	Connection
4	1	612515	Grease Nipple
5	1	612518	Protection Cap
6	1	798229	Screw
7	2	613623-11	Screw
8	2	613556-41	Nut
9	2	752339	Cotter pin
10	2	792106	Washer
11	1	638220-5	Pin
12	1	727042	Screw

5.3.6.8 Adapter kit AMP®-375/1, AMP®-500/1, AMP®-500/2

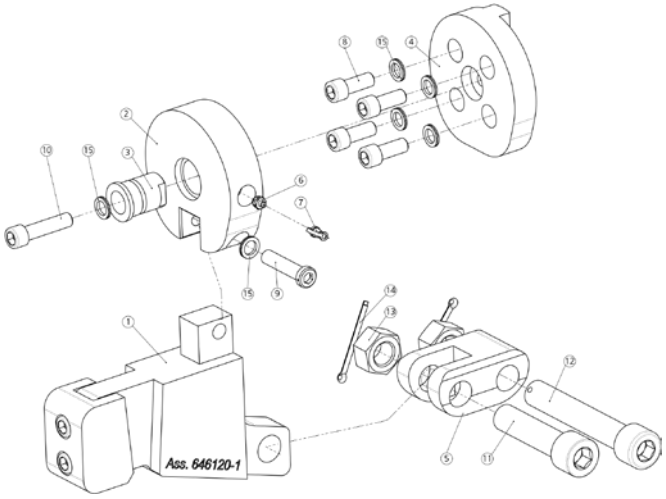

Fig. 95: 646120-1 Adapter kit

Parts List for 646120-1

Pos.	Qty.	P/N	Description
1	1	646120-2	Link Block Assembly
2	1	646120-4	Bracket
3	1	638220-5	Pin
4	1	646120-6	Base plate
5	1	646120-7	Connection
6	1	612515	Grease Nipple
7	1	612518	Protection Cap
8	4	725466	Screw
9	1	798229	Screw
10	1	775435	Screw
11	1	790017-1	Screw
12	1	645018	Screw
13	2	753014	Nut
14	2	735404	Cotter Pin
15	6	792106	Washer

5.3.6.9 Adapter Kit AMP®-750/1, AMP®-1000/1

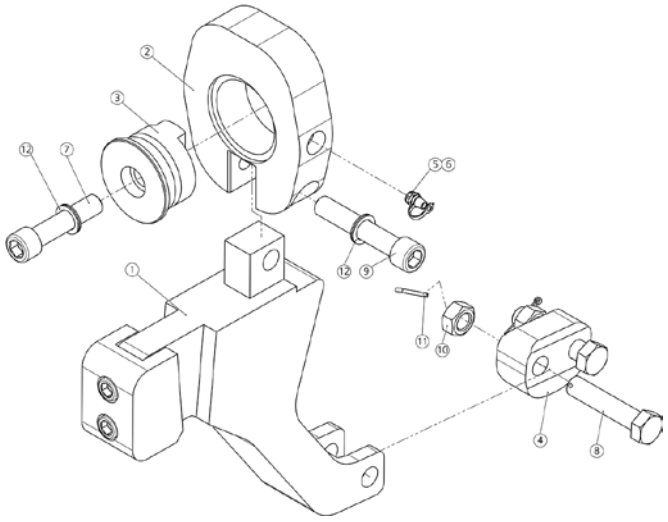

Fig. 96: 678120-1 Adapter Kit

Parts List for 678120-1 Adapter Kit

Pos.	Qty.	P/N	Description
1	1	678120-2	Link Block Assembly
2	1	678120-4	Bracket
3	1	678120 5	Pin 7
4	1	678816	Connection
5	1	612515	Lubrication Fitting
6	1	612518	Protection Cap
7	1	675108	Screw
8	2	613623-11	Screw
9	1	675046	Screw
10	2	613556-41	Nut
11	2	752339	Split Pin
12	2	792108	Washer

5.3.6.10 Adapter Kit AMP®-1250/1

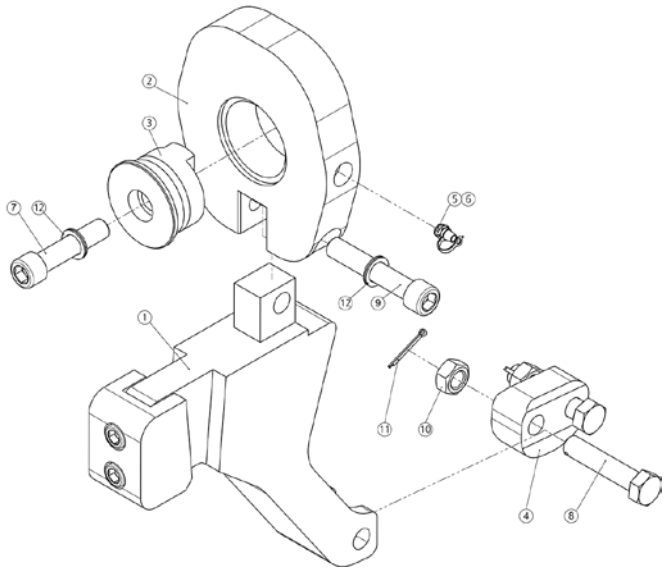

Fig. 97: 688020-1 Adapter Kit

Parts List for 688020-1 Adapter Kit

Pos.	Qty.	P/N	Description
1	1	688020-2	Link Block Assembly
2	1	688020-4	Bracket
3	1	678120-5	Pin 7
4	1	678816	Connection
5	1	612515	Lubrication Fitting
6	1	612518	Protection Cap
7	1	675108	Screw
8	2	613623-11	Screw
9	1	675046	Screw
10	2	613556-41	Nut
11	2	752339	Split Pin
12	2	792108	Washer

5.3.6.11 Hydraulic Assembly Single Rotator (double acting) P/N 678800-H

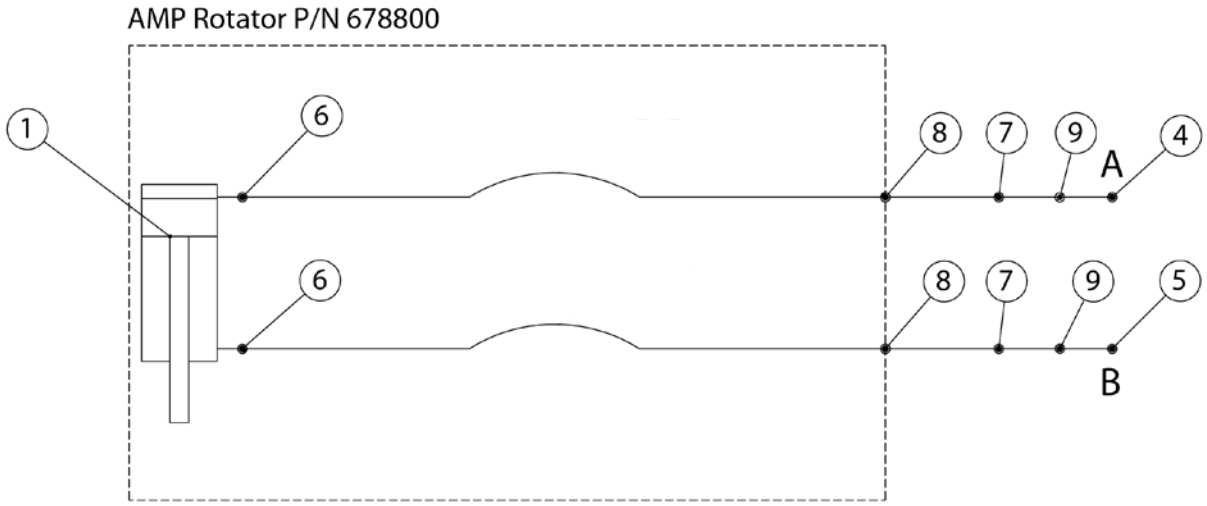

Fig. 98: 678800-H Hydraulic Assembly Single Rotator (double acting)

