Thomson Engineering Design Ltd

# SM15-01 STEEL Manipulator


## Operators' Instructions, Maintenance Instructions & Parts Book

Original Document in English Language

Issue 3

June 2017


Document Number: SM15-01-Inst-03 Issue: 03 Date: June 2017

# Introduction

*The Thomson Engineering Design SM15-01 Steel Manipulator is designed for the handling and installation of I-beams and box section steelwork from 200mm to 650mm.*

The device allows steel sections to be installed at any angle and in any position within the working range of the host machine through the use of three-axis manipulation.

A full range of adapter heads are available to suit all types of excavators with both loose pin and quick coupler mounting systems. Three independently controlled hydraulic services are required to operate the SM15-01 Steel Manipulator but a separate control module is available from the manufacturer if the host machine does not have this arrangement.

This manual describes the safe use and maintenance of the SM15-01 Steel Manipulator and includes spare parts lists.

## *Warning*

**The Thomson Engineering Design SM15-01 Steel Manipulator must not be used for any purpose or in any way not described within this document. Using this device for any purpose not described in this document may be dangerous and may invalidate the manufacturer's warranty.**

**NEVER ALLOW PERSONNEL WITHIN THE WORKING AREA OF THE MACHINE AND LOAD.**

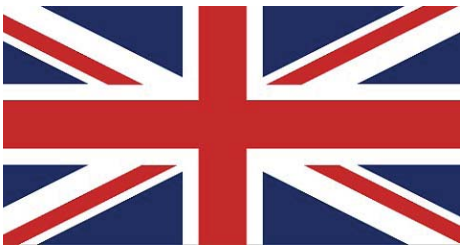
## *Warning*

**The maximum hydraulic pressure which may be applied to the circuits of the Manipulator must not be exceeded. Exceeding the stated pressures may damage or reduce the life of the hydraulic components.**

**It is extremely dangerous to over-pressurise a hydraulic system and doing so can lead to severe injury.**

The hydraulic service on the host machine must be adjusted to ensure that the maximum pressure rating of the SM15-01 Steel Manipulator is not exceeded.

The system pressure within the rotator and tilt cylinders is controlled only by the setting of the host machine however the grab circuit is fitted with a pressure control valve to limit the pressure within the hydraulic cylinders to 120 Bar.



Thomson Engineering Design SM15-01 Steel Manipulators are proudly designed and made in the United Kingdom.



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# Contents



# Specifications (typical)

| | |
|---|---|
| Overall Transport Dimensions | Depends on Specification |
| Overall Weight | Depends on Specification |
| Minimum Hydraulic Pressure | 110 Bar |
| Maximum Hydraulic Pressure (grab circuit) | 210 Bar |
| Maximum Hydraulic Pressure (rotate circuit) | 160 Bar |
| Maximum Working Load | 3,750 kg |
| Proof Load (Factory Test) | 1.25 x SWL |

# Issue Record

| | |
|---|---|
| Issue 1 | Oct 2015 |
| Issue 2 incorporating 60 degree tilt head | May 2016 |
| Issue 3 incorporating check of pendulum valve | June 2017 |

# Description of the SM15-01 Steel Manipulator

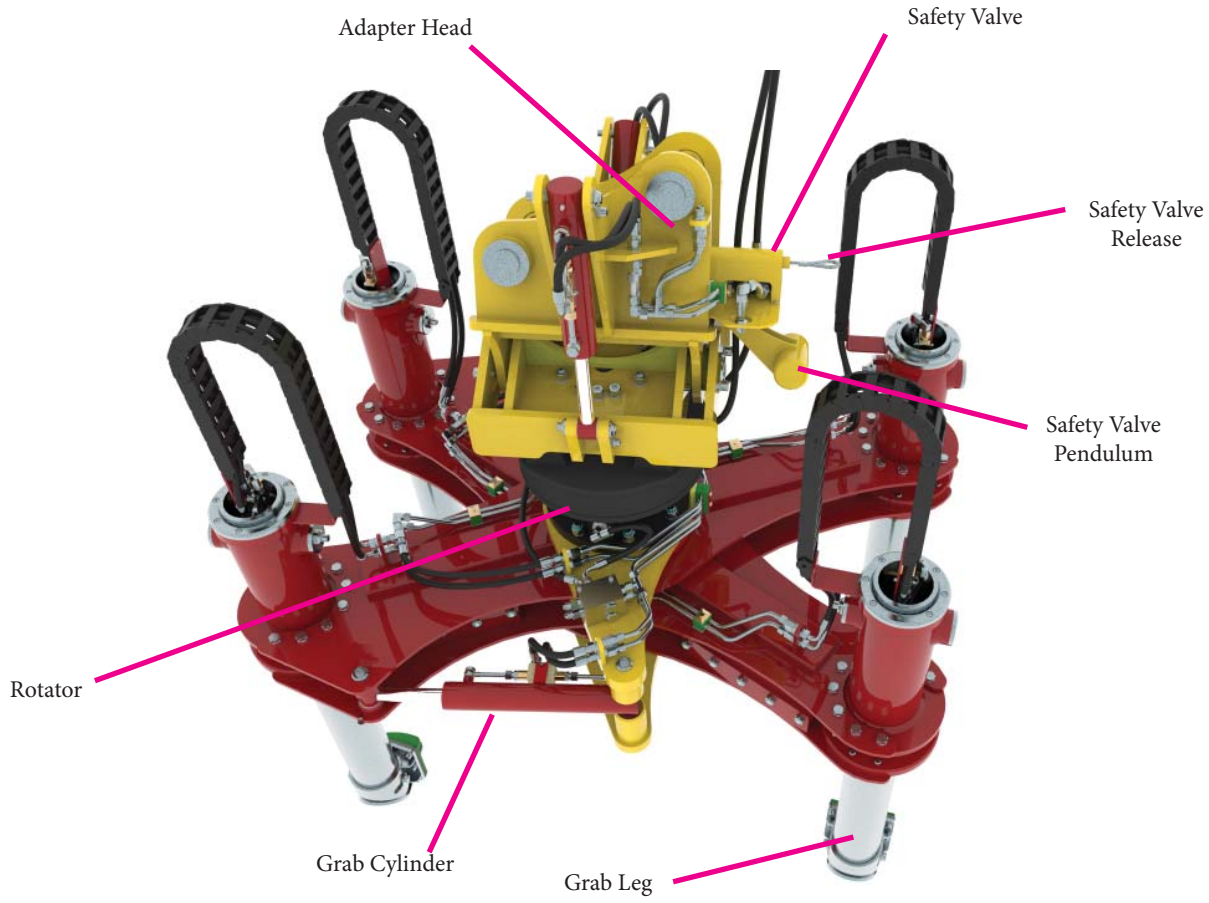
*The main parts of a Thomson Engineering Design SM15-01 Steel Manipulator are illustrated below.*

The SM15-01 Steel Manipulator is suspended from the host machine by the adapter head and connected to the host machine's hydraulic system via the supply hose connections.

The hydraulic rotator allows the operator to revolve the device in order to align it with the sleepers and the track. The tilt mechanism allows the operator to rotate the steel mast to align with its fixing points.

Steel sections are gripped by the grab legs. Once the grab legs are in contact with the load, the legs are hydraulically retracted to pull the load up to the base pad below the main body of the device.

The SM15-01 Steel Manipulator is designed to handle all rectangular, square and fabricated sections from 200mm to 600mm.



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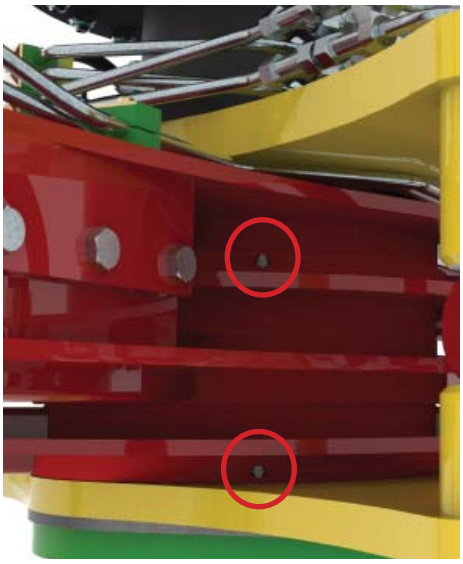
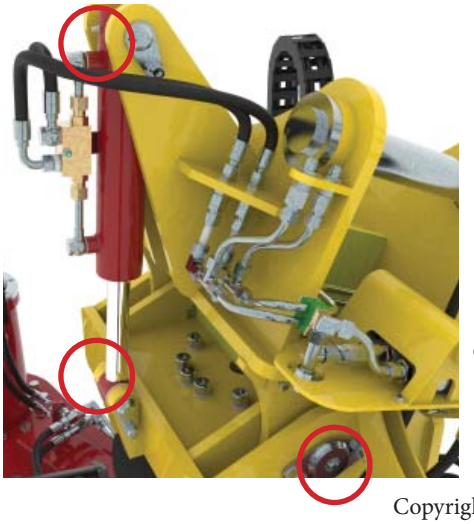
# Daily Checks and Maintenance



One grease nipple is fitted in each hinge boss (4 total)

Grab cylinders have one grease nipple in each end (4 total)



The tilt system hydraulic cylinders have one grease nipple at each end (4 total) and there is one grease nipple for each hinge pin (2 total)

*Daily checks of the SM15-01 Steel Manipulator are designed to ensure that it is fit for use. Daily maintenance is limited to greasing of the hinge bushes and the hydraulic cylinder ends and oiling of the safety valve spool.*

The following is a list of the relevant daily checks. These should be carried out at the start of the shift before putting the SM15-01 Steel Manipulator into service. If the device is used for an extended period then these checks and maintenance operations should be repeated every eight hours of use.

- Grab Legs open and close freely
- Grab Legs telescope freely
- Device rotates smoothly
- Tilt mechanism moves smoothly
- All nuts and bolts are tight
- Hydraulic hoses free from damage
- All parts free of cracks, wear and distortion
- Hydraulic system is free from leaks
- Check pads for wear and damage
- Pendulum valve is operating correctly (see page 8)

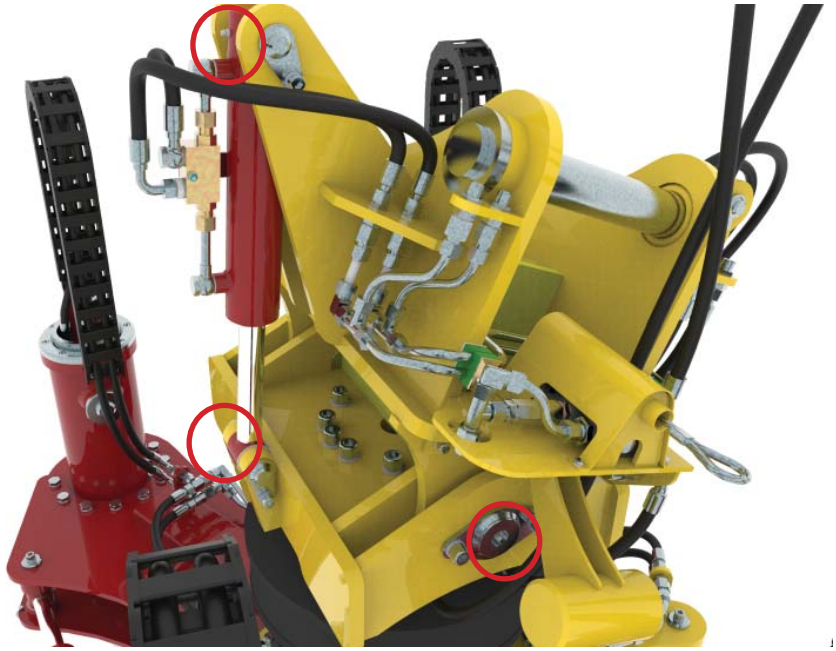
Grease should be applied to the following points (see illustrations and page 6)

- Hinge Bosses
- Hydraulic cylinder ends

Oil should be applied to the following points (see illustrations and page 6)

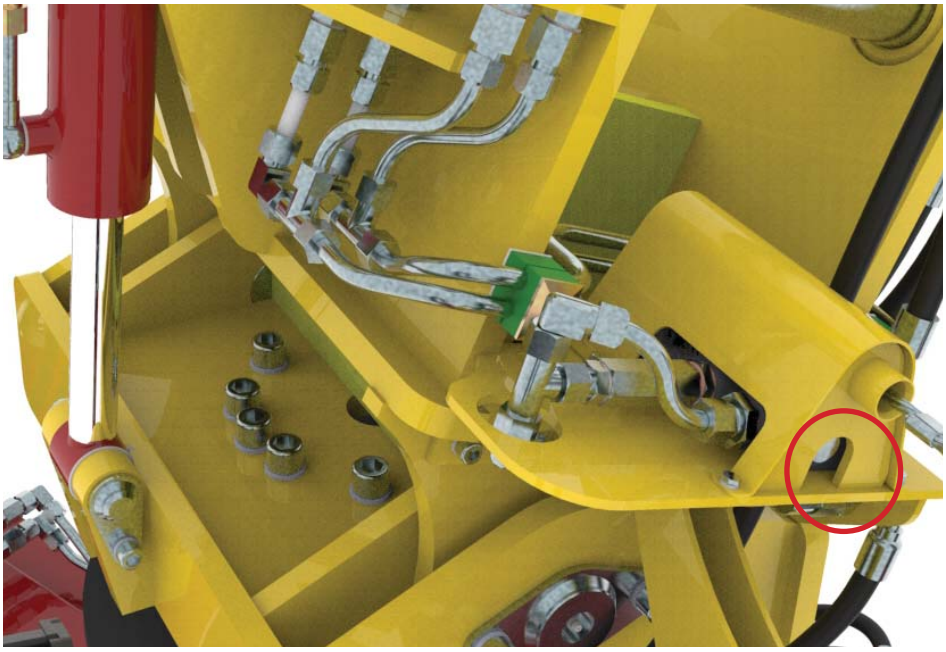
- Safety valve spool

# Daily Checks and Maintenance (cont'd..)



Grease the cylinder ends (4 total) and hinge pins (2 total) of the adapter head

Check that swivel pads move freely



Oil the spool of the safety valve and check that the pendulum moves freely

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# Attaching & Connecting the SM15-01 Steel Manipulator

## *Attach the SM15-01 Steel Manipulator to the Host Machine*

Connect the SM15-01 Steel Manipulator to the host machine using the mounting pins of the Adapter Head either connected to a quick coupler or directly to the machine boom.

**Adapter Head pins must be securely attached to the host machine and if a quick coupler is used, ensure that the Operators' Instructions for the quick coupler are adhered to.**

## *Connect the SM15-01 Steel Manipulator Hydraulic System to the Host Machine*

Stop the engine of the host machine and de-pressurise the hydraulic system.

The SM15-01 Steel Manipulator is equipped with hoses fitted to the connections illustrated (right). Connect the hoses of the SM15-01 Steel Manipulator to the auxiliary hydraulic connections of the host machine.

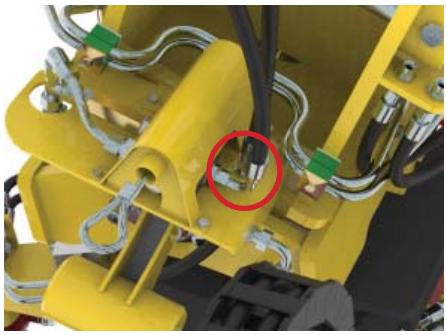
**Note: changes of temperature can mean that the closed system of the SM15-01 Steel Manipulator can become pressurised whilst it is being stored. Beware of the risk from release of hydraulic fluid under pressure which can cause very serious injury.**

Once the hydraulic connections are secure, re-start the host machine, lift the SM15-01 Steel Manipulator clear of the ground and operate the hydraulic control to check all the hydraulic functions, this ensures that any trapped air is discharged from the cylinders and pipes of the SM15-01 Steel Manipulator before use.

