EN

# T40140

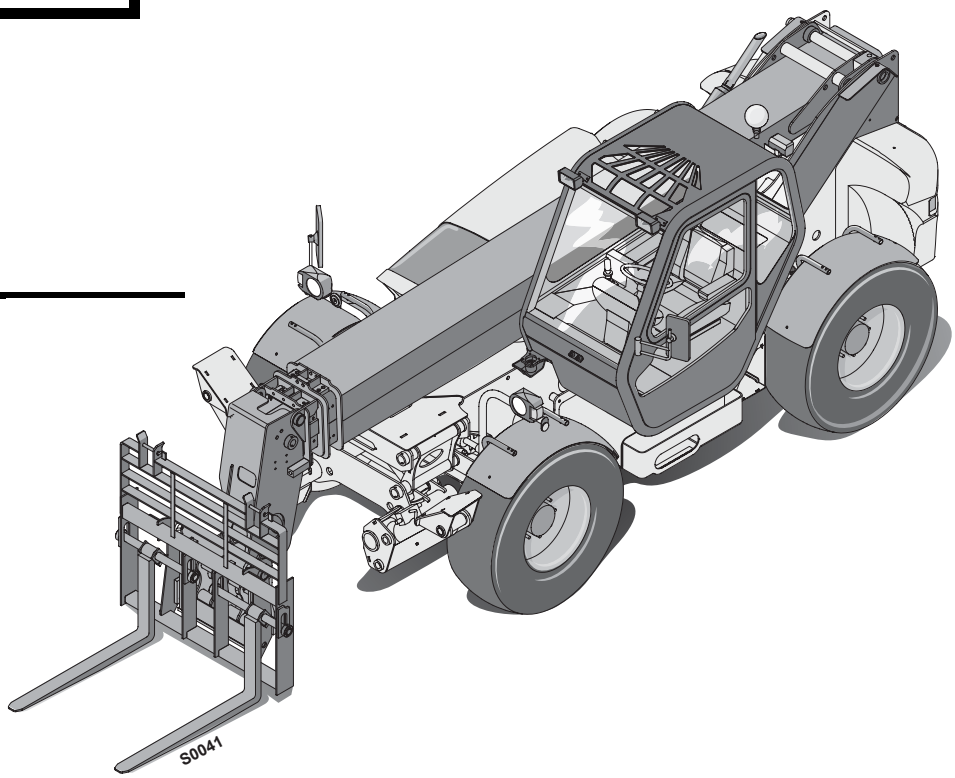
**S/N 3603 12001 & above**

# T40170

**S/N 3609 12001 & above**

Bobcat®

# Service Manual - V2 Boom




6852045ENa (08-03)

# CONTENTS

**IMPORTANT**

**This document provides specific information for the new version of the T40140 and T40170 telescopic handlers. Read this document for a better understanding of the advantages this version has over previous versions of telescopic handlers.**

# NEW BOOM

## Introduction

The principal change that characterises both new machines is the design and construction of a new boom. It is simple but heavy-duty for machines in the 14-17 meter category.

The new boom uses the most advanced technology on the market.

The simple, modern design integrates a new technology with the following features:

- Compensation cylinder.
- Reduced weight of booms.
- 78% less pressure on the pads.
- 100% increase of pad / boom contact surface area.
- Simplified maintenance
- A counter jib allowing the boom to be horizontal under full load.
- Change of location of the electric enclosure of the boom tip.

***Figure 1***


## Stronger boom

### Material

A high elastic limit (HEL) steel is used to build the new generation boom, resulting in a 28% increase in strength compared to the previous version.

- V1 strength: 36 kg/ mm²
- V2 strength: 50 kg/ mm²

### Counter jib

A counter jib was created to keep the boom perfectly horizontal when fully extended under load, to avoid the "fishing pole" effect. This technique is used in crane construction.

***Figure 2***

## New boom design

This new boom was created to simplify all maintenance operations as well as exceptional operations, such as removing the telescoping cylinder or hydraulic hoses.