Parts List for 678800-H Hydraulic Assembly Single Rotator (double acting)

Pos.	Qty.	P/N	Description
1	1	678865	Hydraulic Cylinder
2	1	678800-H-A	Hose Assembly Connection A Lmm
3	1	678800-H-B	Hose Assembly Connection B L285mm
4	1	645833	Coupling, Flat Face
5	1	645834	Coupling, Flat Face
6	2	613945	Swivelling Screw Fitting 90°
7	2	613946	Straight connection
8	2	645106	Connection
9	2	613944	Reducing Nipple

5.3.6.12 Hydraulic Assembly Single Rotator (single acting) P/N 678801-H

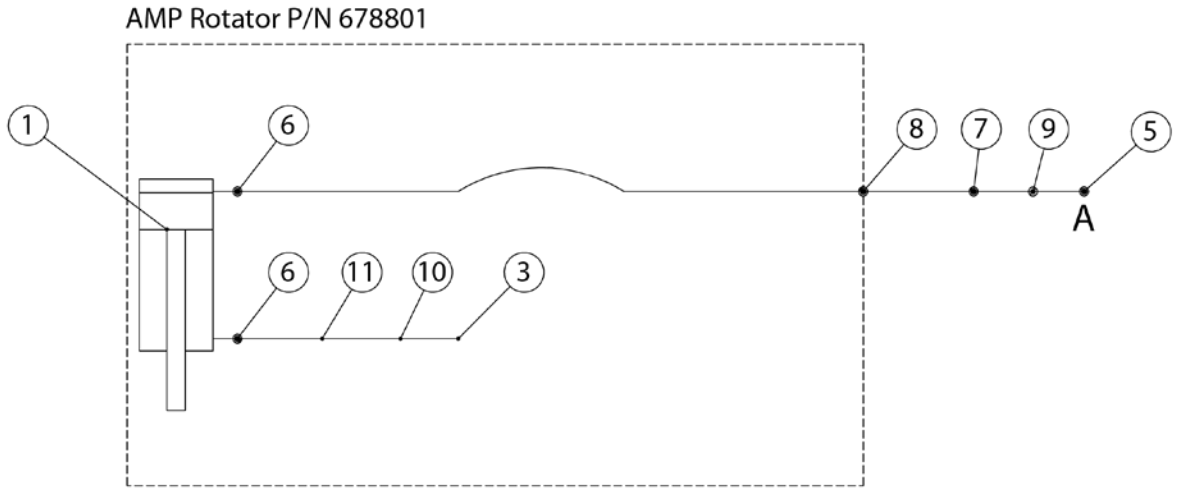

Fig. 99: 678801-H Hydraulic Assembly Single Rotator (single acting)

Parts List for 678801-H Hydraulic Assembly Single Rotator (single acting)

Pos.	Qty.	P/N	Description
1	1	678866	Hydraulic Cylinder
2	1	678801-H-A	Hose Assembly Connection A L285mm
3	1	678866-1	Filter
4	1	645833	Coupling, Flat Face
5	1	645834	Coupling, Flat Face
6	1	613945	Swivelling Screw Fitting 90°
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

5.3.7 Recommended Spare Parts [RSP] AMP® type series

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

5.3.7.1 RSP for AMP®-350/1, AMP®-375/1 and AMP®-500/1

648100-RSP for one year operation

Pos.	Qty.	P/N	Description
5	1	648009-RSP	Hydraulic Assembly
13	1	648055-RSP	Latch Mechanism Assembly
16	1	648065	Load Sensor Assembly
30	10	688067	Retainer Bolt
32	2	752219	Overload Spring
38	22	792111	Washer
40	3	756790	Lubricating nipples
41	4	70064	Grease Nipple
43	10	87805	Screw
48	3	648119	Screw
49	20	688099	Screw
52	4	752832	Screw
55	4	613548	Screw
57	8	645620	Screw
61	6	613623-11	Screw
62	8	613633	Nut
64	12	613556-41	Nut
66	12	752339	Split Pin
72	10	792112	Washer
73	35	792103	Washer
74	10	792104	Washer
75	12	792106	Washer
76	6	792108	Washer
78	15	671642	Warning Sign - Grease Daily
79	9	671641	Warning Sign - Squeeze Danger
80	3	671639	Warning Sign - Automatic
81	3	671638	Warning Sign - Warning
83	3	613129	Sticker Hotline
85	6	612530-1	Marking Point
86	3	612530-3	Marking Point
87	3	612530-9	Marking Point

648100-RSP2 for two year operation

Pos.	Qty.	P/N	Description
-	1	648100-RSP	Set of Spare Parts
-	1	648190	Hydraulic Cylinder
-	1	648191	Hydraulic Cylinder
-	1	638250	Cylinder Console No.2
-	1	638270	Cylinder Console No.1
-	1	648162	Trigger Assembly
-	1	648168	Load Ring Segment
19	1	648011-1	Bushing Retainer (body)
20	1	648011-2	Bushing Retainer (door)

648009-RSP for Hydraulic Assembly

Pos.	Qty.	P/N	Description
-	2	613937	Hydraulic Hose Assembly L1
-	1	648009-30	Hydraulic Hose Assembly L1
-	2	755355	Plastic Protective Coil Sleeve
K1	2	612936	Coupling, Flat Face, Male
K3	1	612965	Coupling, Flat Face, Male
K4	1	612966	Coupling, Flat Face, Female
V4, V9	4	87997	$^{2}/_{2}$ Way Directional Control Valve

648055-RSP for Latch Mechanism Assembly

Pos.	Qty.	P/N	Description
5	2	648161	Securing Sheet
8	3	792111	Washer
9	3	612671	Screw
12	6	792112	Washer
14	1	613633	Nut

5.3.7.2 RSP for AMP®-350/2

638200-RSP for one year operation

Pos.	Qty.	P/N	Description	Location
12	1	638255	Latch Mechanism Assembly	Main Drawing AMP®-350/2
15	1	648060	Load Sensor Assembly	Main Drawing AMP®-350/2
17	1	638278	Latch Pin	Main Drawing AMP®-350/2
18	4	648179	Pin Securing Plate	Main Drawing AMP®-350/2
19	1	638278-1	Door Pin	Main Drawing AMP®-350/2
20	2	638277	Hinge Pin	Main Drawing AMP®-350/2
21	6	638276-1	Cylinder Pin	Main Drawing AMP®-350/2
26	2	638290-1	Pivot	Main Drawing AMP®-350/2
38	10	671642	Warning sign "GREASE DAILY"	Main Drawing AMP®-350/2
40	5	671638	Warning sign Forum	Main Drawing AMP®-350/2
41	5	671639	Warning sign "Automatic"	Main Drawing AMP®-350/2
42	5	671641	Warning sign "squeeze danger"	Main Drawing AMP®-350/2
43	16	792112	Washer	Main Drawing AMP®-350/2
45	36	792103	Washer	Main Drawing AMP®-350/2
46	6	89126	Screw	Main Drawing AMP®-350/2
46	8	89126	Screw	Main Drawing AMP®-350/2
47	28	792111	Washer	Main Drawing AMP®-350/2
48	10	612671	Screw (replaces 612528)	Main Drawing AMP®-350/2
49	4	645136	Screw	Main Drawing AMP®-350/2
51	12	87805	Screw	Main Drawing AMP®-350/2
53	4	752832	Screw	Main Drawing AMP®-350/2
54	8	752339	Split Pin	Main Drawing AMP®-350/2
55	6	613623-11	Screw	Main Drawing AMP®-350/2
56	8	613556-41	Nut	Main Drawing AMP®-350/2
57	8	645620	Screw	Main Drawing AMP®-350/2
59	20	792106	Washer	Main Drawing AMP®-350/2
61	4	755137	Nut	Main Drawing AMP®-350/2
63	4	70263	Split Pin	Main Drawing AMP®-350/2
65	24	688099	Flat head screw	Main Drawing AMP®-350/2
66	2	756790	Lubricating nipples	Main Drawing AMP®-350/2
67	8	70064	Grease Nipple	Main Drawing AMP®-350/2
71	10	645683	Washer	Main Drawing AMP®-350/2
73	18	792104	Washer	Main Drawing AMP®-350/2
74	2	613786	Screw	Main Drawing AMP®-350/2
75	2	645679	Washer	Main Drawing AMP®-350/2
76	4	710348	Nut	Main Drawing AMP®-350/2
77	4	648169	Shoulder Screw	Main Drawing AMP®-350/2
-	2	755355	Plastic protective coil sleeve	-
-	1	638259-20	Hydraulic Hose Assembly	-