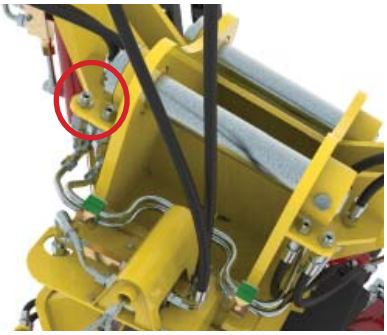
Operate the rotator of the SM15-01 Steel Manipulator to check that it is free running and to check that the hoses do not catch or rub on any part of the machinery.

Check the complete hydraulic system for signs of leakage. Stop the host machine and correct any leaks found before using the SM15-01 Steel Manipulator.

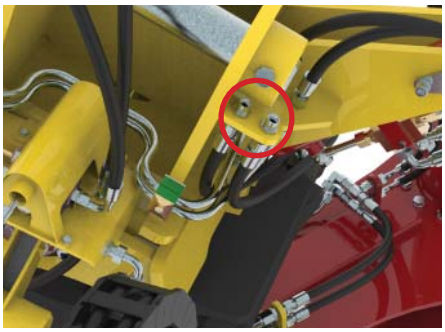
**Note: hydraulic quick release couplings should be of a type which prevents fluid discharge to the environment on connection and release.**



Grab Connections



Tilt Connections



Rotator Connections

## *Respect the Environment*

Hydraulic fluids, even biodegradable fluids, can cause serious damage to the natural environment particularly if discharged into a watercourse.

Respect the environment and handle hydraulic fluids carefully. Contain and remove any fluid spills immediately.

# Checking the Operation of the Pendulum Valve

*Before using the SM15-01 Steel Manipulator it is important to check that the pendulum valve is operating correctly. Repair operations such as the replacement of hoses can, if incorrectly carried out, reverse the operation of this valve so it should be checked at the start of each shift.*

With the Manipulator fully connected to the host machine, lift the manipulator clear of the ground with the legs vertical and operate the grab function. Check that the grab opens and closes.

Now tilt the Manipulator so that the legs are horizontal. Check that the grab can be closed but that the grab CANNOT BE OPENED when in this position.

If the Manipulator does not operate correctly the cause must be investigated and rectified before the Manipulator is put to use.

## *Troubleshooting*

If the hoses on the Manipulator have been accidentally reversed then, with the legs horizontal, the grab will open but not close.

If the grab can be opened and closed with the legs in the horizontal position then the most likely cause is that pendulum valve is jamming.



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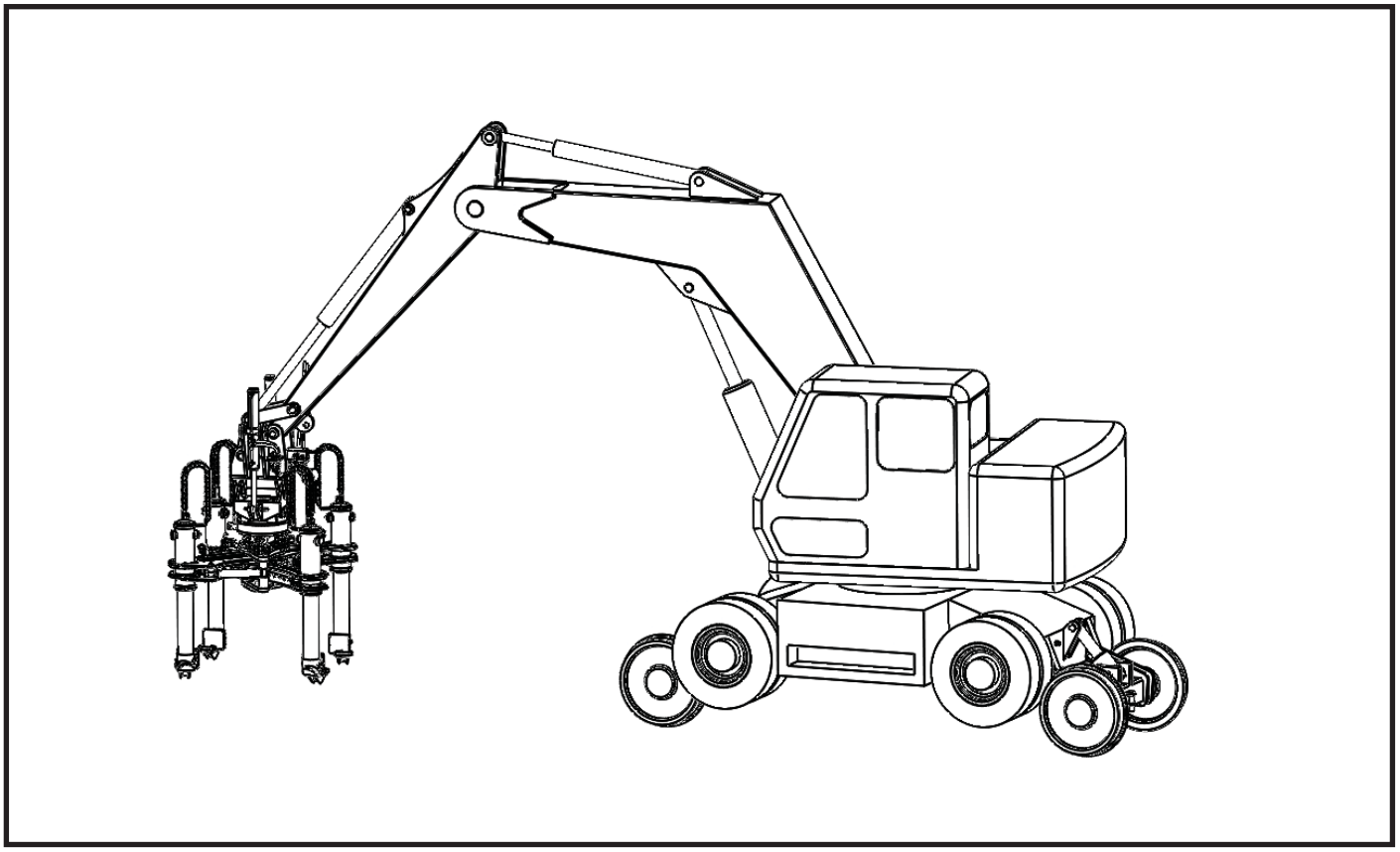
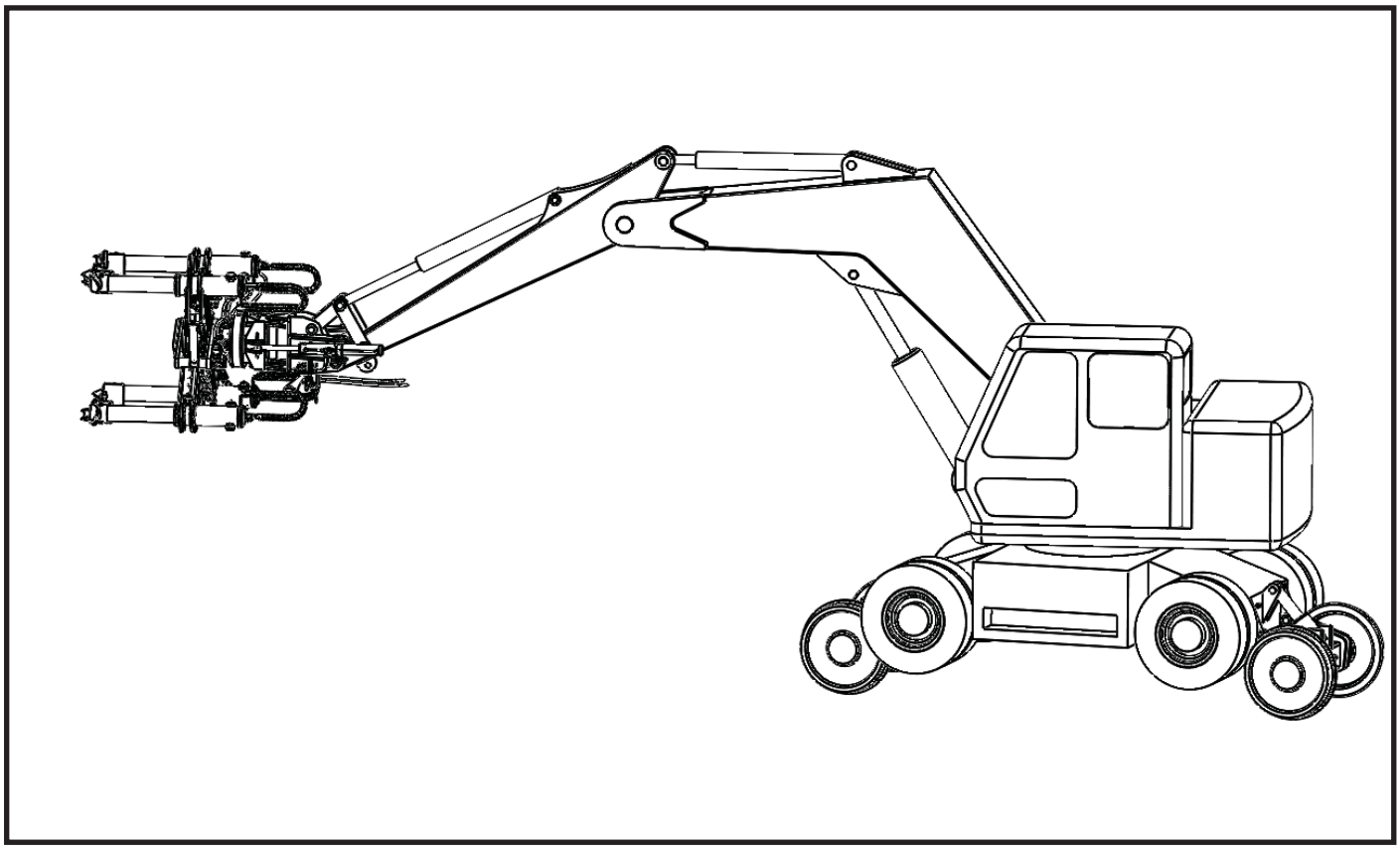


***1) With the legs of the SM15-01 vertical the grab should open and close freely***



***2) With the legs of the SM15-01 horizontal it should be possible to close the grab but it should not be possible to open the grab.***

# Using the SM15-01 Steel Manipulator

*The SM15-01 Steel Manipulator is completely controlled from the cab of the host machine using the auxiliary hydraulic controls to grab and manipulate steel sections.*

When erecting masts and columns it is necessary for the safety valve to be released by the machine controller before the grab can be released from the steel section. This feature is designed to prevent the operator inadvertently releasing the load during the lifting operation.

One control is used to operate the rotate function, a second control operates the grab function and a third control operates the tilt function.

**BE SURE THAT YOU ARE COMPLETELY FAMILIAR WITH THE CONTROLS AND THEIR FUNCTIONS BEFORE USING THE SM15-01 STEEL MANIPULATOR TO LIFT STEEL SECTIONS.**

On the lower face of the Adapter Head is a safety valve controlled by a pendulum. When the grab legs are vertical this valve is open and the operator has complete control of the grab.

Once the Manipulator is tilted more than 15 degrees, the pendulum closes the safety valve and the operator can tighten the grip on the load but he cannot release the grip unless the safety valve is also released by another operative.

The normal sequence of operation is:

1) Lift the SM15-01 Steel Manipulator and set it with the grab legs pointing vertically downwards.

2) Fully open the grab and wait until all four legs have fully extended.

3) Lower the grab legs over the load until the feet are just below the load.

4) Operate the control again to close the grab legs and grip the load

5) Continue to operate the 'grab close' control until the telescopic legs have drawn the load tightly up to the body of the Manipulator

**Note: if the load does not lift evenly open the grab and re-position closer to the centre of gravity of the load.**

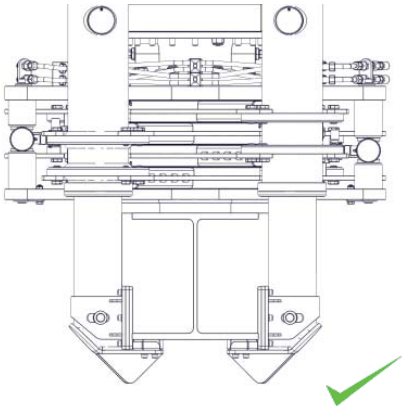
6) Once the load is tightly gripped use the machine to elevate, manipulate and position the steelwork in accordance with the lifting plan

7) Once the steel section has been secured in place the machine controller uses a rope or a hooked pole to pull on the safety valve release

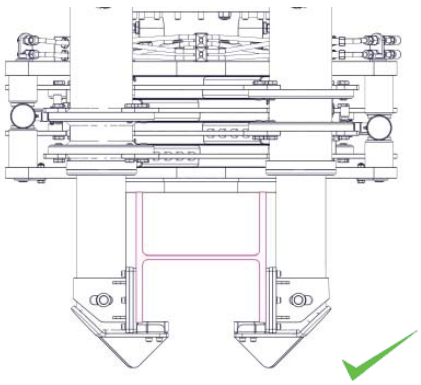
8) With the safety valve open operate the grab control to open the grab and release it from the steel section.

## Warning

This device requires skill and practice. Don't try to operate the Manipulator quickly until you are confident of all the controls.



The Manipulator may be used to handle steel sections in either orientation



## Warning

Steel sections exceeding 2,000kg must be gripped as close to their centre of mass as possible.

Lighter sections may be gripped closer to the ends if required.