The inside of the boom is broken down into two independent, removable subassemblies:

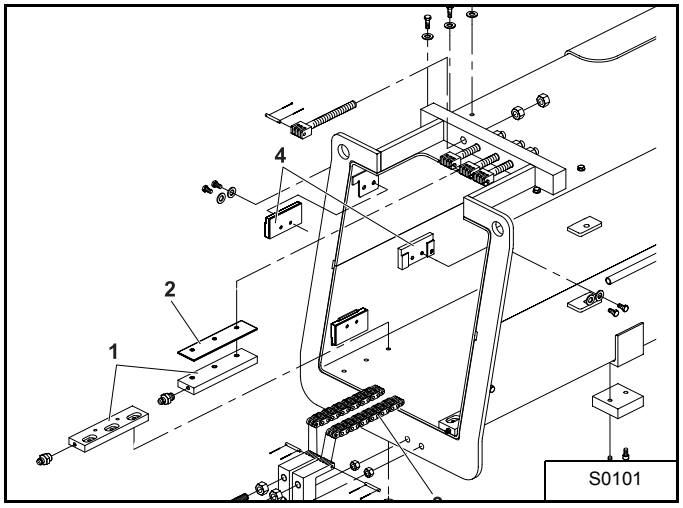
- The telescoping cylinder (right).
- The cassette (left).

As viewed from the back of the machine.

### Different components of the boom

***Front part of element 1***

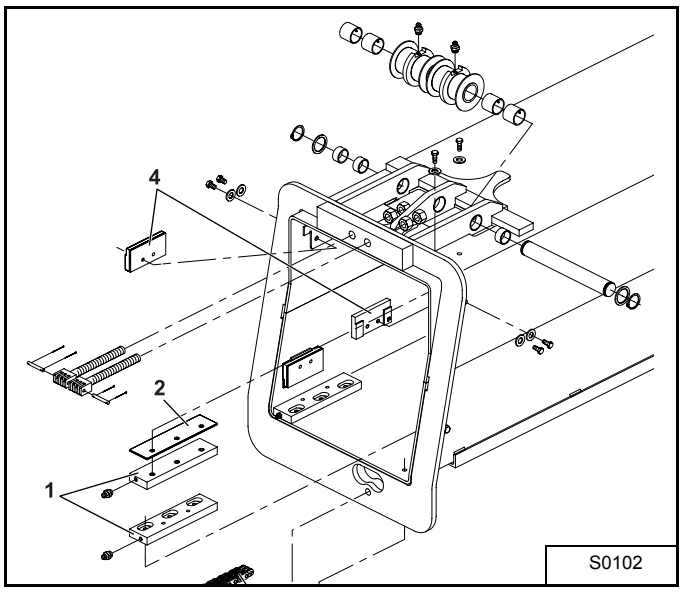
***Figure 3***




| Ref. | Description |
|---|---|
| 1 | Upper and lower pads<br>• Quantity = 4<br>• Do not insert adjusting shims with the lower pads.<br>• Reduce play by inserting shims only with the upper pads. |
| 2 | Adjusting shims |
| 3 | Boom retracting chains<br>• Connected to element 1 and element 3. |
| 4 | Side pads<br>• Quantity = 4, two of which are 13mm.<br>• Install 13mm thick pads on the left side of the caisson and adjust with pads of appropriate thickness to limit the play. |