Pos.	Qty.	P/N	Description	Location
-	8	638290-2	Seal Kit for Hydraulic Cylinder	-
V4, V9	4	87997	$^2/_2$ way directional control valve	Hydraulic Assembly 638209

638200-RSP2 for two year operation

Pos.	Qty.	P/N	Description	Location
-	1	638200-RSP	Set of Spare Parts	-
5	1	638211-1	Bushing Retainer (Body)	Main Drawing AMP®-350/2
6	1	638211-2	Bushing Retainer (door, right)	Main Drawing AMP®-350/2
7	1	638211-3	Bushing Retainer (door, left)	Main Drawing AMP®-350/2
23	1	638292-1	Cylinder Fork	Main Drawing AMP®-350/2
26	2	638290-1	Pivot	Main Drawing AMP®-350/2
27	1	638268	Load Ring Segment	Main Drawing AMP®-350/2
72	1	660568	Nut	Main Drawing AMP®-350/2
76	2	710348	Nut	Main Drawing AMP®-350/2
-	1	651538	Pestle Assembly	-
-	1	638255	Latch Mechanism Assembly	-
-	1	638255-2	Latch Mechanism Flange	-
-	1	638270	Cylinder Console No.1	-
-	1	638250	Cylinder Console No.2	-
-	1	648162	Trigger Assembly	-
Z1	1	638290	Hydraulic Cylinder	Hydraulic Assembly 638209
Z2	1	638291	Hydraulic Cylinder	Hydraulic Assembly 638209

5.3.7.3 RSP for AMP®-500/2

648200-RSP for one year operation

Pos.	Qty.	P/N	Description
-	1	648209-RSP	RSP for Hydraulic Assembly 648209
12	1	648060	Load Sensor Assembly
24	8	648079	Pin Securing Plate
28	10	688067	Retainer Bolt
35	6	638276	Cylinder Pin
44	5	671638	Warning sign Forum
45	5	671641	Warning sign "squeeze danger"
47	10	671642	Warning sign "GREASE DAILY"
48	45	792103	Washer
49	4	648197	Screw
50	4	612672	Screw
51	33	792111	Washer
53	16	792104	Washer
54	2	752219	Overload Spring
56	22	87805	Screw
57	4	648169	Shoulder Screw
59	8	752832	Screw
60	4	752339	Split Pin
61	8	613556-41	Nut
62	8	613623-11	Screw
63	12	645697	Retaining ring
64	8	645620	Screw
65	4	615879	Washer
66	2	660416	Split Pin
67	4	710727	Screw
68	4	87724	Screw
69	30	688099	Flat head screw
70	2	725461	Screw
71	8	70064	Grease Nipple
72	12	792112	Washer
74	2	613786	Screw
75	4	645683	Washer
76	6	613633	Nut

Pos.	Qty.	P/N	Description
77	2	735852	Screw
78	4	645682	Screw
79	4	792317	Nut
80	4	612588	Screw
81	4	613548	Screw
82	4	617519	Screw
83	14	792106	Washer
84	6	792134	Screw
85	8	88233	Screw
86	4	774312	Washer

648200-RSP2 for two year operation

Pos.	Qty.	P/N	Description
22	2	648254	Arrester Plate 1
23	1	648255	Arrester Plate 2
25	1	648251-1	Bushing Retainer (Body)
26	1	648251-2	Bushing Retainer (Door right)
27	1	648251-3	Bushing Retainer (Door left)
32	1	648268	Load Ring Segment
34	2	648087	Pivot
55	2	710348	Nut
-	1	648200-RSP	Set of Spare Parts
-	1	688040	Feedback Valve Assembly
-	1	648253	Latch Mechanism Assembly
-	1	648261	Latch Mechanism Flange
-	1	638270	Cylinder Console No.1
-	1	638250	Cylinder Console No.2
-	1	648262	Trigger Assembly
Z1	1	638290	Hydraulic Cylinder
Z2	1	638291	Hydraulic Cylinder

5.3.7.4 RSP for AMP®-750/1 and AMP®-1000/1

678100-RSP for one year operation

Pos.	Qty.	P/N	Description
11	1	688040	Feedback Valve Assembly
14	1	648060	Load Sensor Assembly
20	1	688055-2	Latch Mechanism Flange
25	1	678168	Load Ring Segment
26	2	648179	Pin Securing Plate
27	2	752219	Overload Spring
31	6	638276-1	Cylinder Pin
32	10	688067	Retainer Bolt
35	4	641512	Safety Plate
40	2	756790	Lubricating nipples
41	4	70064	Grease Nipple
43	6	612671	Screw
46	12	87805	Screw
47	4	645136	Screw
48	8	772878	Screw
50	6	613786	Screw
52	16	612676	Screw
53	30	688099	Flat head screw
54	4	752832	Screw
55	8	753049	Screw
56	4	613548	Screw
57	4	671056	Screw
58	4	757410	Screw
60	8	645620	Screw
63	6	613623-11	Screw

Pos.	Qty.	P/N	Description
64	20	792106	Washer
65	16	792112	Washer
66	28	792111	Washer
67	36	792103	Washer
68	18	792104	Washer
71	12	645697	Retaining ring
72	4	752339	Split Pin
73	6	70263	Split Pin
77	8	613556-41	Nut
78	10	671642	Warning sign "GREASE DAILY"
80	5	671641	Warning sign "squeeze danger"
81	3	613129	Sticker Hotline
82	5	671638	Warning sign Forum
83	5	671639	Warning sign "Automatic"
-	1	678109-RSP	RSP for Hydraulic Assembly

678100-RSP2 for two year operation

Pos.	Qty.	P/N	Description
5	1	678111-1	Bushing Retainer (Body)
6	1	678111-2	Bushing Retainer (door, right)
7	1	678111-3	Bushing Retainer (door, left)
19	2	638290-1	Pivot
20	1	688055-2	Latch Mechanism Flange
22	1	688092-1	Pivot
25	1	678168	Load Ring Segment
75	1	660568	Nut
76	2	710348	Nut
-	1	678100-RSP	Set of Spare Parts
-	1	688040	Feedback Valve Assembly
-	1	678155	Latch Mechanism Assembly
-	1	638270	Cylinder Console No.1
-	1	638250	Cylinder Console No.2
-	1	678162	Trigger Assembly
Z1	1	638290	Hydraulic Cylinder
Z2	1	638291	Hydraulic Cylinder

678109-RSP for Hydraulic Assembly

Pos.	Qty.	P/N	Description
-	1	678109-30	Hydraulic Hose Assembly
-	2	755355	Plastic protective coil sleeve
K1	2	612936	Coupling, Flat Face, Male
K2	2	612936	Coupling, Flat Face, Female
K3	2	612965	Coupling, Flat Face, Male
K4	2	612966	Coupling, Flat Face, Female
V4, V9	2	87997	$^{2}/_{2}$ way directional control valve
-	8	638290-2	Seal Kit for Hydraulic Cylinder

5.3.7.5 RSP for AMP®-1250/1

678100-RSP for one year operation

Pos.	Qty.	P/N	Description
11	1	688040	Feedback Valve Assembly
14	1	648060	Load Sensor Assembly
20	1	688055-2	Latch Mechanism Flange
25	1	678168	Load Ring Segment
26	2	648179	Pin Securing Plate
27	2	752219	Overload Spring
31	6	638276-1	Cylinder Pin
32	10	688067	Retainer Bolt