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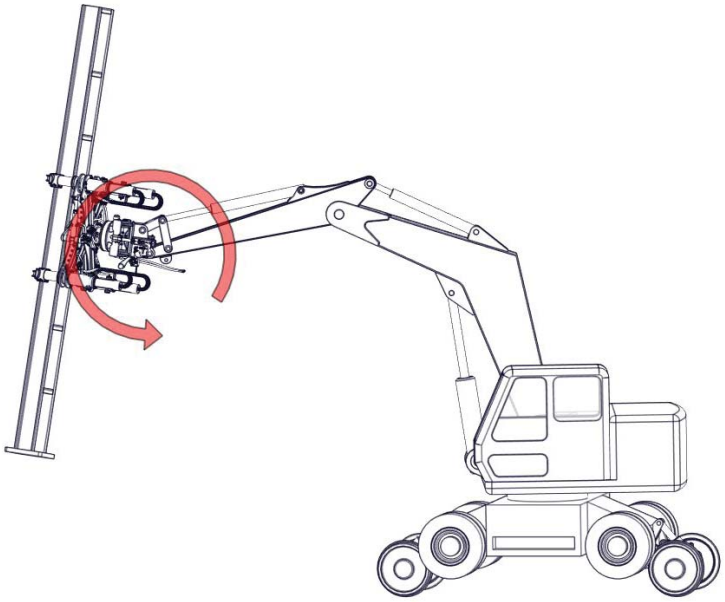
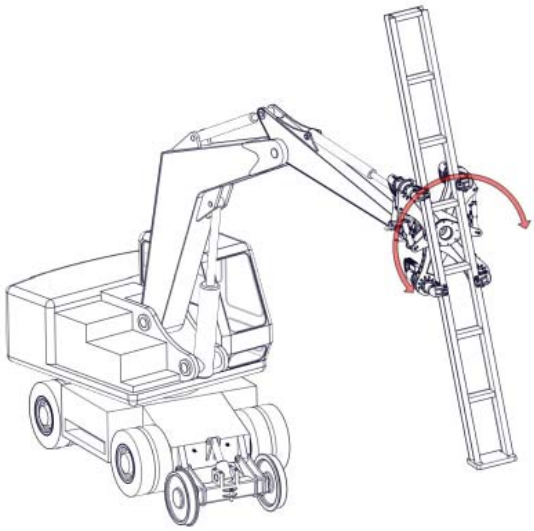
# Manipulation Controls

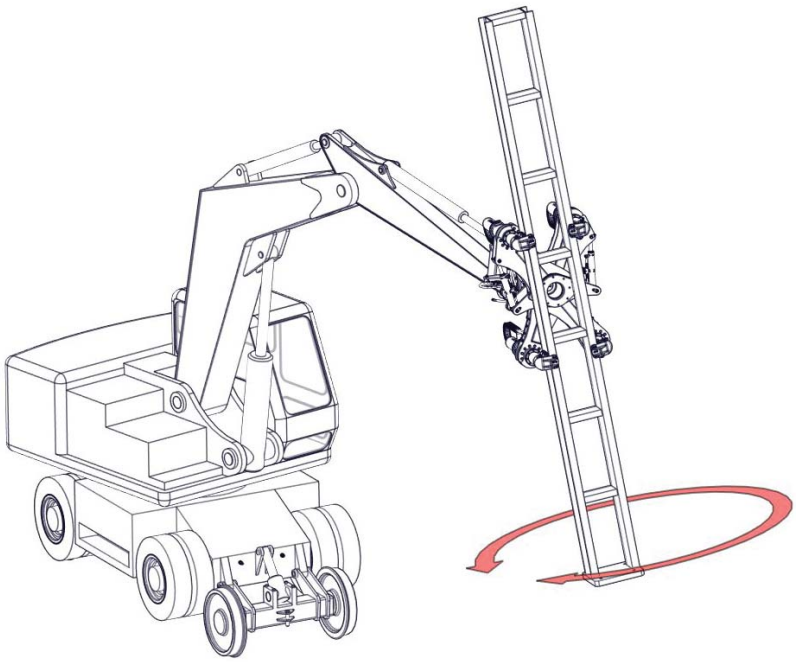
*The illustrations on this page show how the functions of the host machine and the Manipulator move the steel section.*



Use the bucket crowd function to elevate the load



The Rotator moves the load as shown above



The Tilt function can rotate a steel mast to align a bolt flange

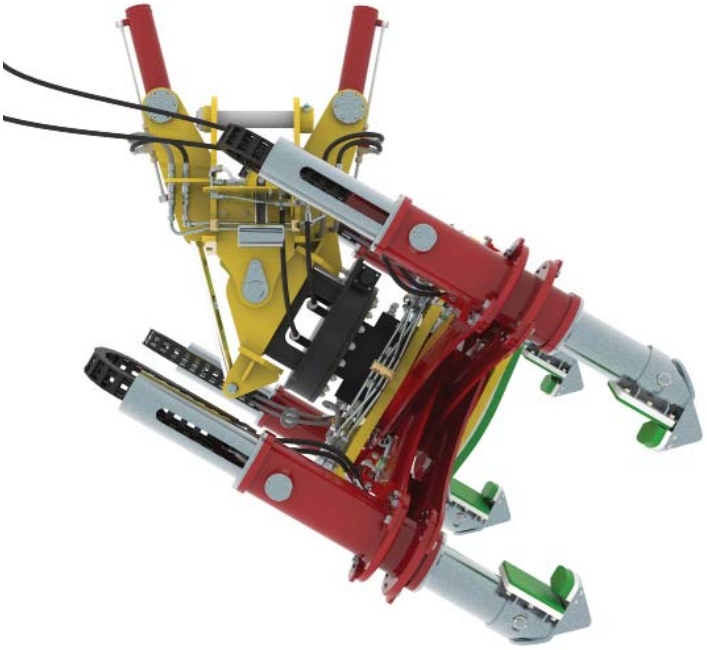
# Using the 60 Degree Tilt Head

*Two adapter head arrangements are available for the SM15-01 Steel Manipulator: a 25 degree tilt and a 60 degree tilt head.*

The 60 degree tilt head allows the operator much more flexibility when installing masts and steelwork in restricted areas however when the head is fully tilted it can come into contact with the grab legs if the rotator is operated after tilting.

To avoid damage to the manipulator when used with a 60 degree tilt head it is important to set the mast upright BEFORE operating the tilt function to rotate the load.

With the 25 degree tilt head at full tilt the manipulator can still be rotated without the legs coming into contact with the adapter head



With a 60 degree tilt head fitted if the rotator is operated after the head is fully tilted the legs can collide with the head causing damage.

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# Disconnecting and Transporting the SM15-01 Steel Manipulator

*Once the steel handling operation is complete the SM15-01 Steel Manipulator should set as illustrated below for transport.*

Fully close the grab until the legs are completely retracted then slowly open the grab but stop before the legs begin to extend.

Place the SM15-01 Steel Manipulator on a firm, level surface before disconnecting from the boom of the host machine.

Stop the engine of the host machine and de-pressurise the hydraulic system.

Release the hydraulic connections and disconnect the SM15-01 Steel Manipulator from the host machine.

Transport the SM15-01 Steel Manipulator resting on its grab legs. The device may be secured using ratchet straps passing over the adapter head pins but be careful not to trap or damage any of the hydraulic pipes and hoses.



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# Warnings

## WARNING

ALWAYS STOP THE ENGINE OF THE HOST MACHINE AND RELEASE THE PRESSURE FROM THE HYDRAULIC SERVICES BEFORE ATTEMPTING TO CONNECT OR DISCONNECT HYDRAULIC ATTACHMENTS.

MAXIMUM RATED PRESSURE OF HYDRAULIC CIRCUITS MUST NOT BE EXCEEDED. EXCEEDING RATED PRESSURE MAY LEAD TO BURST HOSES OR LEAKAGE FROM COMPONENTS.

HYDRAULIC FLUID UNDER PRESSURE MAY CAUSE SEVERE INJURY.

## WARNING

NEVER MOVE ANY LOAD UNTIL YOU ARE SURE THAT THE WORK AREA IS CLEAR OF ALL PERSONNEL.

ALWAYS ENSURE THAT LIFTING OPERATIONS ARE PROPERLY PLANNED.

REMEMBER THAT INADVERTENT OPERATION OF THE CONTROLS MAY CAUSE INJURY TO PERSONNEL IN THE WORK AREA.

WORN OR DAMAGED PADS WILL REDUCE THE GRIP ON THE LOAD.

## WARNING

SMOOTH AND STEADY OPERATION OF THE SM15-01 STEEL MANIPULATOR WILL PROLONG ITS WORKING LIFE.

ALWAYS ENSURE THAT STEELWORK IS PROPERLY FIXED BEFORE RELEASING THE GRIP OF THE SM15-01 STEEL MANIPULATOR

## WARNING

HANDLING STEELWORK IS A LIFTING OPERATION.

ALL LIFTING OPERATIONS MUST BE CAREFULLY PLANNED TAKING INTO ACCOUNT THE DUTY CHART OF THE HOST MACHINE TO ENSURE THAT NEITHER THE SM15-01 STEEL MANIPULATOR NOR THE HOST MACHINE CAN BECOME OVERLOADED.

OVERLOADING OF THE SM15-01 STEEL MANIPULATOR OR THE HOST MACHINE MAY LEAD TO SERIOUS INJURY OR DEATH.

## WARNING

THE SM15-01 STEEL MANIPULATOR IS DESIGNED FOR THE HANDLING OF SQUARE, RECTANGULAR AND I-BEAM SECTIONS. IT MUST NOT BE USED FOR ANY OTHER PURPOSE.

THE USE OF THE SM15-01 STEEL MANIPULATOR FOR ANY OTHER PURPOSE MAY LEAD TO SEVERE INJURY TO PERSONS AND DAMAGE TO THE DEVICE.

## WARNING

ONLY TRAINED AND COMPETENT OPERATORS SHOULD USE THE SM15-01 STEEL MANIPULATOR DO NOT ATTEMPT TO USE THE SM15-01 STEEL MANIPULATOR UNTIL YOU HAVE READ AND UNDERSTOOD THIS OPERATORS' MANUAL.

ALWAYS COMPLETE THE DAILY CHECKS AND MAINTENANCE BEFORE USING THE SM15-01 STEEL MANIPULATOR

*If any part of this Operators' Instruction document is unclear or for any technical advice please contact the manufacturer.*

Manufacturer's contact details can be found on Page 14.

# Contacting the Manufacturer

*Thomson Engineering Design SM15-01 Steel Manipulators are manufactured in the United Kingdom by:*


***Thomson Engineering Design Ltd***
***Valley Road***
***Cinderford***
***Gloucestershire***
***England***
***GL14 2NZ***

***Tel: +44 (0) 1594 82 66 11***
***Fax: +44 (0) 1594 82 55 60***

***Email: sales@thomsondesignuk.com***


All spare parts, technical, training and sales enquiries should be directed to the manufacturer.

Please note that outside normal business hours all calls are monitored. Queries will be dealt with as soon as an on-call manager becomes free.




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# Certificate of Conformity

WE:

THOMSON ENGINEERING DESIGN LTD
Valley Road
Cinderford
Gloucestershire
GL14 2NZ

Declare under our sole responsibility that the product known as:

## SM15-01 STEEL MANIPULATOR

To which this declaration relates is in conformity with the following standards:

## 2006/42/EC

Authorised signatory:

David Thomson BSc CEng MIMechE
Oct 2015

# Ordering Spare Parts

*All spare parts for the Thomson SM15-01 Steel Manipulators are available from the manufacturer and through our agents.*

Parts may be ordered by giving the device serial number (from the manufacturer's plate affixed to the frame) and the part number/description from the parts lists in the following pages.