***Front part of element 2***

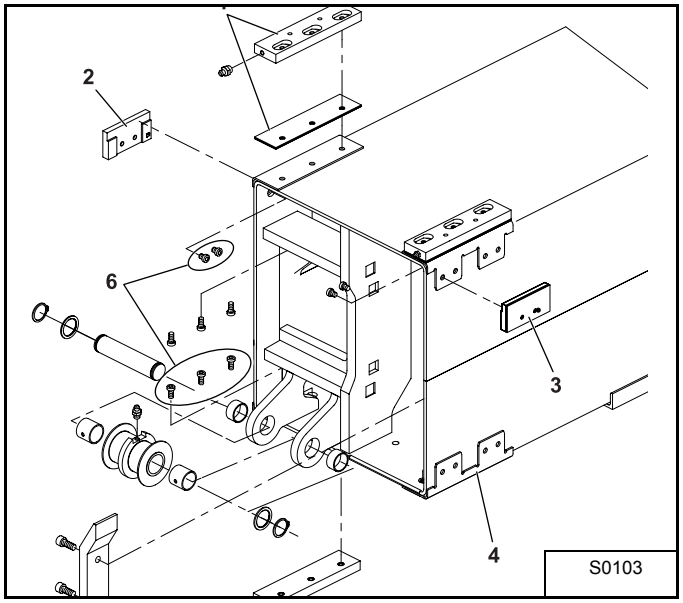
***Figure 4***




| Ref. | Description |
|---|---|
| 1 | Upper and lower pads<br>• Quantity = 4<br>• Do not insert adjusting shims with the lower pads.<br>• Reduce play by inserting shims only with the upper pads. |
| 2 | Adjusting shims |
| 3 | Boom retracting chain<br>• Connecting element 2 and element 4. |
| 4 | Side pads<br>• Quantity = 4, two of which are 13mm.<br>• Install 13mm thick pads on the left side of the caisson and adjust with pads of appropriate thickness to limit the play. |
| 5 | Chain rollers for boom extension<br>• Chains connecting element 1 to element 3. |

***Rear part of element 2***

***Figure 5***




| Ref. | Description |
|---|---|
| 1 | Side pads<br>• Quantity = 2, one of which is 13mm.<br>• Install the 13mm thick pad on the left side of the caisson and adjust to the right with a pad of appropriate thickness to limit the play. |
| 2 | Upper pads.<br>• Compensate for play by inserting shims between the upper pads and the caisson. |
| 3 | Right side pad |
| 4 | No shimming on the lower side parts for all elements. |
| 5 | Lower pads<br>• Do not insert adjusting shims. |

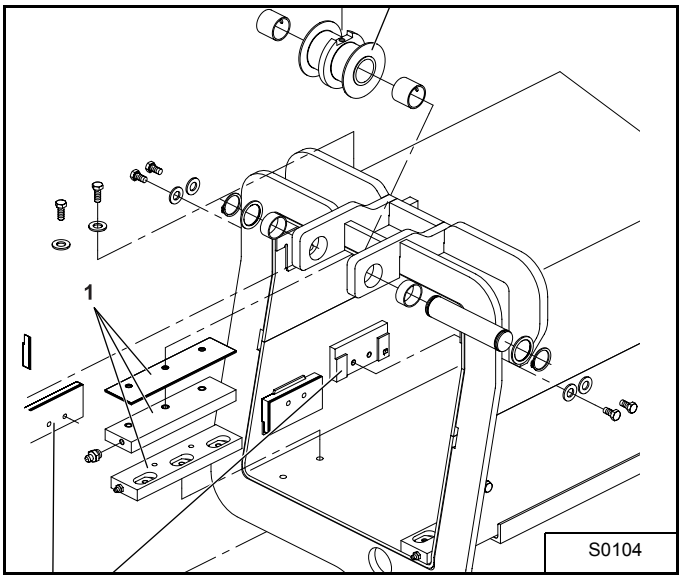
**⚠ WARNING**

**Some (6) retaining screws (Allen) are specific: the height of the head is lower (screws for side pads and for upper and lower pads).**