Pos.	Qty.	P/N	Description
35	4	641512	Safety Plate
40	2	756790	Lubricating nipples
41	4	70064	Grease Nipple
43	6	612671	Screw
46	12	87805	Screw
47	4	645136	Screw
48	8	772878	Screw
50	6	613786	Screw
52	16	612676	Screw
53	30	688099	Flat head screw
54	4	752832	Screw
55	8	753049	Screw
56	4	613548	Screw
57	4	671056	Screw
58	4	757410	Screw
60	8	645620	Screw
63	6	613623-11	Screw
64	20	792106	Washer
65	16	792112	Washer
66	28	792111	Washer
67	36	792103	Washer
68	18	792104	Washer
71	12	645697	Retaining ring
72	4	752339	Split Pin
73	6	70263	Split Pin
77	8	613556-41	Nut
78	10	671642	Warning sign "GREASE DAILY"
80	5	671641	Warning sign "squeeze danger"
81	3	613129	Sticker Hotline
82	5	671638	Warning sign Forum
83	5	671639	Warning sign "Automatic"
-	1	678109-RSP	RSP for Hydraulic Assembly

678109-RSP for Hydraulic Assembly

Pos.	Qty.	P/N	Description
8	4	87997	$^{2}/_{2}$ Way Directional Control Valve
32	2	612937	Coupling, Flat Face, Female
33	2	612936	Coupling, Flat Face, Male
34	1	612965	Coupling, Flat Face, Male
35	1	612966	Coupling, Flat Face, Female
36	1	688009-30	Hydraulic Hose Assembly
-	2	755355	Plastic Protective Coil Sleeve
-	8	638290-2	Seal Kit For Hydraulic Cylinder

5.3.8 Recomendend Spare Parts Rotator

5.3.8.1 678800-RSP - Double Acting Rotator

Pos.	Qty.	P/N	Description
1	553468	1	Lifting eye
2	756790	6	Lubricating nipples
3	753079	1	Screw
4	772878	6	Screw
6	725466	6	Screw
7	755137	1	Nut
8	752137-2	1	Nut
9	70263	4	Split Pin
10	660416	2	Split Pin
11	792108	2	Washer
12	792106	8	Washer
13	792112	6	Washer
14	612679	4	Washer
15	671646	2	Sign "lifting point" - sticker
16	612530-3	4	Marking Point for Lubrication Fitting
17	612530-5	8	Marking Point for Lubrication Fitting
18	671641	4	Warning sign "squeeze danger"
19	671642	6	Warning sign "GREASE DAILY"
20	678800-H-A	1	Hose Assembly Connection A Lmm
21	678800-H-B	1	Hose Assembly Connection B L285mm
22	645833	1	Cuppling, Flat Face
23	645834	1	Coupling, Flat Face

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5.3.8.2 678801-RSP - Single Acting Rotator

Pos.	Qty.	P/N	Description
1	553468	1	Lifting eye
2	756790	6	Lubricating nipples
3	753079	1	Screw
4	772878	6	Screw
6	725466	6	Screw
7	755137	1	Nut
8	752137-2	1	Nut
9	70263	4	Split Pin
10	660416	2	Split Pin
11	792108	2	Washer
12	792106	8	Washer (replaces 753700-13)
13	792112	6	Washer
14	612679	4	Washer
15	671646	2	Sign "lifting point" - sticker
16	612530-3	4	Marking Point for Lubrication Fitting
17	612530-5	8	Marking Point for Lubrication Fitting
18	671641	4	Warning sign "squeeze danger"
19	671642	6	Warning sign "GREASE DAILY"
20	678800-H-A	1	Hose Assembly Connection A Lmm
21	678800-H-B	1	Hose Assembly Connection B L285mm
22	645833	1	Coupling, Flat Face
23	645834	1	Coupling, Flat Face
24	678866-1	1	Filter
25	678875	4	Spring
26	678876	6	Spring

INSPECTION / MAINTENANCE

6 Inspection / Maintenance

This chapter contains important information on how to service your AMP® 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 AMP® will be increased by following the instructions in this OMM.

Ensure that only sufficiently qualified and trained personnel accomplish maintenance work.

Read these instructions carefully before servicing the AMP®.

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. 2. Ensure that exclusively the FORUM Handling Tools Service Department or an authorized repair company observing the FORUM Handling Tools welding instructions performs welding work on cast parts.
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 accomplished 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 AMP® can be removed by grinding (Refer to Critical Areas).
6. 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 AMP® is set down on a good supporting surface so that it could not tip.
2. Provide for sufficient lighting at the workplace.
3. The AMP® must be removed from the Elevator-Links.
4. Ensure that AMP® is disconnected from hydraulic system.

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!

INFO

The specified lubricants can be obtained through FORUM Handling Tools. Contact your local representative.

Lubrication Points

The AMP is supplied with grease via lubrication nipples by a manual or pneumatic grease gun.

1. Latch
2. Hinge Pins (2x)
3. Latch Pin
4. Trigger System
5. Rotator pins

Fig. 101: Lubrication points I

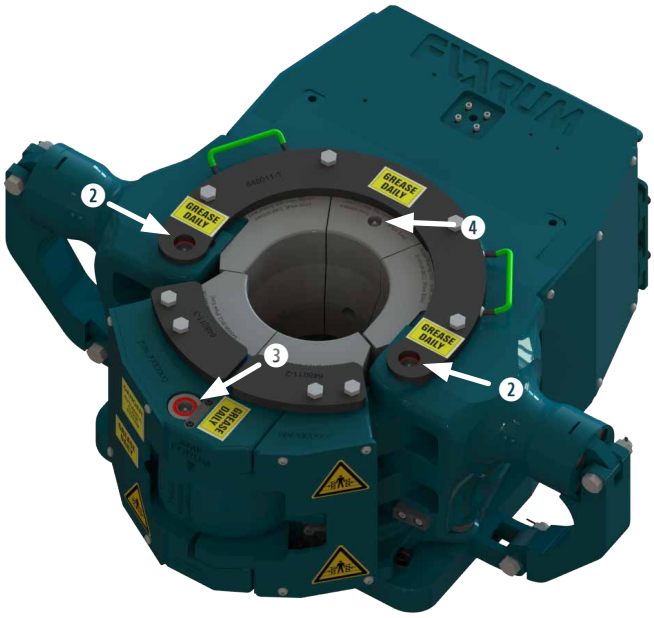


Fig. 102: Lubrication points II

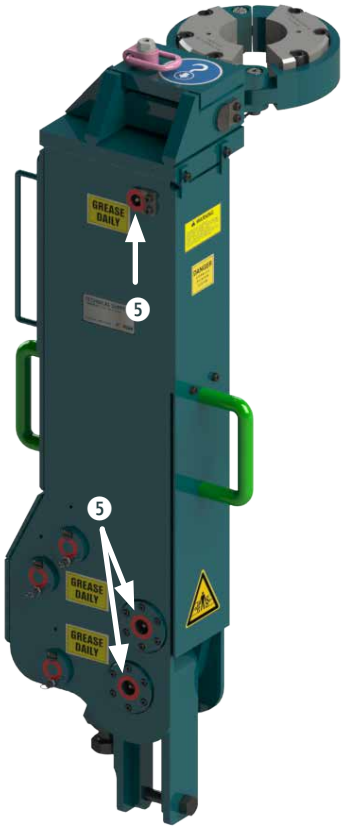


Fig. 103: Lubrication points III

6.2 Inspections

FORUM Handling Tools recommends performing inspections in compliance with API RP 8B at specified intervals and in inspection categories. Otherwise, the frequency of required inspections depends on the conditions of use of the AMP®.

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 or sand blasting.

Document the scope and results of the performed tests after an inspection.