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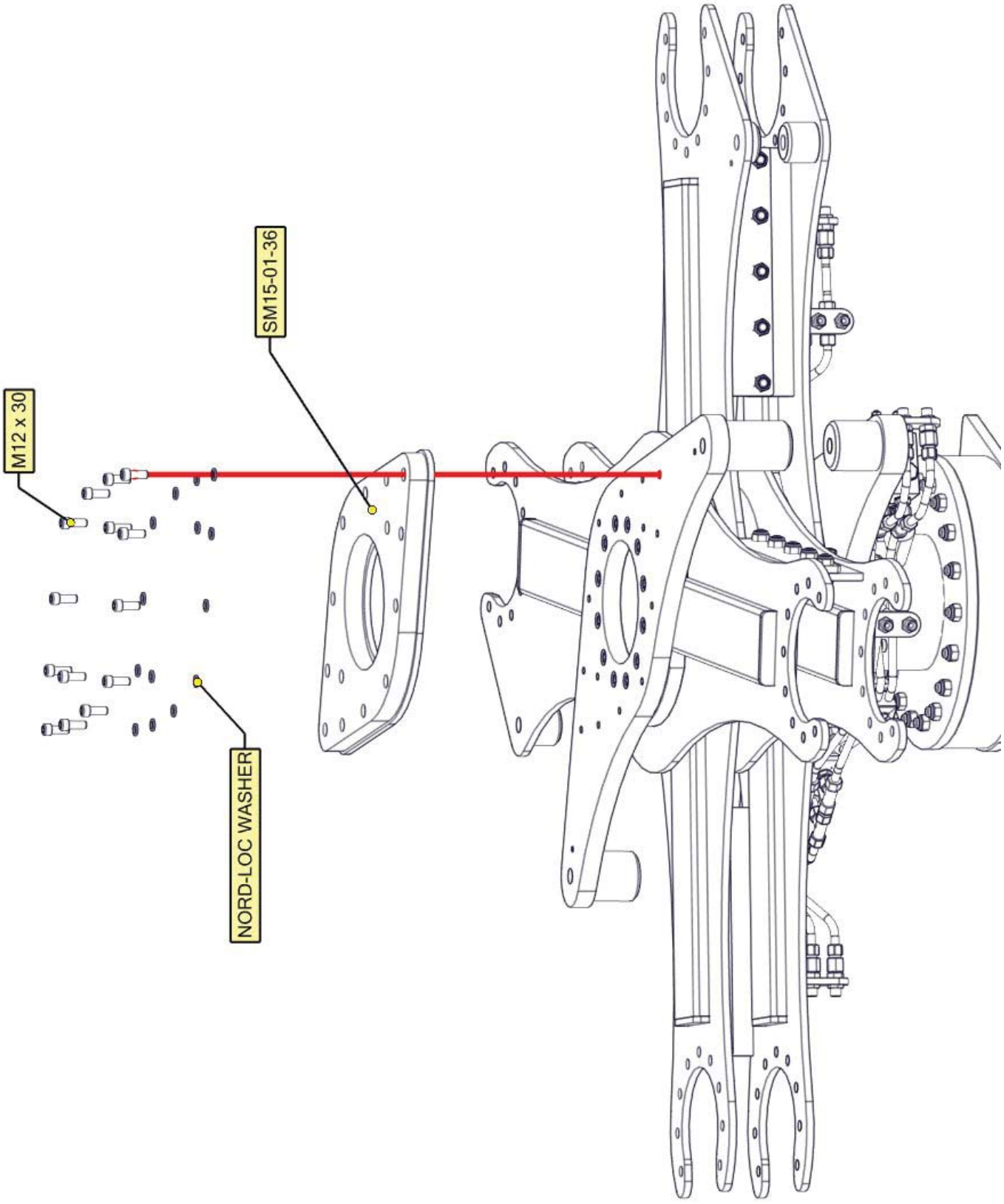
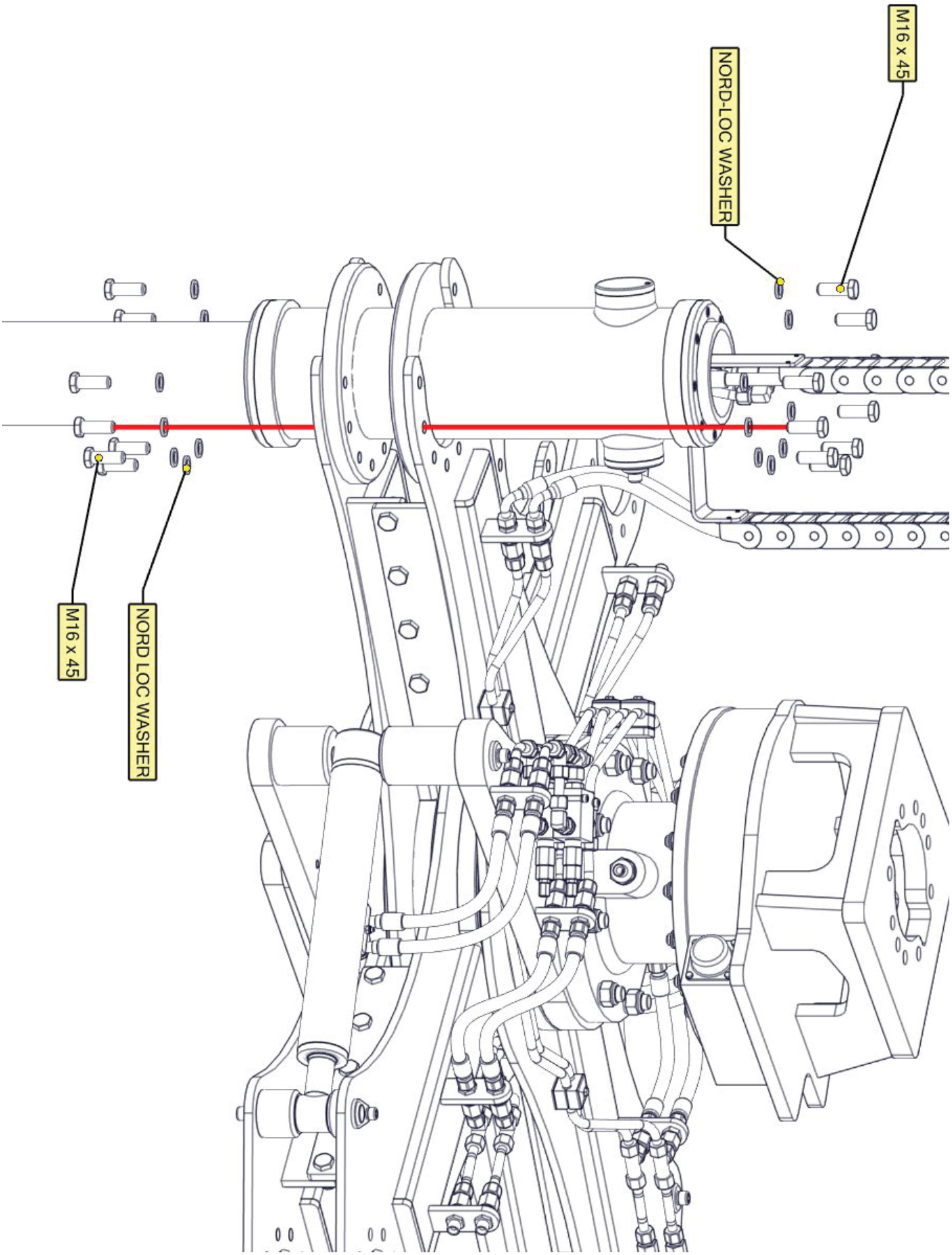
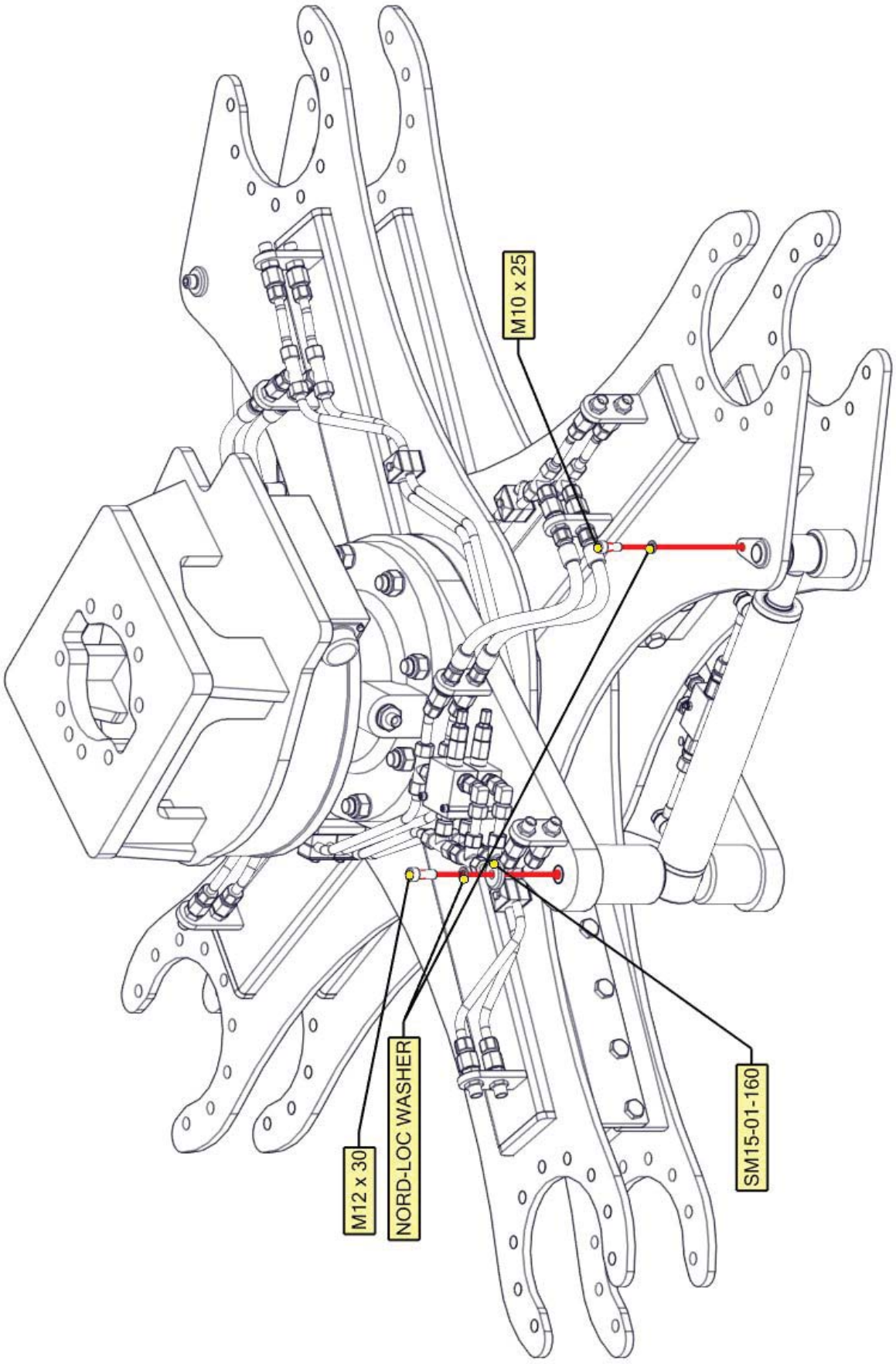
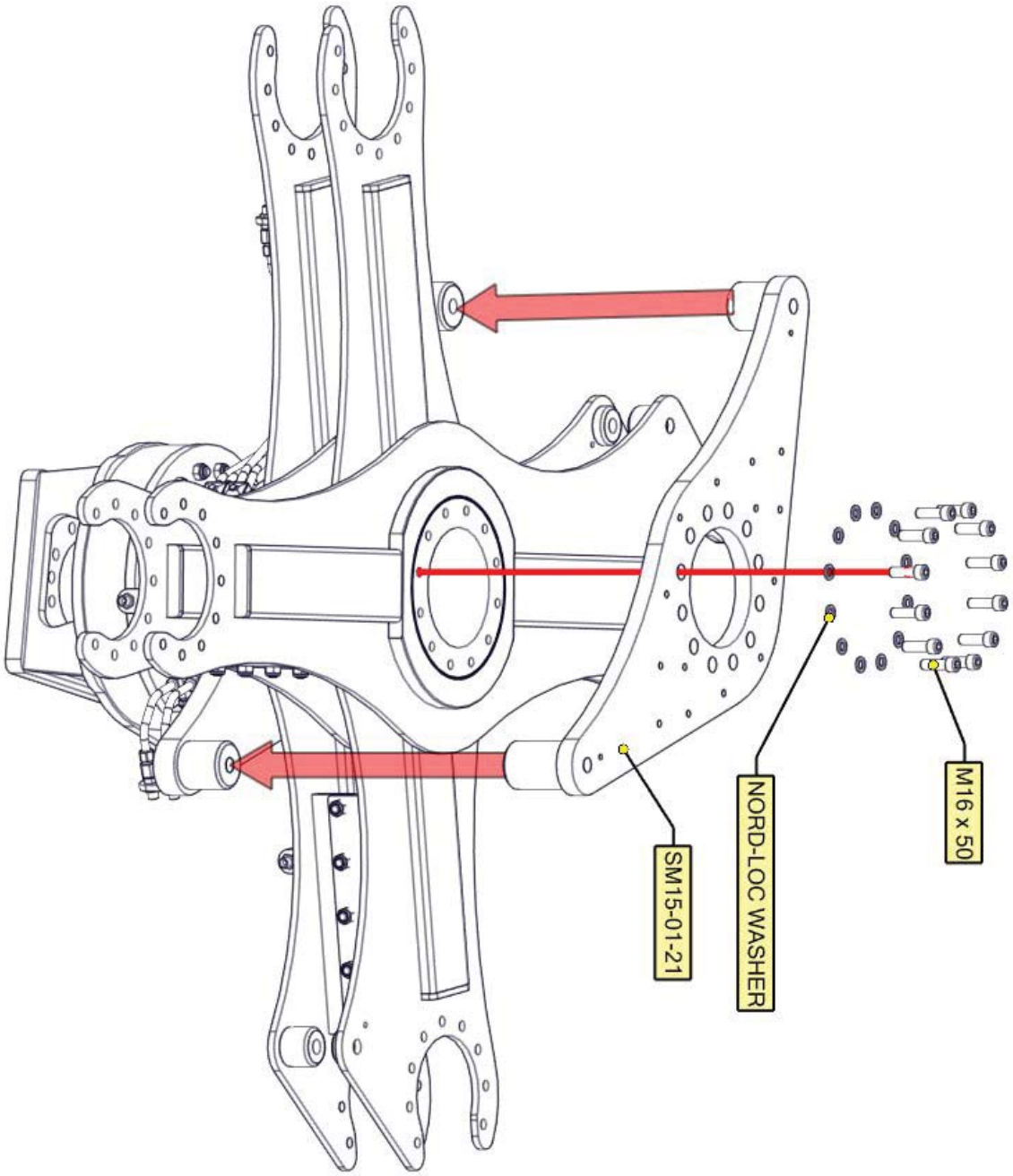
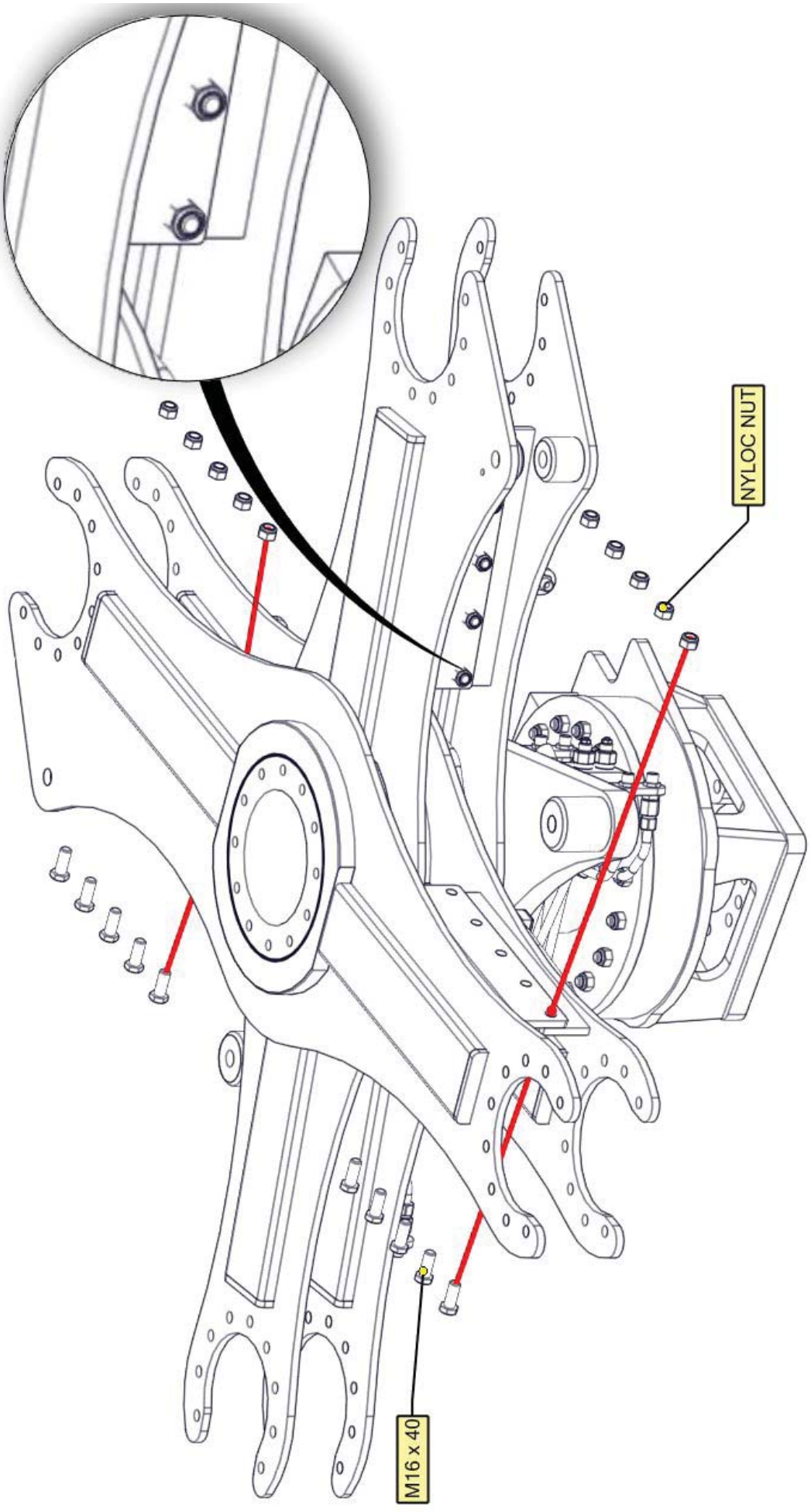
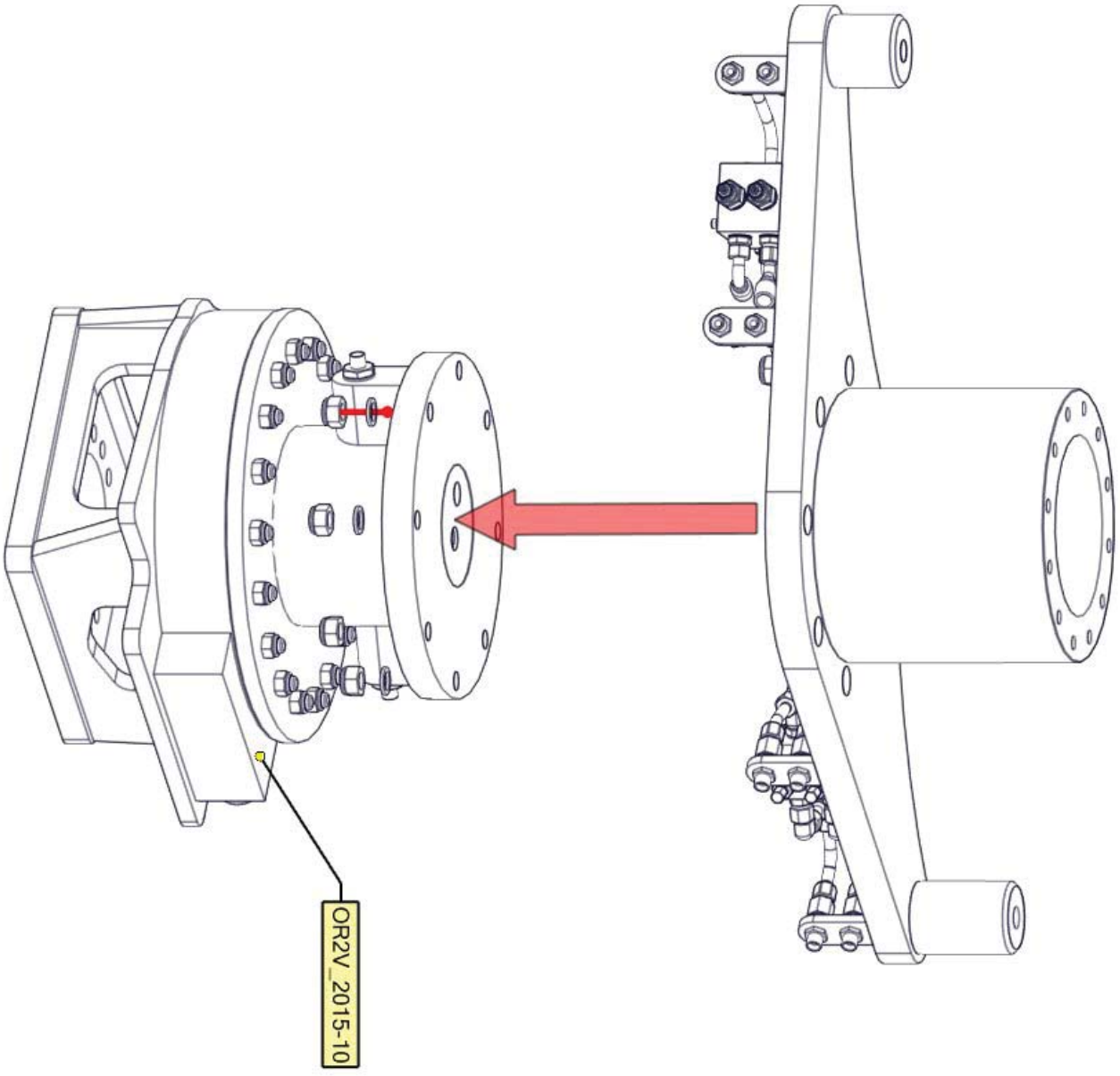