**Make sure to put them back in the right place.**

***Front part of element 3***

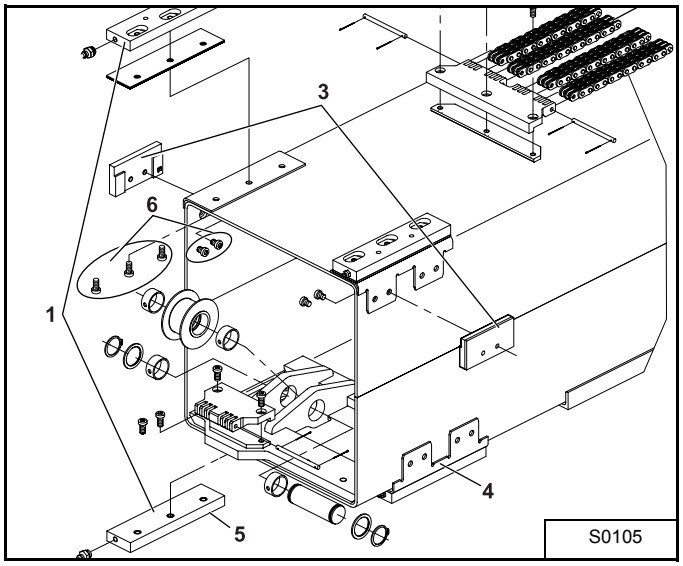
***Figure 6***




| Ref. | Description |
|---|---|
| 1 | Upper and lower pads<br>• Quantity = 4<br>• Do not insert adjusting shims with the lower pads.<br>• Reduce play by inserting shims only with the upper pads. |
| 2 | Chain rollers for boom extension<br>• Chains connecting element 2 to element 4. |
| 3 | Side pads<br>• Quantity = 4, two of which are 13mm.<br>• Install 13mm thick pads on the left side of the caisson and adjust with pads of appropriate thickness to limit the play. |

*Rear part of element 3*

*Figure 7*




| Ref. | Description |
|---|---|
| 1 | Upper and lower pads<br>• Quantity = 4<br>• Do not insert adjusting shims with the lower pads.<br>• Reduce play by inserting shims only with the upper pads. |
| 2 | Extension chains<br>• Connecting element 1 to element 3. |
| 3 | Side pads<br>• Quantity = 2, one of which is 13mm.<br>• Install the 13mm thick pad on the left side of the caisson and adjust to the right with a pad of appropriate thickness to limit the play. |
| 4 | No shimming on the lower side parts for all elements. |
| 5 | Lower pads<br>• Do not insert adjusting shims. |

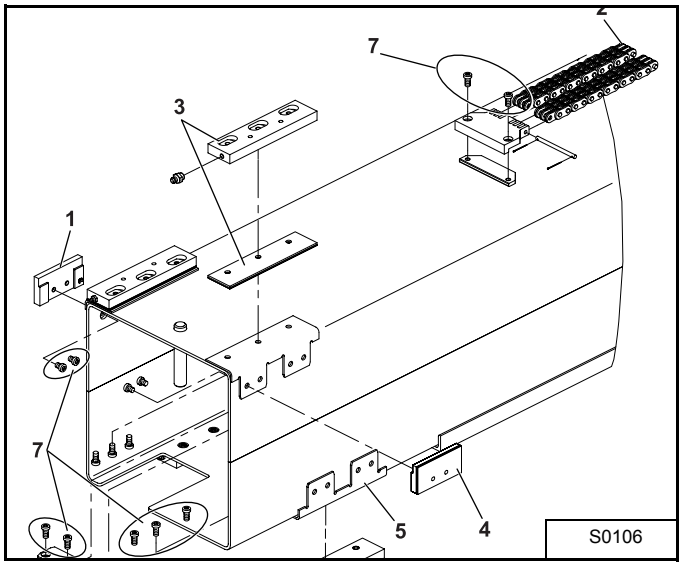
**⚠ WARNING**

**Some (6) retaining screws (Allen) are specific: the height of the head is lower (screws for side pads and for upper and lower pads and securing chains).**

**Make sure to put them back in the right place.**

*Rear part of element 4*

*Figure 8*




| Ref. | Description |
|---|---|
| 1 | Side pads<br>• Quantity = 2, one of which is 13mm.<br>• Install the 13mm thick pad on the left side of the caisson and adjust to the right with a pad of appropriate thickness to limit the play. |
| 2 | Extension chains<br>• Connecting element 2 to element 4. |
| 3 | Upper pads.<br>• Compensate for play by inserting shims between the upper pads and the caisson. |
| 4 | Right side pad |
| 5 | No shimming on the lower side parts for all elements. |
| 6 | Lower pads<br>• Do not insert adjusting shims. |