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

INFO

The specified maintenance intervals are recommended for the FORUM Handling Tools AMP® 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

Inspection intervals

Category	Intervals	Preparatory measures
I	Daily	AMP® mounted to Elevator-Links.
II	Weekly	AMP® mounted to Elevator-Links.
III	Semiannually	AMP® removed from Elevator-Link. AMP® partly dismantled.
IV	Annualy	AMP® removed from Elevator-Link. AMP® completely dismantled.

INFO

The above-mentioned inspection intervals refer to a 100% use of the AMP® on each day of a week (24/7). Personal inspection intervals may vary according to the type and extent of use and may need to be adjusted. All inspection categories are in accordance with the latest API RP 8B.

Ensure that only sufficiently qualified and trained personnel accomplish maintenance work.

6.2.1 Inspection of Hydraulic Equipment

Check the hydraulic equipment daily for leakages. If unacceptably high leakages occur 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 wedges.
- Pulling wedged drill strings.
- Holding heavy drill pipes / drill strings.
- Jarring.
- Operation at very low ambient temperatures (< - 20°C to - 4°F).

6.2.3 Inspection Following Removal

Generally the AMP® should be inspected immediately before it is taken out of service temporarily or stored. Moreover it should be inspected before putting back into service.

- It is necessary to disassemble the AMP® 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 only FORUM Handling Tools or an authorized service company in compliance with the welding specifications issued by FORUM Handling Tools accomplishes welding work on cast parts.
- If the field inspection indicates that further inspection work is required, remove the AMP® and have it inspected in an appropriately equipped workshop.

6.3 Inspection Categories

6.3.1 Inspection Category I

Observe the AMP® during operation. Recognizing inadequate performance and apparent defects is the goal of this category.

Scope/Prerequisites/Procedure:

- Daily visual inspection of the AMP® for damages and defects during operation. Repair them if necessary.
- Functional test.
- A person with appropriate expertise must carry out the test.

6.3.2 Inspection Category II

The inspection of category II includes all inspections of inspection category I and additional tests.

Scope/Prerequisites/Procedure:

- Checking the state of lubrication, the condition of the entire AMP® and the settings of all valves.
- A person with appropriate expertise must carry out the test.

6.3.3 Inspection Category III

The inspection of category III includes all inspections of inspection category II and additional tests.

Scope/Prerequisites/Procedure:

- Non-Destructive Testing (NDT) of selected critical areas and verification of all wear limits.
- Before carrying out an NDT test, remove all foreign material such as dirt, paint, lubricants, oil and abrasion from the affected parts. Use suitable methods such as pickling, steam cleaning and sandblasting.

6.3.4 Inspection Category IV

The inspection of category IV includes all inspections of inspection category III and additional tests.

Scope/Prerequisites/Procedure:

- Before carrying out an NDT test, remove all foreign material such as dirt, paint, lubricants, oil and abrasion from the affected parts. Use suitable methods such as pickling, steam cleaning and sandblasting.
- Non-destructive material testing (NDT) of all critical areas and replacement of selected consumables and hydraulic components.

6.3.5 Inspection intervals and Inspection tasks

Pos.	Task	Daily	Weekly	Semiannually	Annually
1	Function test and ongoing observation.	✓	✓	✓	✓
2	Functionality of Feedback.	✓	✓	✓	✓
3	Checks for cracks and loose fittings/hoses.	✓	✓	✓	✓
4	Checks for signs of deformations and leakages.	✓	✓	✓	✓
5	Check for signs of wear and corrosion.	✓	✓	✓	✓
6	Check for no loose components and presence of all warning signs.	✗	✓	✓	✓
7	Check for state of lubrication and conservation.	✗	✓	✓	✓
8	Check all possible settings (eg. valves) on the AMP®.	✗	✓	✓	✓
9	Checking the condition of the overall structure (Rotary Table, hydraulic system) and the interaction of all components and possible attachments with the AMP®.	✗	✓	✓	✓
10	Checking wear limits (component measurement).	✗	✗	✓	✓
11	NDT tests of selected components (AMP® is largely disassembled).	✗	✗	✓	✓
12	Complete NDT test of all critical areas (AMP® is completely disassembled).	✗	✗	✗	✓
13	Exchange of selected hydraulic components.	✗	✗	✗	✓
14	Replacement of wear-intensive components (recommended spare parts).	✗	✗	✗	✓

✓ Necessary ✗ Unnecessary

INFO

NDT Non-destructive testing

- Magnetic Particle Inspection (MPI)
- Ultrasonic Measurement Methods (UT)
- Eddy Current Testing (ET)
- Dye Penetrant Inspection (DPI)

6.3.6 Inspection Checklist

INFO

The following checklist serve as a copy template for inspections to be performed in compliance with API RP 8B. Performed inspections must always be documented and stored safely.

Ensure that only sufficiently qualified and trained personnel accomplish maintenance work.

AMP Model: _____

Serial number: _____

☐ **Inspection Category I**

Date / Place of Inspection:	Result OK ☐	Result NOK ☐	Name of Inspection Operator / Supervisor:	Sign:

Remarks:

☐ **Inspection Category II**

Date / Place of Inspection:	Result OK ☐	Result NOK ☐	Name of Inspection Operator / Supervisor:	Sign:

Remarks:

☐ **Inspection Category III**

Date / Place of Inspection:	Result OK ☐	Result NOK ☐	Name of Inspection Operator / Supervisor:	Sign:

Remarks:

☐ **Inspection Category IV**

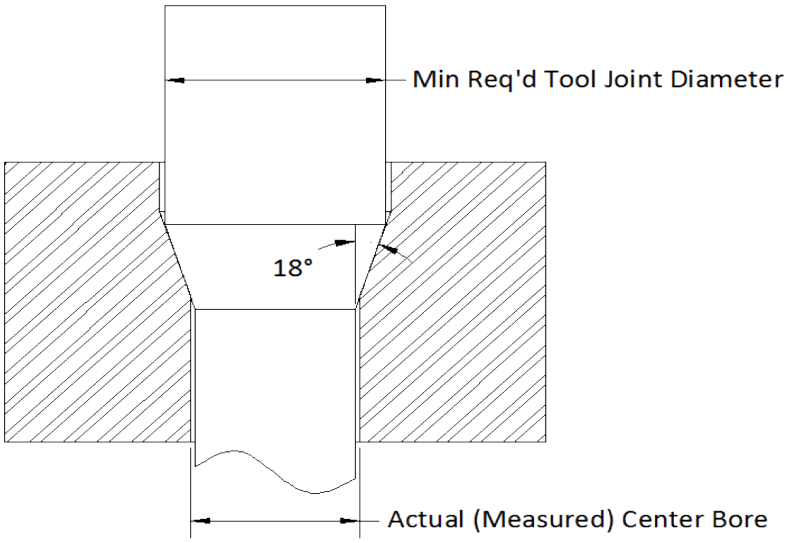
Date / Place of Inspection:	Result OK ☐	Result NOK ☐	Name of Inspection Operator / Supervisor:	Sign:

Remarks:

6.4 Measuring of Wear

6.4.1 Wear at the Tool Joint

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.



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).