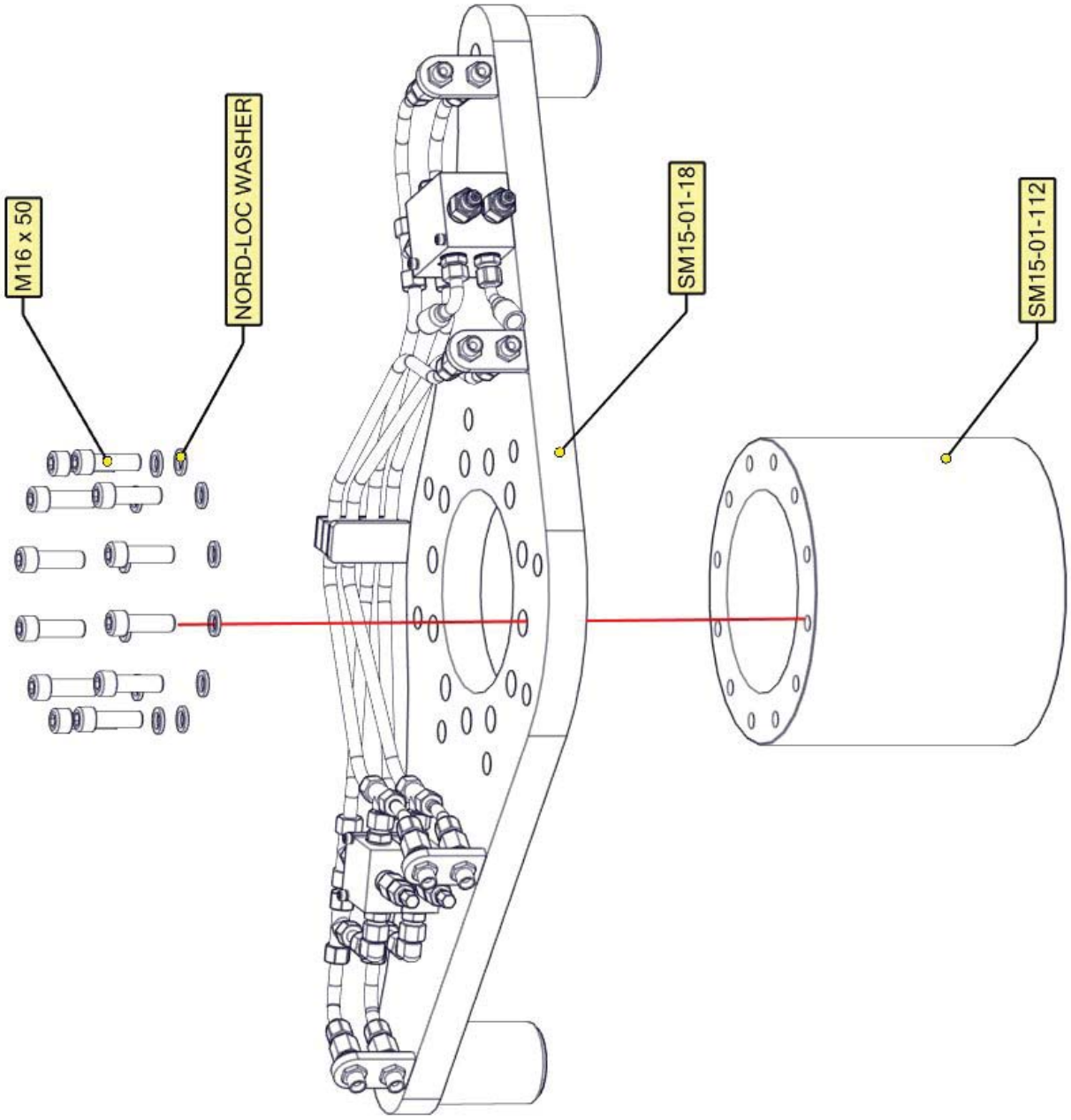


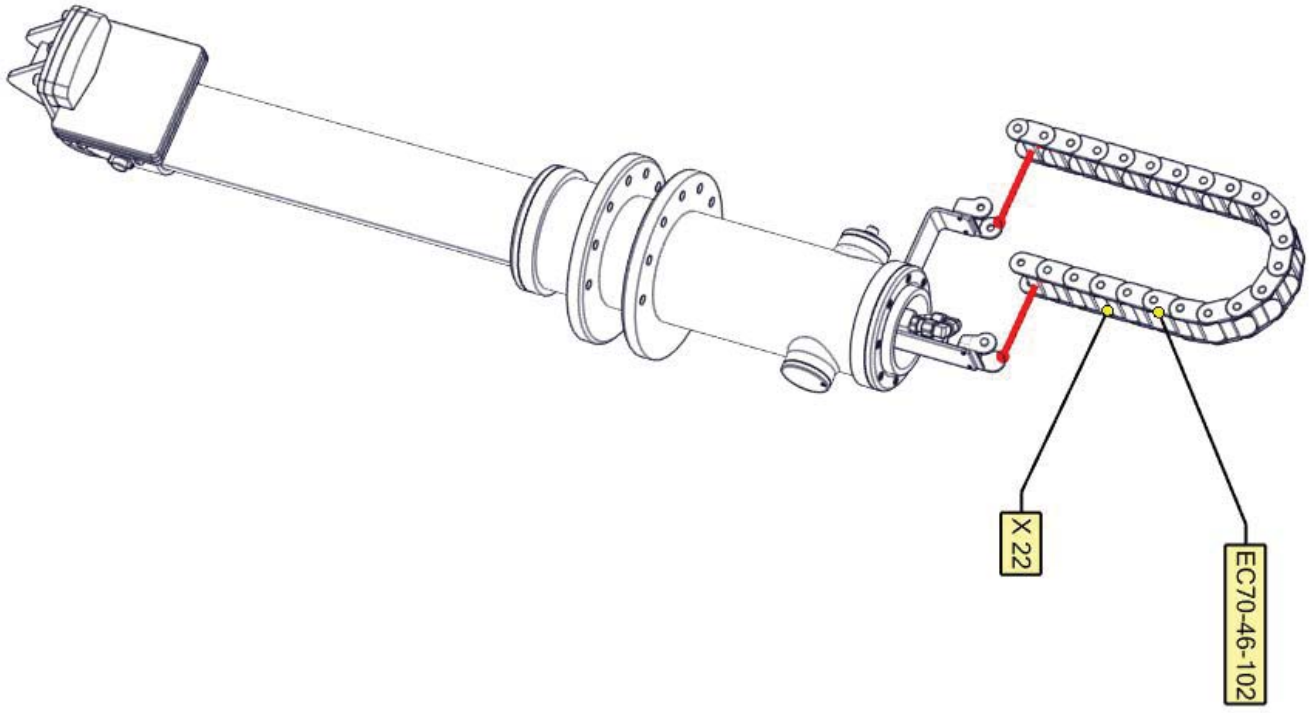


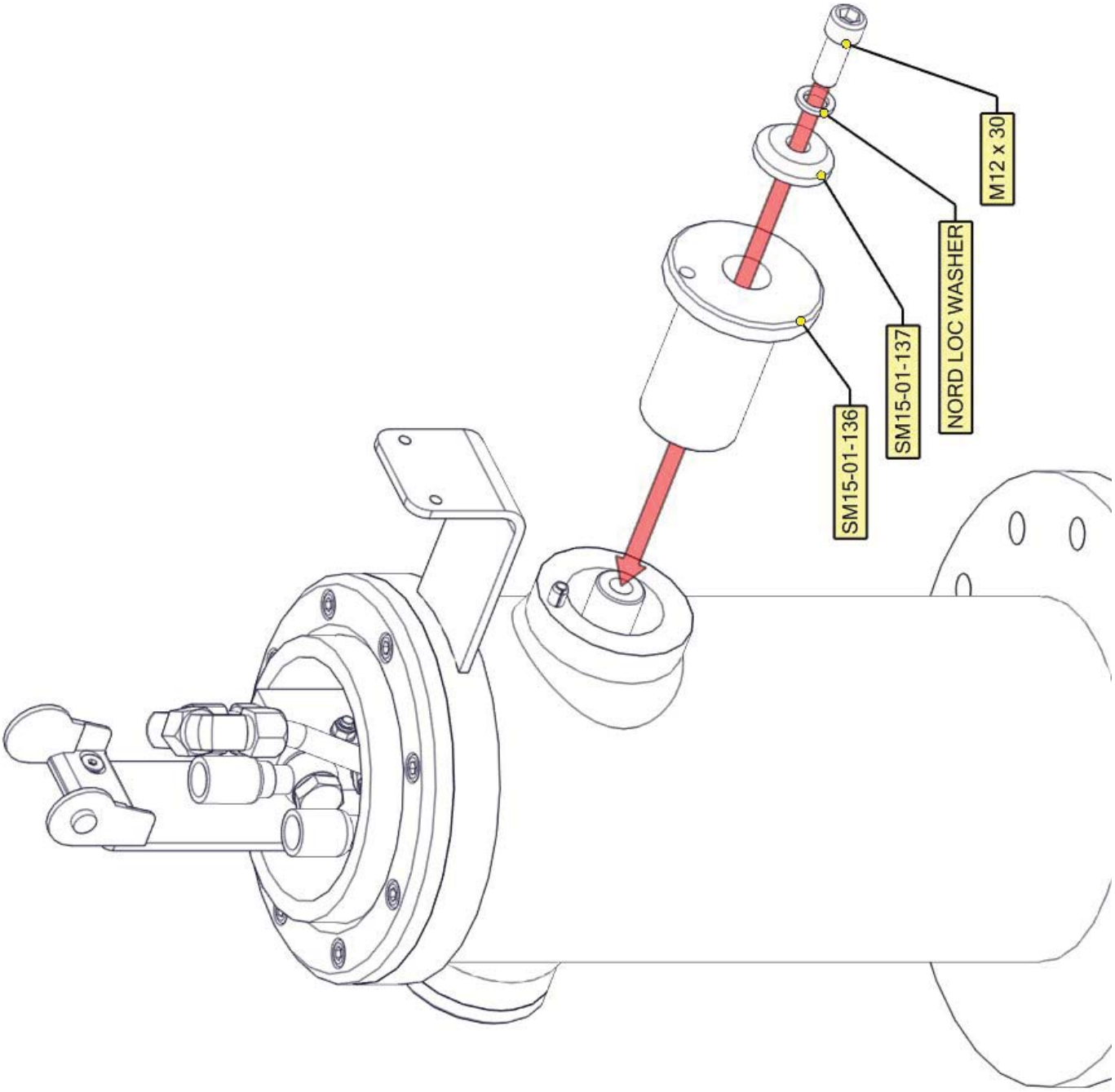


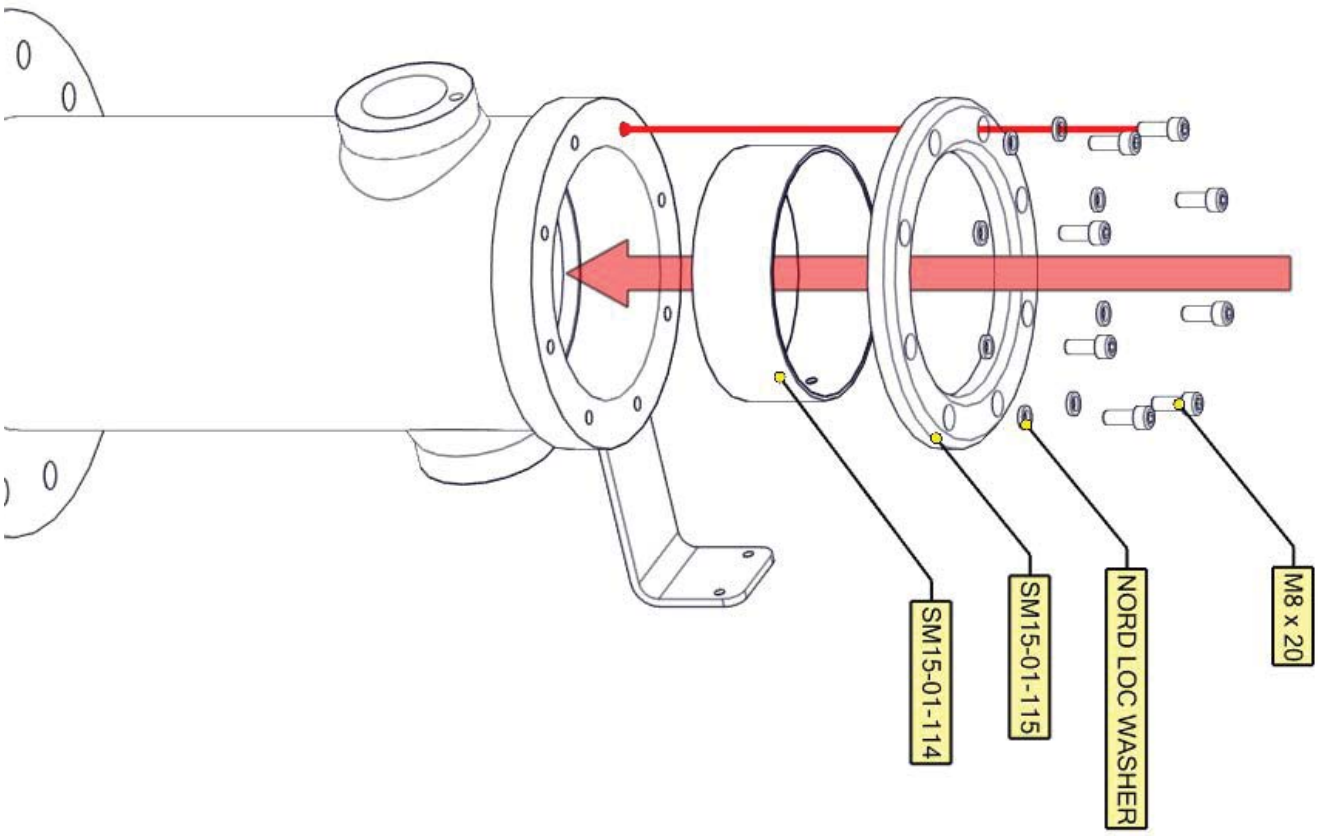


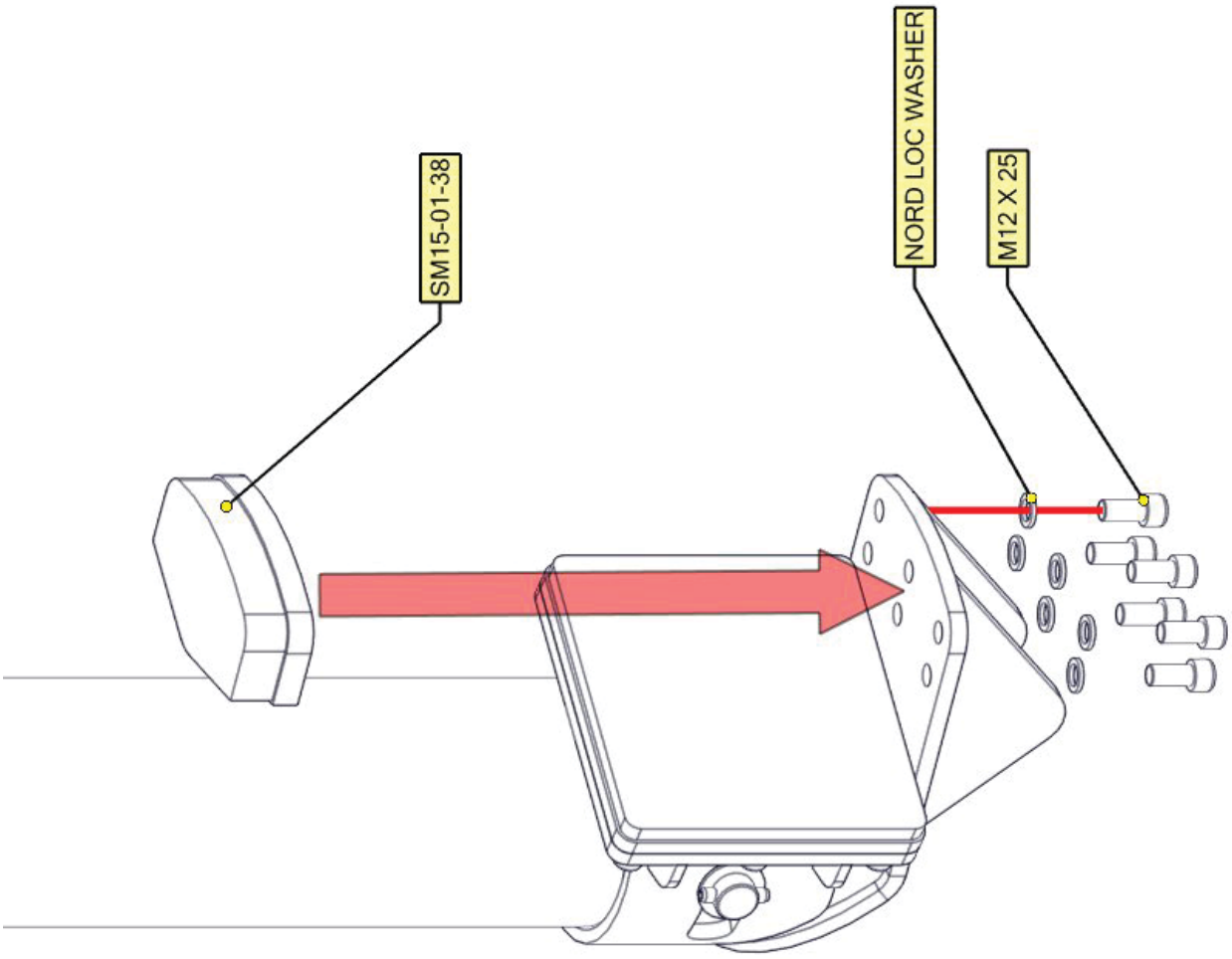


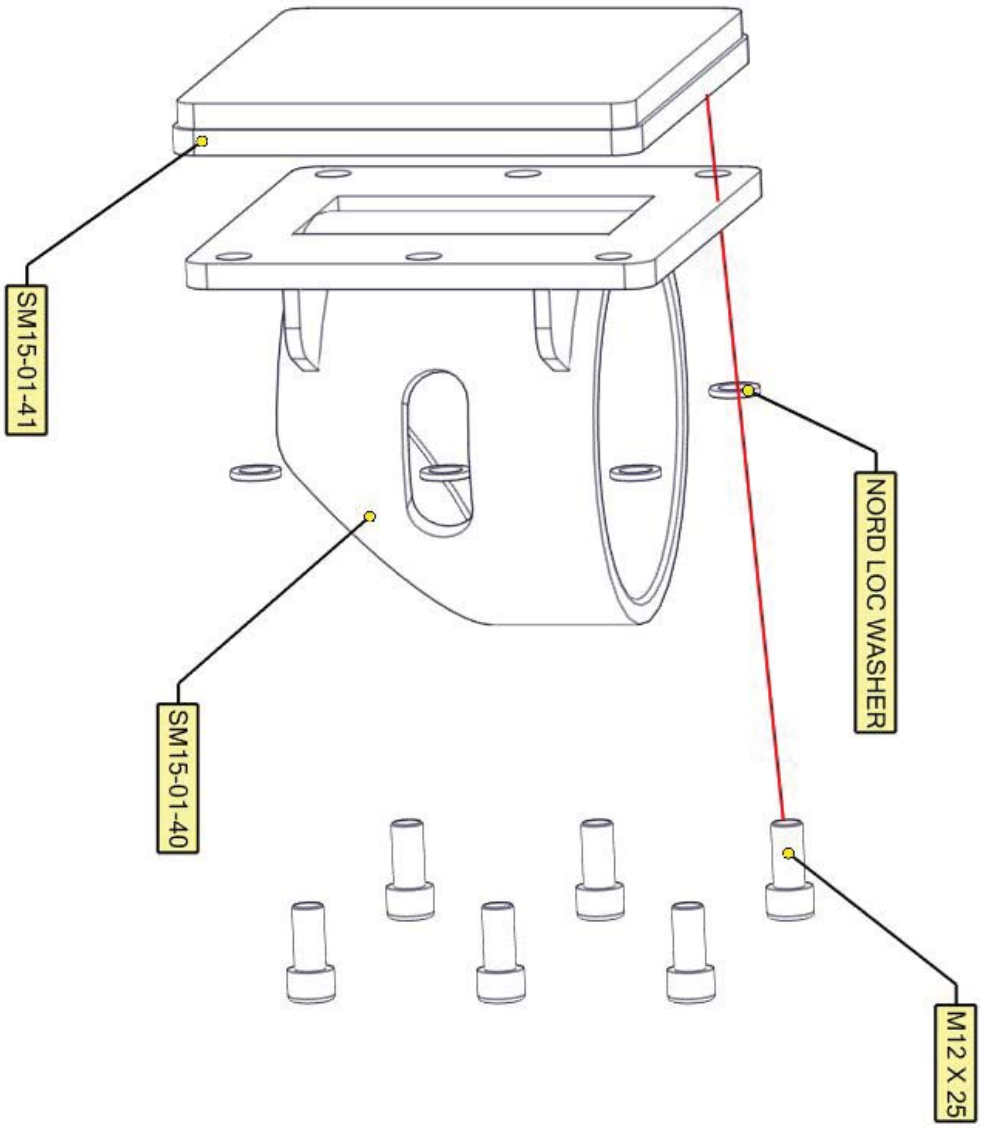