**⚠ WARNING**

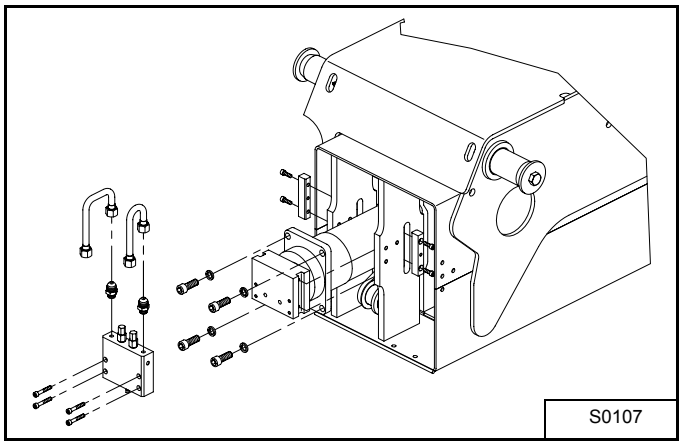
**Some (7) retaining screws (Allen) are specific: the height of the head is lower (screws for side pads and for upper and lower pads and attaching chain hookup).**

**Make sure to put them back in the right place.**

## Telescoping cylinder

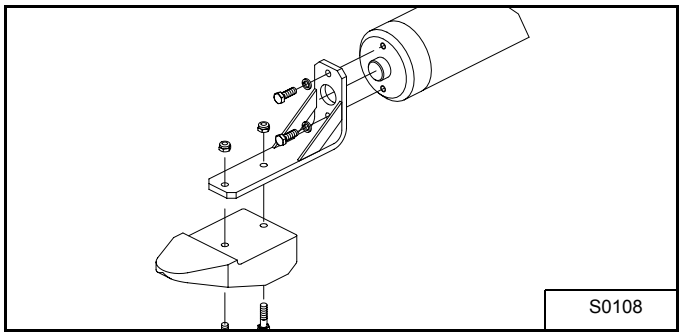
*Rear part of cylinder - attachment to element 1*

***Figure 9***




*Front part of cylinder*

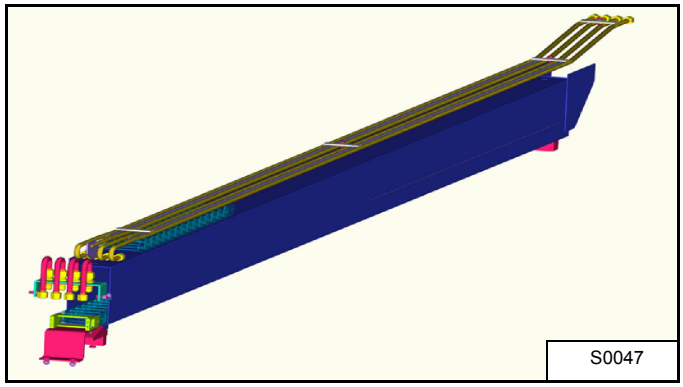
***Figure 10***




## Cassette.

The concept of “cassette” is unique on the market in that it collects together all of the boom's hoses and electrical cables.

***Figure 11***

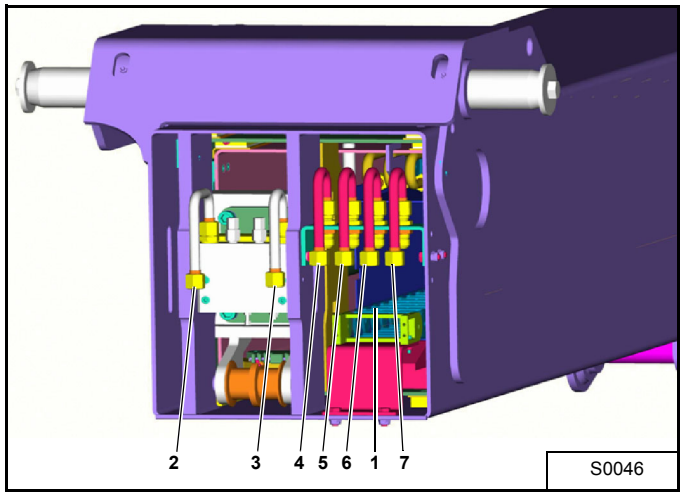



This unique, patented technology avoids having to completely remove the boom during inspections or technical problems. The hoses are simply disconnected at the front and back of the boom and the whole cassette removed. This provides a significant time gain during after-sale service.