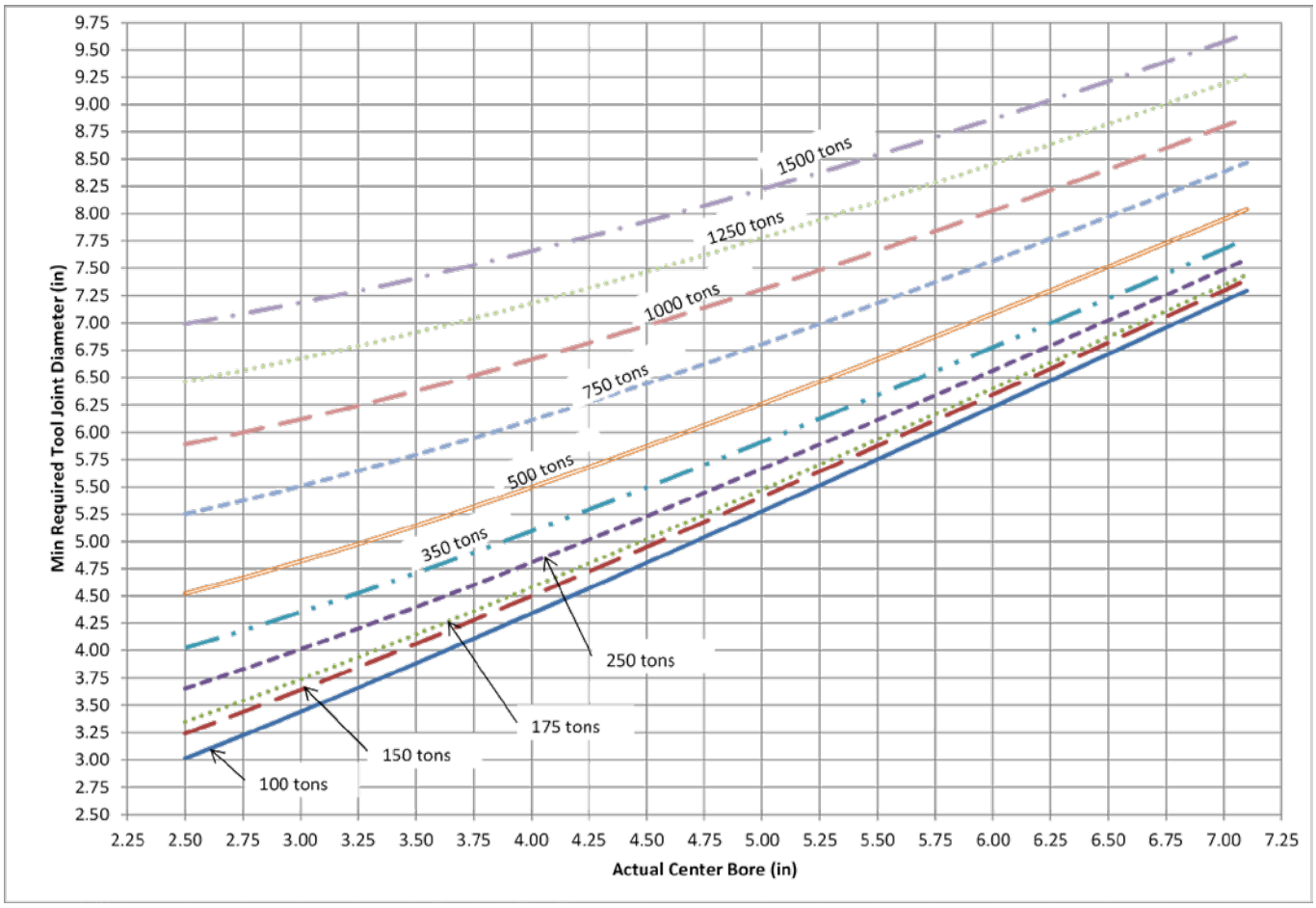


Fig. 104: Minimum A for Tool Joints

6.4.2 Wear data for components

Check the wear limits as specified in the inspection checklists.

6.4.3 Minimum ear dimensions

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 criterion cannot determine the overall condition of the elevator and its suitability for continued use.

Fig. 105: Minimum ear dimensions

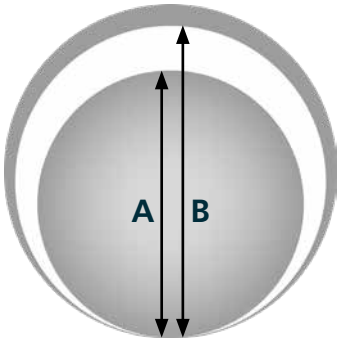
Elevator Type [P/N]	AMP®-350/1		AMP®-375/1		AMP®-350/2		AMP®-500/1		AMP®-500/2		AMP®-750/1 AMP®-1000/1		AMP®-1250/1	
	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
Minimum Dimension A	110,5	4,35	110,5	4,35	110,5	4,35	149	5,87	149	5,87	189,25	7,45	210,5	8,29

Hinge-Pin und Latch-Pin

Elevator Type [P/N]	AMP®-350/1 AMP®-375/1 AMP®-500/1		AMP®-350/2		AMP®-500/2		AMP®-750/1 AMP®-1000/1		AMP®-1250/1	
Hinge-Pin	[P/N 648177]		[P/N 638277]		[P/N 648077]		[P/N 678177]		[P/N 688077]	
	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
Ⓐ Hinge Pin Diameter New Min.	62	2,44	60	2,36	58	2,28	70	2,76	90	3,54
Ⓐ Hinge Pin Diameter worn Max	61,6	2,43	58,96	2,32	57,6	2,27	69,7	2,74	89,6	3,53
Ⓑ Bore Diameter New max.	62	2,44	60	2,36	58	2,28	70	2,76	90	3,54
Ⓑ Bore Diameter Worn max.	62,3	2,45	60,94	2,40	58,3	2,30	70,2	2,76	90,3	3,56

Elevator Type [P/N]	AMP®-350/1 AMP®-375/1 AMP®-500/1		AMP®-350/2		AMP®-500/2		AMP®-750/1 AMP®-1000/1		AMP®-1250/1	
Latch-Pin	[P/N 648178]		[P/N 638278]		[P/N 648078]		[P/N 678178]		[P/N 688078]	
	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
Ⓐ Latch Pin Diameter New Min.	55	2,17	45	1,77	45	1,77	50	1,97	60	2,36
Ⓐ Hinge Pin Diameter worn Max	54,28	2,14	44,11	1,74	44,6	1,76	49,7	1,96	59,6	2,35
Ⓑ Bore Diameter New max.	55	2,17	45	1,77	45	1,77	50	1,97	60	2,36
Ⓑ Bore Diameter Worn max.	55,46	2,18	45,89	1,81	45,3	1,78	50,2	1,98	60,3	2,37

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 (Refer to critical areas). Following the repair, the parts should again be inspected by an appropriate method to insure that the defect has been completely removed.



6.4.4 Wear Check for 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 tool 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 tool 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

5. Fit the gauge to the inner bore of the bushing.
6. Push the gauge against the bushing and start to move the gauge downwards until the chamfer touches the 18° shoulder or the bore.
7. 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. 106: Position the 18° and 15° gauge