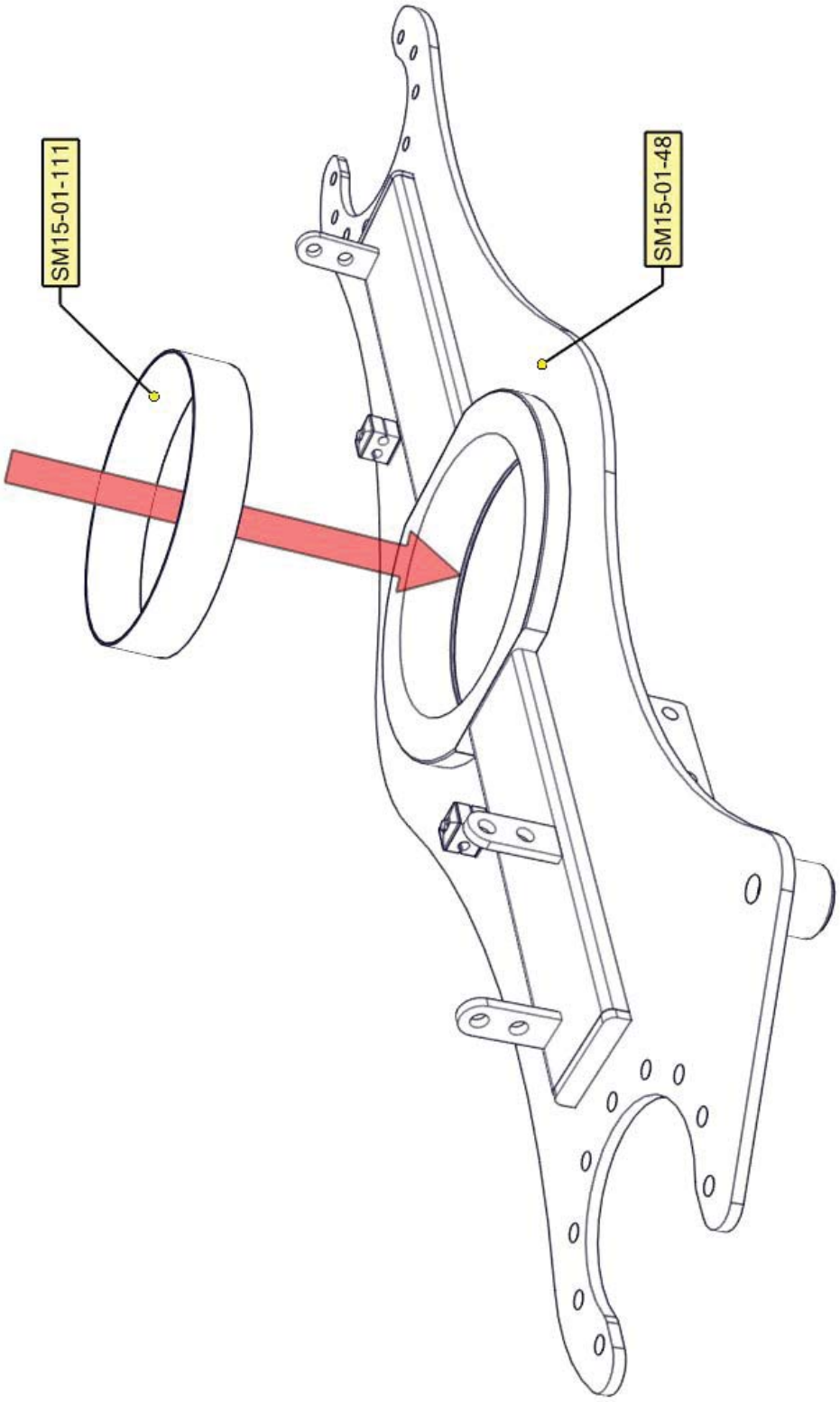


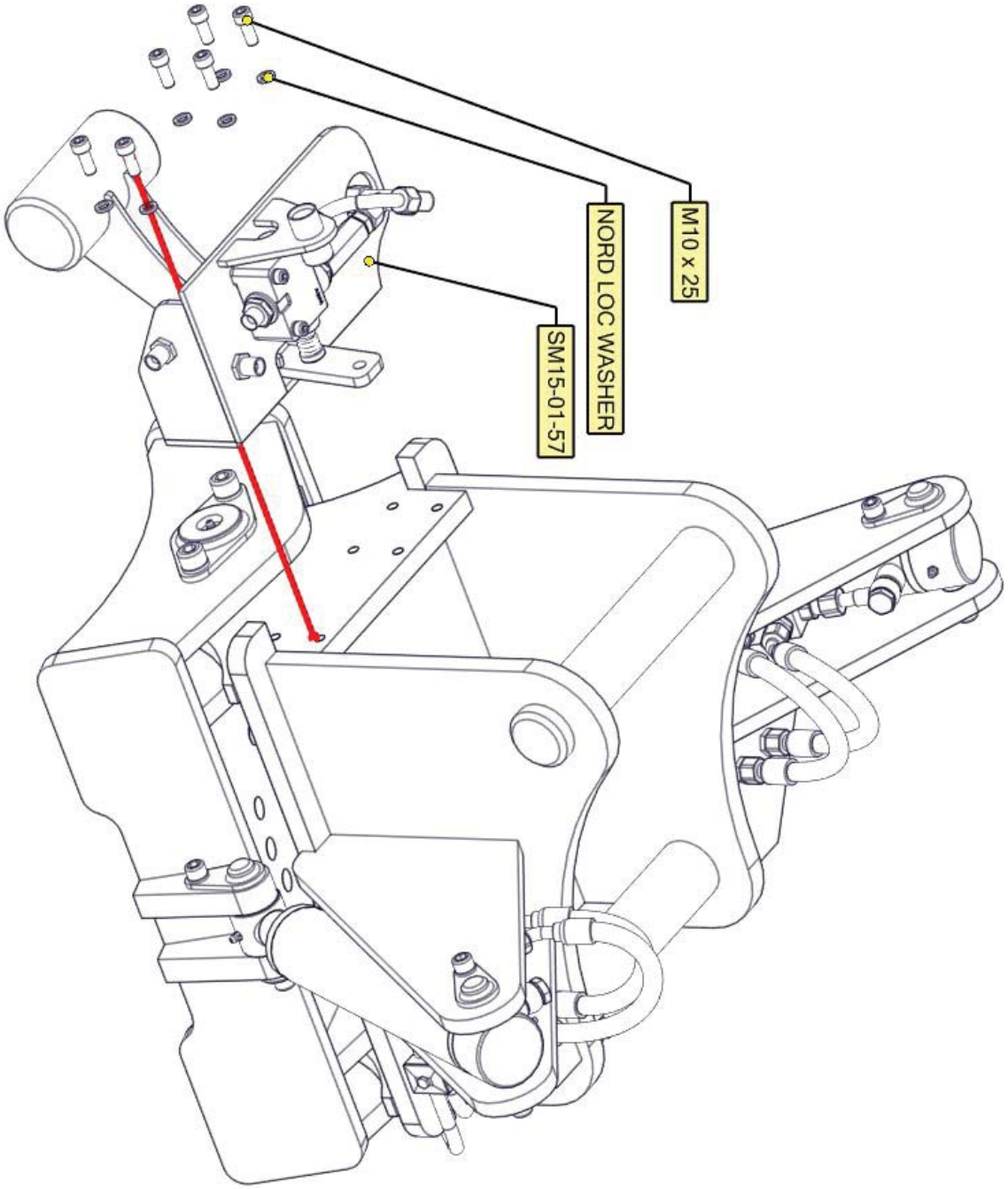


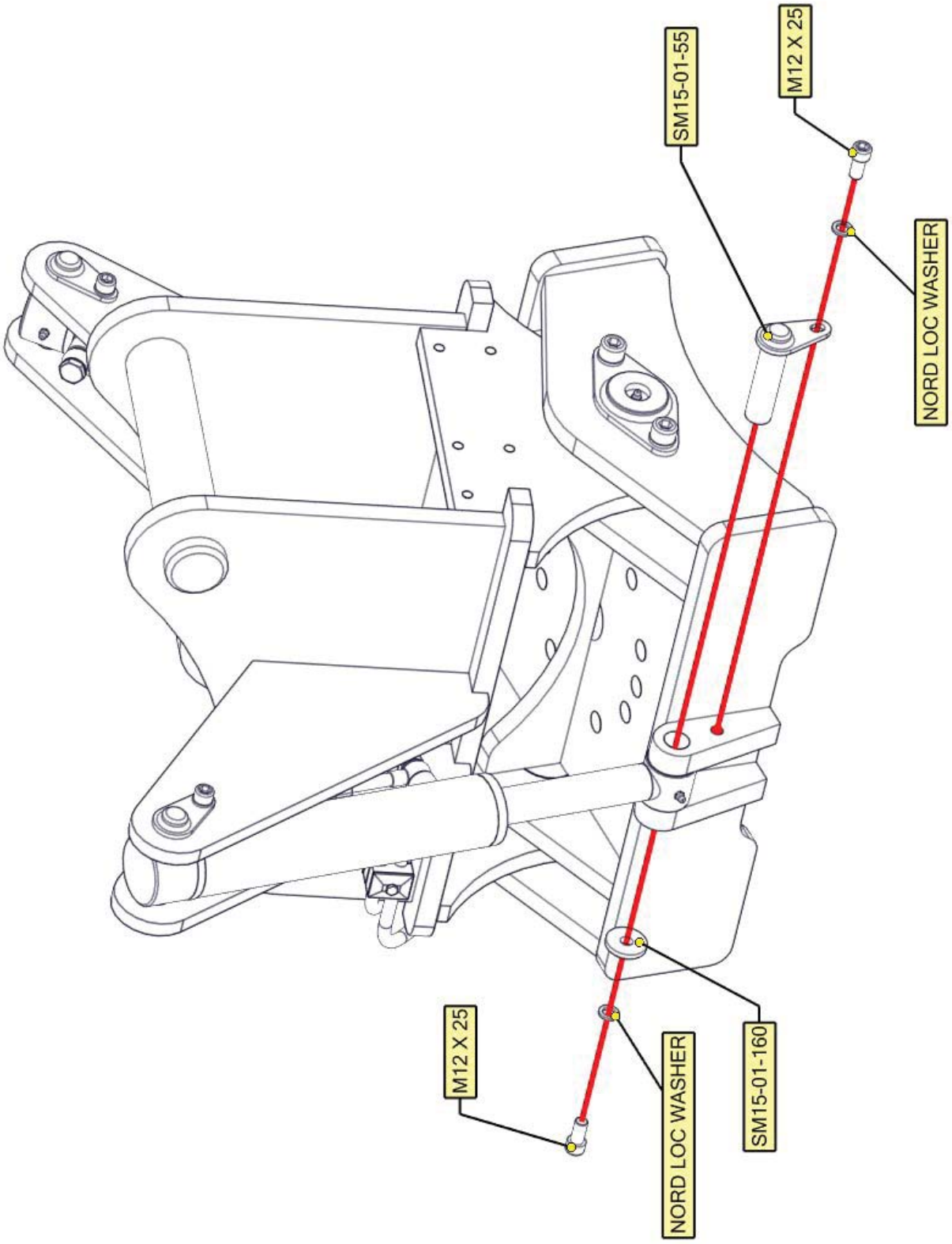


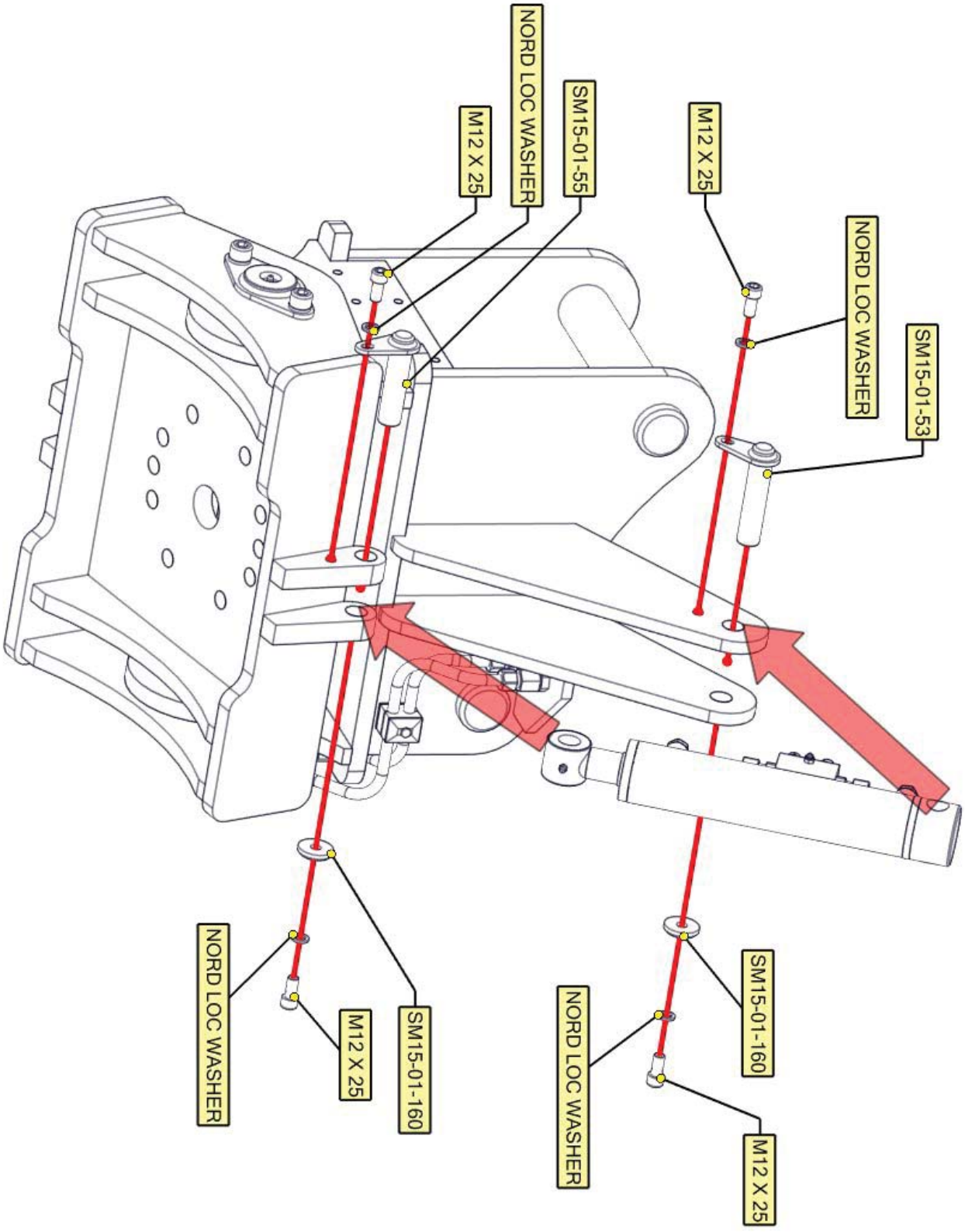


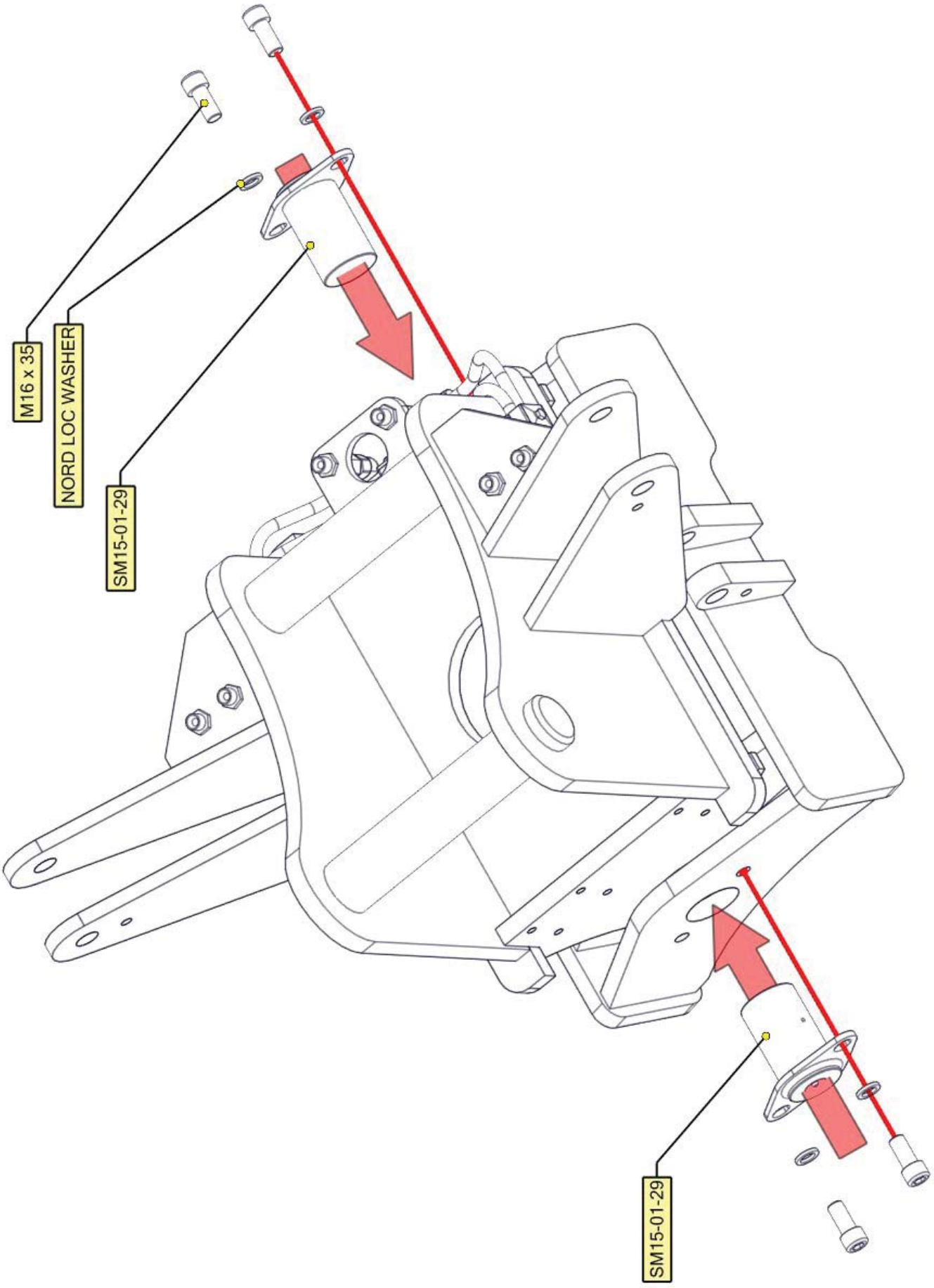


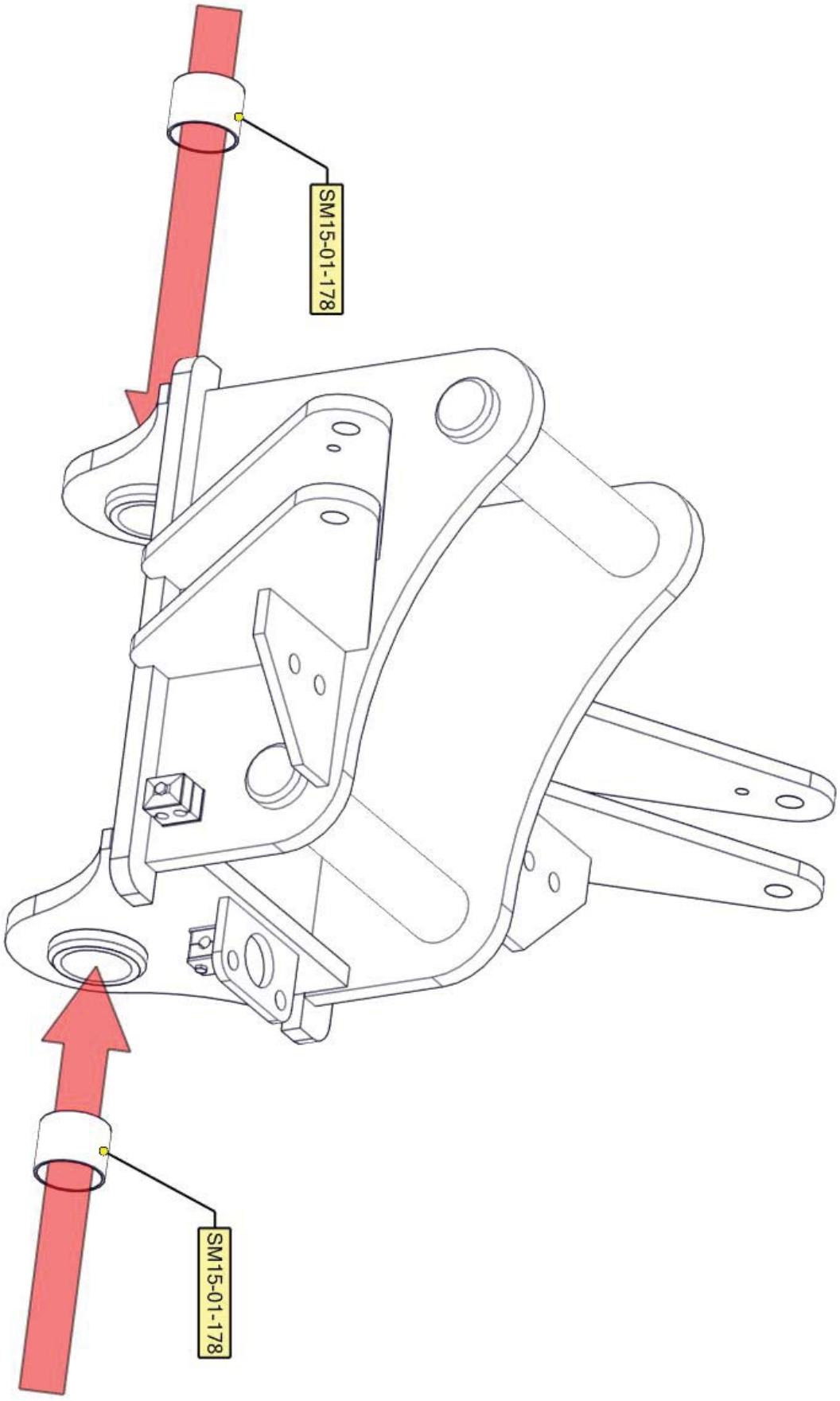


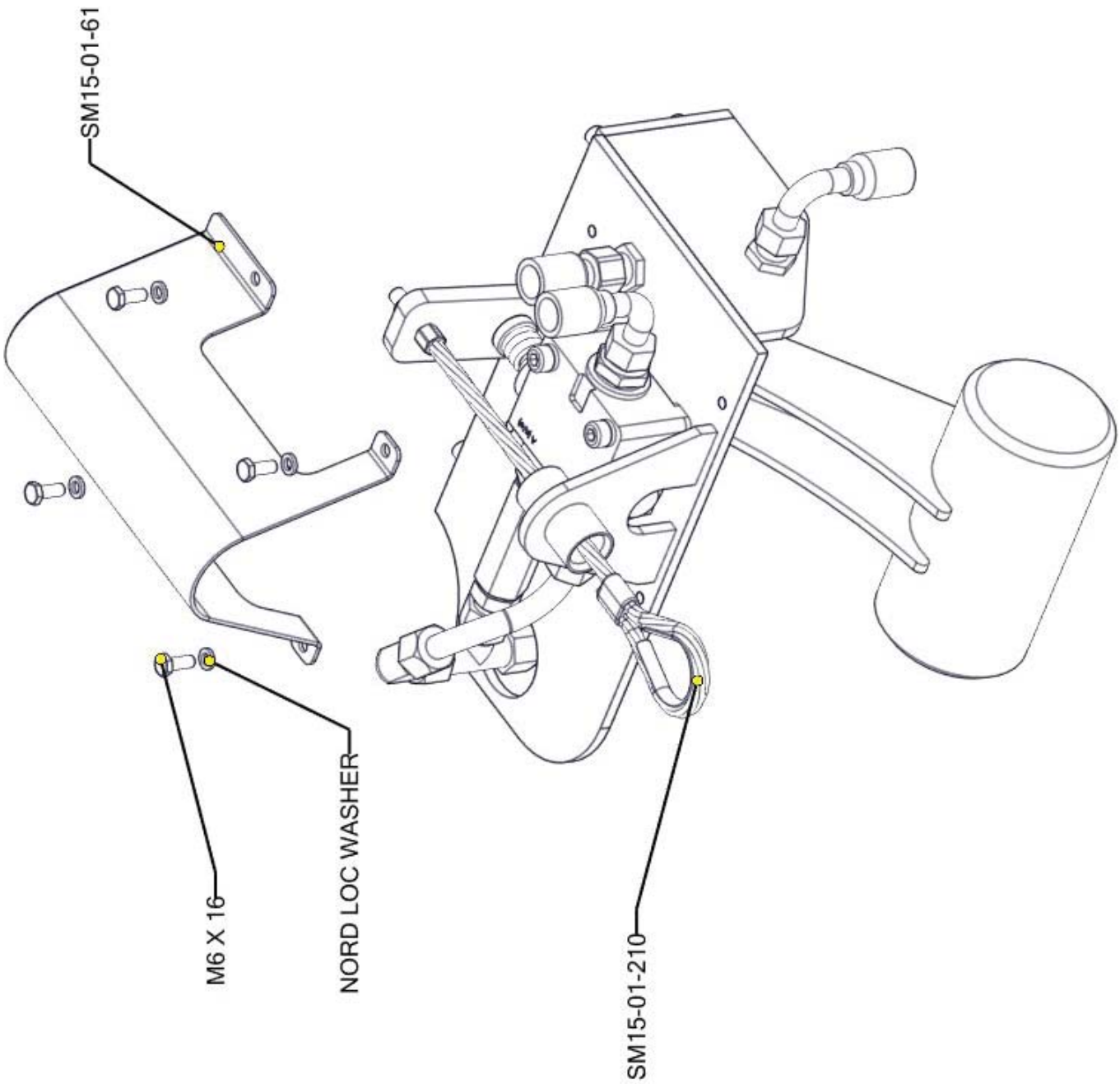


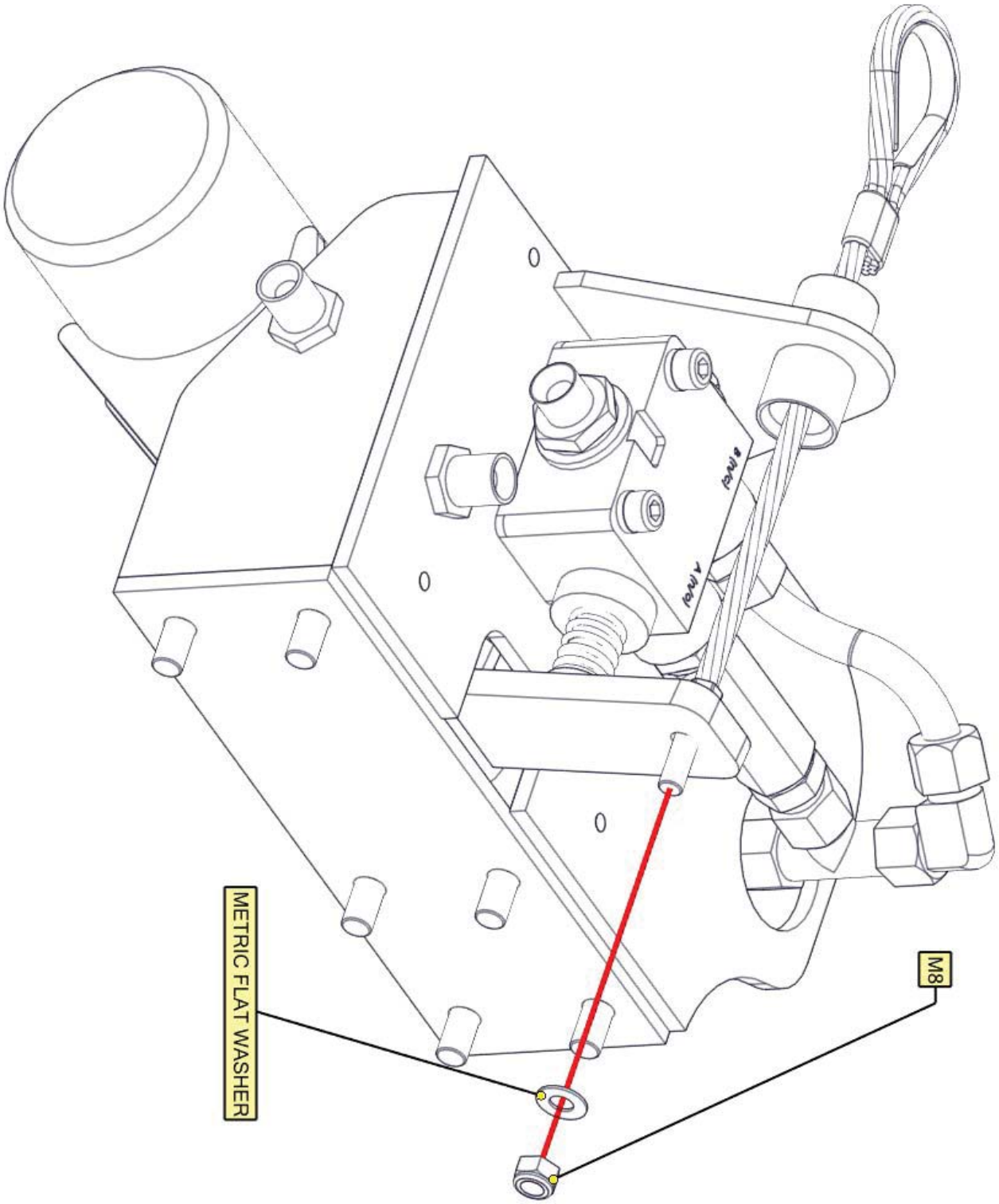


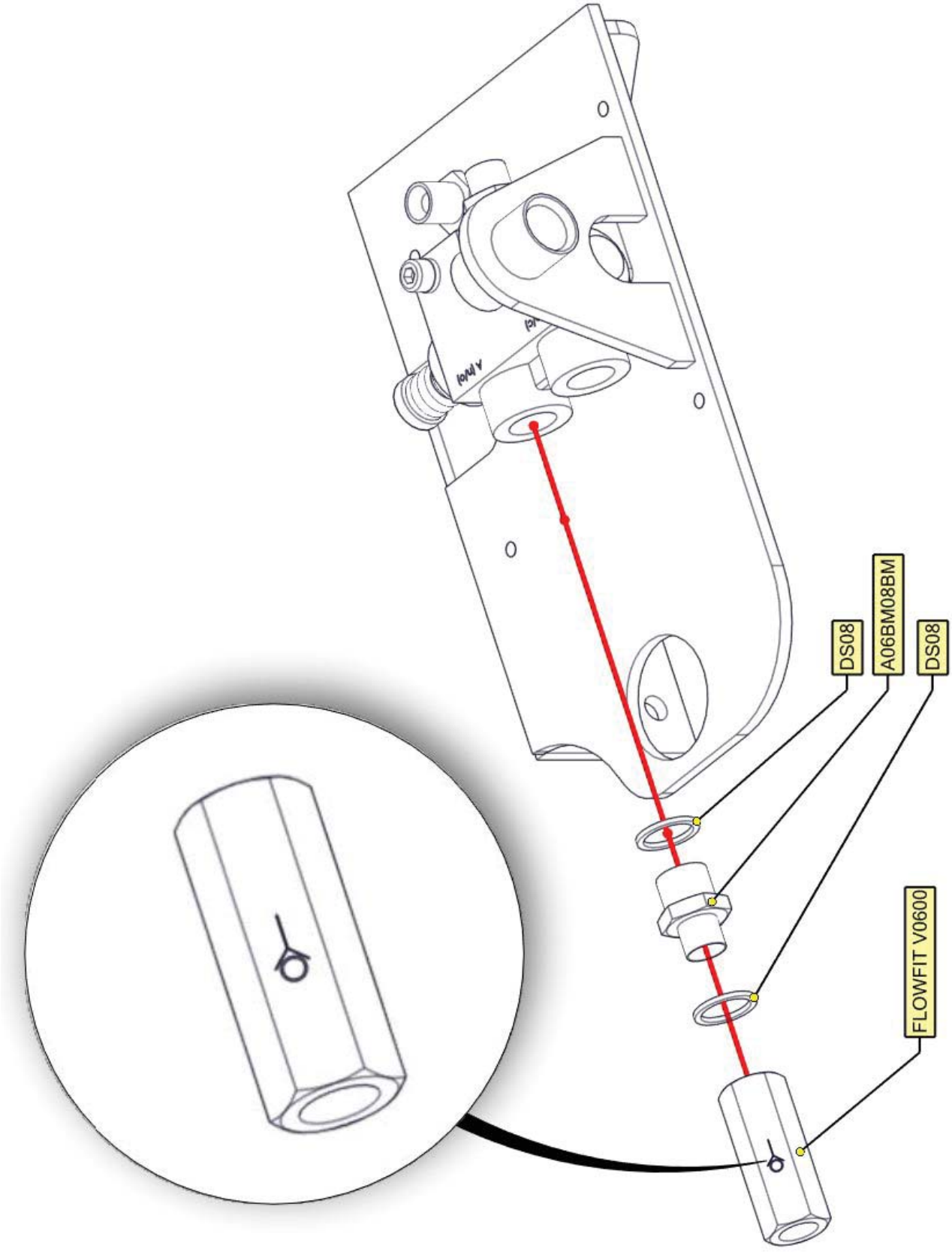




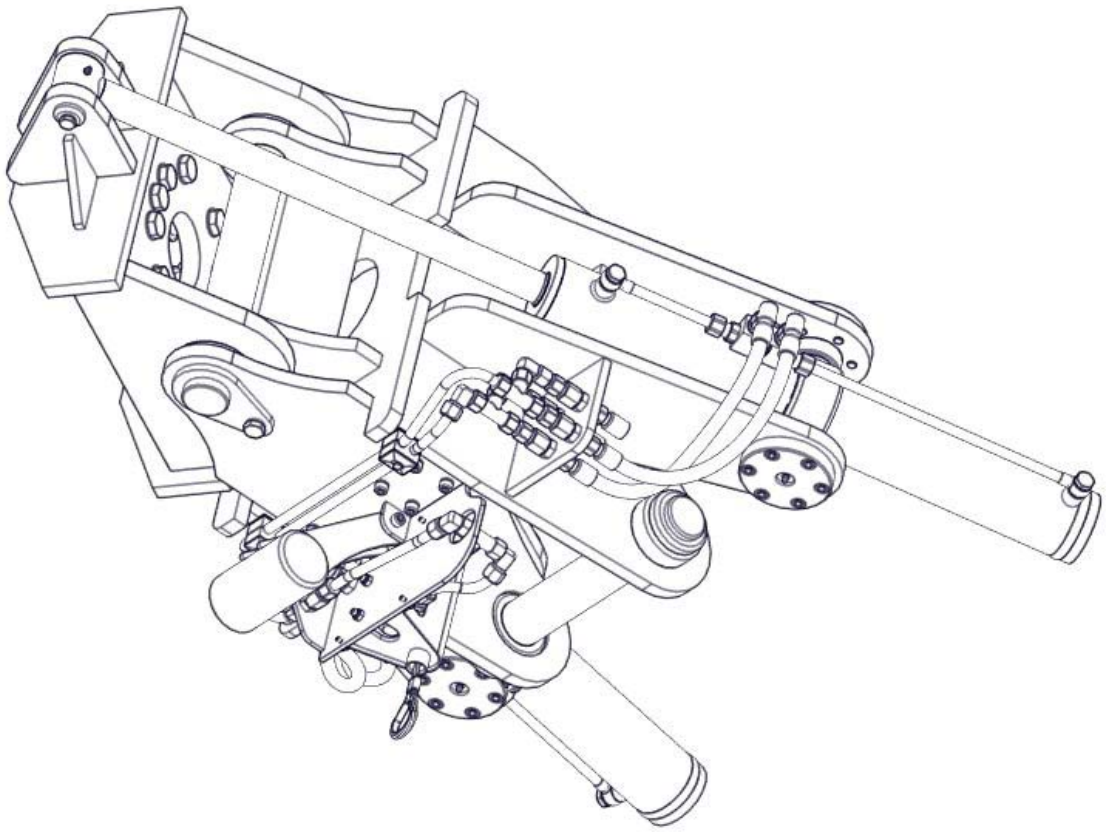








# 60 Degree Tilt Adapter Head