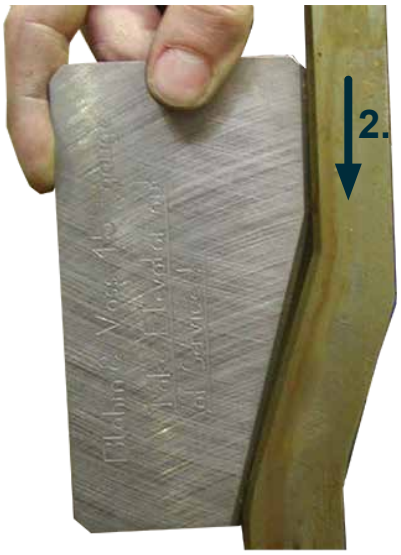


Fig. 107: Move for measurement

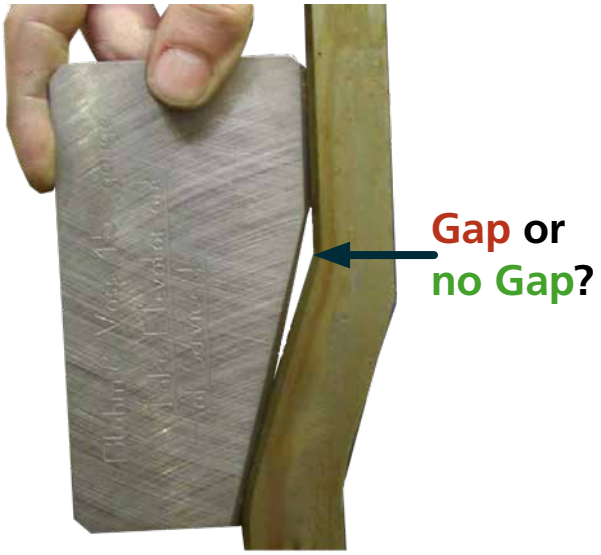


Fig. 108: Evaluation

6.5 Critical Areas

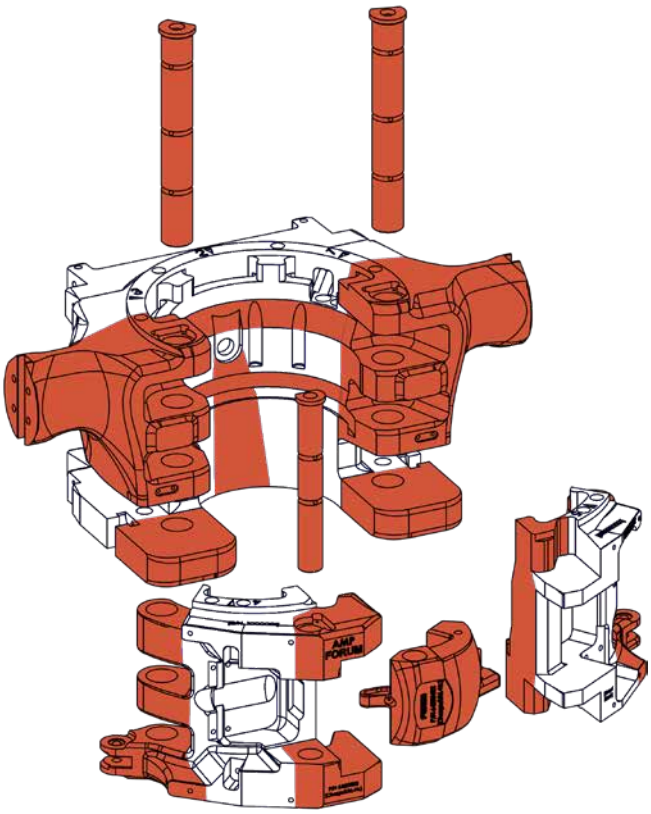


Fig. 109: Critical Areas AMP®-350/1, AMP®-375/1 and AMP®-500/1

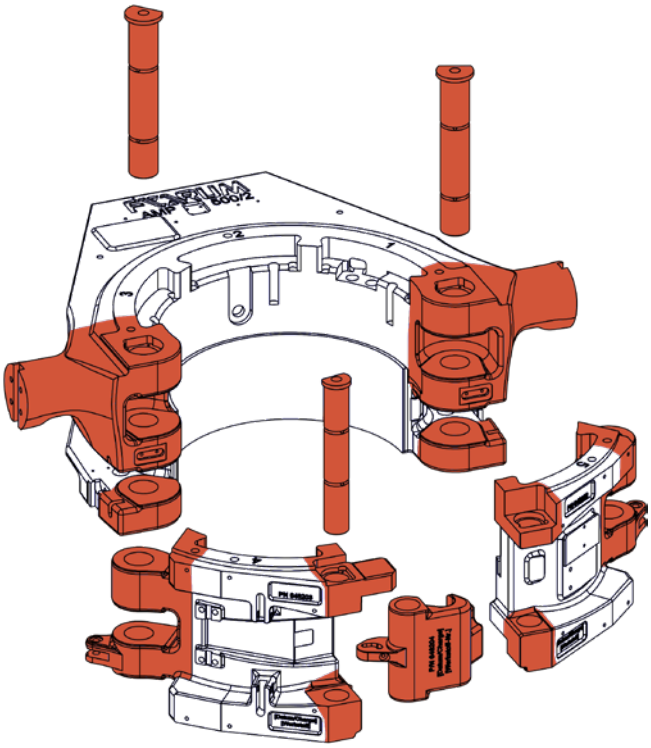


Fig. 110: Critical Areas AMP®-500/1

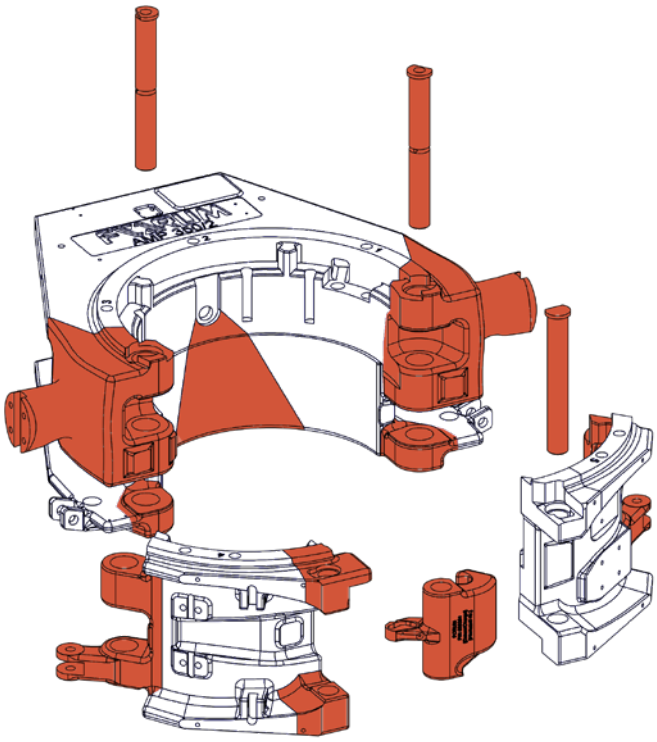


Fig. 111: Critical Areas AMP®-350/2

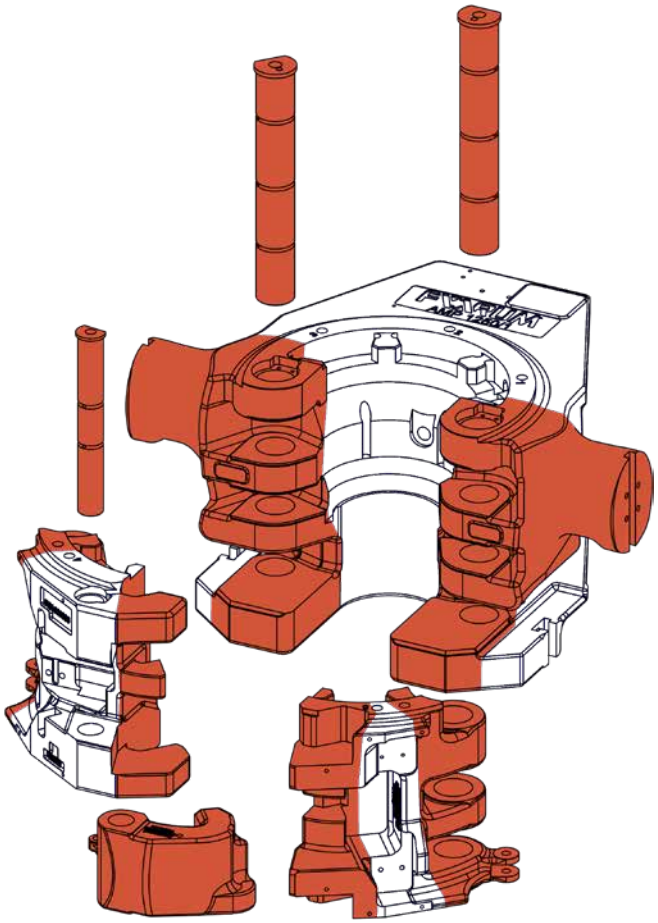


Fig. 112: Critical Areas AMP®-1250/1

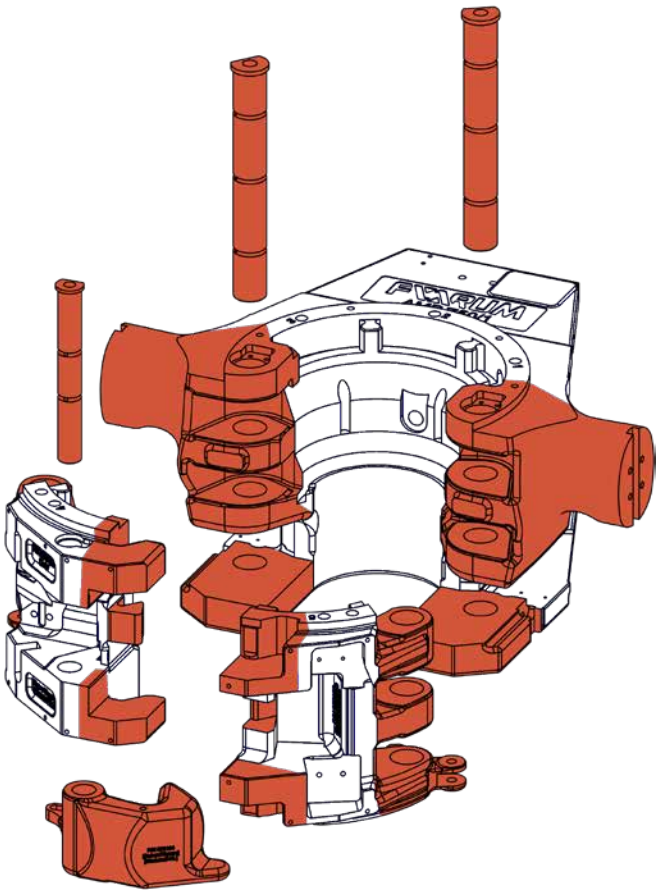


Fig. 113: Critical Areas AMP®-750/1 and AMP®-1000/1

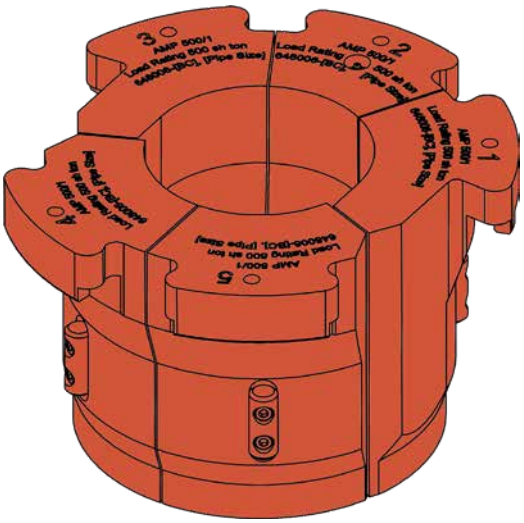


Fig. 114: Critical Areas Bushing Assembly

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 AMP®. Remove this contamination regularly to prevent incrustation and to ensure safe operation of the AMP®. Clean contamination from drilling from the AMP® regularly. The AMP® should be cleaned thoroughly at the end of each shift at the latest. FORUM Handling Tools recommends cleaning the AMP® with a high-pressure steam cleaner.

STORAGE/ DISPOSAL

7 Storage / Disposal

This section deals with procedures to be taken to the storage after the decommissioning of the AMP®. The goal is to protect the AMP®, the environment and people from damages. Therefore, FORUM Handling Tools recommends reading and implementing the following procedure accurately.

7.1 Storage

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. Lubricate 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.

Intermediate Storage	
Protection of equipment	• Clean the equipment roughly. • Apply corrosion preventative to all bare surfaces. • Protect all other bare surfaces with Tectyl Type 864 or an equivalent agent. • Place the AMP® only on surrounded pallets and secure them with tensioning cables and anti-slip mat.
Ambient Conditions	• Store in dry surroundings (maximum humidity 80%).

Longer Storage	
Protection of equipment	• Clean the equipment roughly. • Apply corrosion preventative to all bare surfaces. • Protect all other bare surfaces with Tectyl Type 864 or an equivalent agent. • Place the AMP® only on surrounded pallets and secure them with tensioning cables and anti-slip mat. • Protect the AMP® against water penetration with a plastic tarp. • Disassemble all hydraulic components and drain the oil.
Ambient Conditions	• Store in dry surroundings (maximum humidity 80%).

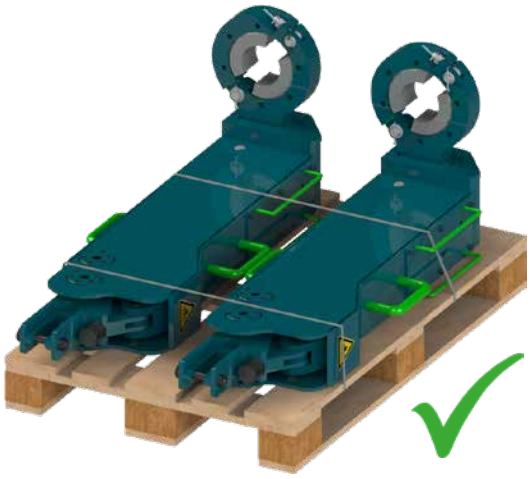


Fig. 115: Correct Storage on pallet I

Fig. 116: Correct Storage on pallet II

7.2 Disposal

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

However, operation of the AMP® requires use of hydraulic fluids, lubricants and cleaning agents, which can pollute the environment. For this reason always ensure that such substances are disposed of properly according to international, national and local regulations.