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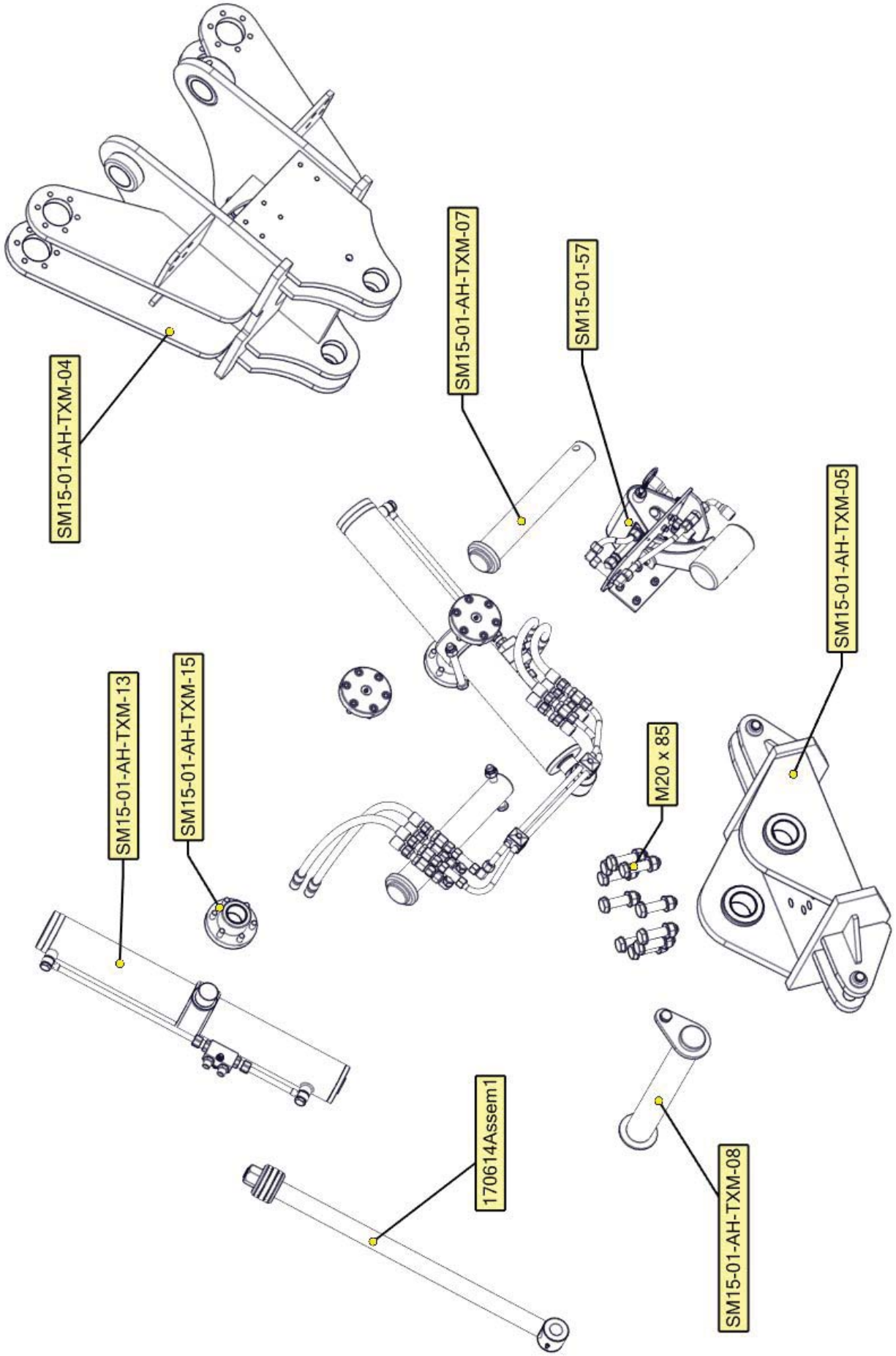

Thomson Engineering Design Ltd.  Valley Road, Cinderford, Gloucestershire.  GL14 2NZ
Tel: +44 (0) 1594 82 66 11 Fax: +44 (0) 1594 82 55 60 Email: sales@thomsondesignuk.com