Never dispose of hydraulic fluids, oils, lubricants, 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 OMM.

Fig. 117: Correct Storage in shelf

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APPENDIX

8 Appendix

A. Sample of EC Declaration **PAGE 147**

B. Third Party Documents **PAGE 148**

I Safety Data-Sheet PAGE 148

II Components PAGE 149

A. Sample of EC Declaration

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: **Hydraulic Operated Multi-Pipe Elevator AMP®-350 - AMP®-1500**

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 hazardous areas

Amongst others following harmonized and technical standards and specifications were used:

API 8C, 5. Edition	Specification for Drilling and Well Servicing Equipment
DIN EN ISO 13535	Petroleum and natural gas industries - Drilling and well-servicing equipment
DIN EN ISO 12100	Safety of machinery, Risk assessment and Risk Reduction
DIN EN ISO 80079-36	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 data book]
Rated Capacity:	[refer to data book]
Part Number:	[refer to data book]
Serial Number:	[refer to data book]
Delivery date:	[refer to data book]
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 2014/34/EU Article 13 (1) b) ii) have been deposit at the notified body IBExU - Institut fur 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 and API 01 approved by API Quality Registrar, Washington D.C./USA, Registration No. 2850 + 01-2769.

Hamburg, issued on [refer to data book]

Authorized Representive

Name Matthias Theiss
Position Managing Director

FORUM B + V Oil Tools GmbH
Hermann-Blohm-Strasse 2, 20457 Hamburg
P.O.Box 11 22 53, 20422 Hamburg, Germany Phone:
+49 40 37022-6855, Fax: +49 40 37022-6899 E-Mail:
oiltools@f-e-t.com
Internet: www.blohmvoss-oiltools.com
Registered Office: Hamburg

Managing Directors: Matthias Theiss, Dr. Uwe Wagner, Tylar Kipp Schmitt
Commercial Register: District Court of Hamburg, HRB 125 890
Tax-No.: 46/722/02375, 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 / 2835 / 006 / IBAN: DE50 3003 0880 4012 8350 06
14.09.2017

Fig. 118: EC Certificate of Conformity Sample

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	
[Lubricant] Thermaplex Hi Temp Bearings	
[Paint] Paint Gallon	
[Paint] Paint Marker	

Material Name	Link to file
[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	

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

FORUM B + V Oil Tools GmbH
D-20457 Hamburg (Germany)
Hermann-Blohm-Strasse 2
fon: +49.40.37022 6855
fax: +49.40.37022 6 896

FORUM Energy Technologies Inc.
Broussard, LA 70518 USA
1023 Forum Drive
fon: +1.337.373 1800
fax: +1.337.373 4466