Inside this cassette, a separator has been built in to separate:

- the hydraulic function
- the electrical function

***Figure 12***

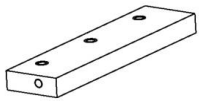
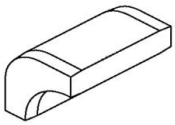



| Ref. | Description |
|---|---|
| 1 | Cassette inside which the chains and hoses turn. |
| 2 | Extend boom |
| 3 | Retract boom |
| 4 | Tilt? |
| 5 | Pitch? |
| 6 | Attachment (male coupling) |
| 7 | Attachment (female coupling) |

## Pads

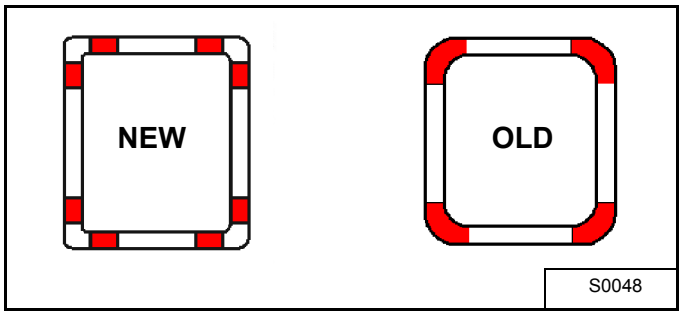
### New concept

The new pads have been simplified. The total support surface has been quadrupled compared to the older models.

| Description | New | Old |
|---|---|---|
| Figure |  |  |
| Pad length | 90 mm | 200 mm |
| Pad width | - | 50 mm |
| Height | 60 mm | 17 mm |
| Support surface | 2,660 mm² | **10,000 mm²** |

Previously the wear pads were placed in the corners of the boom. Now they are placed on the sides of the boom.

***Figure 13***



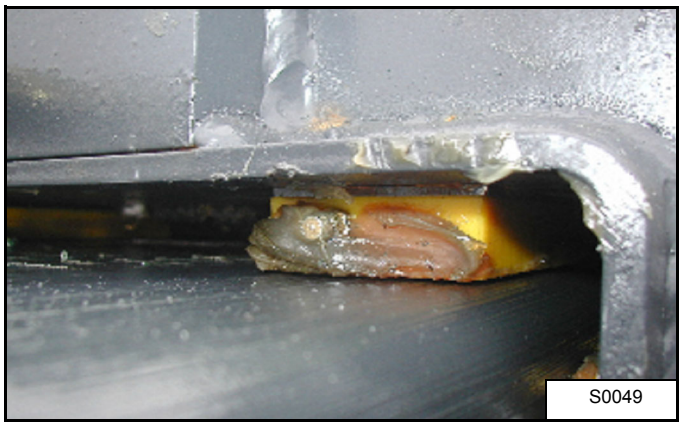

This method allows the contact surface of the boom on the pads to be considerably increased. This results in a 78% decrease in pressure (the whole surface of the pad is used) on the pad compared to the previous arrangement.

In the present system, the pads no longer fit closely around the boom elements, but now help guide it. The effort needed for the telescoping function, therefore, has been divided by two!

### Lubricator built into the pads

The upper and lower pads are equipped with a built-in lubricator, considerably facilitating their maintenance.

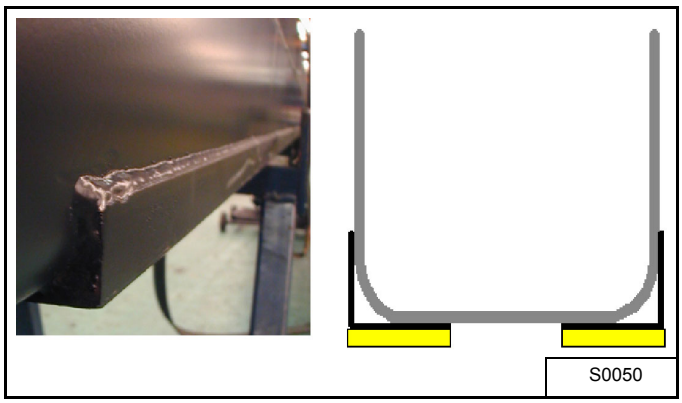
***Figure 14***




### Glide angle iron for the pads

An angle iron is welded to the lower part of the boom elements so that the glide of the pad and the contact surface are perfectly in the same plane.

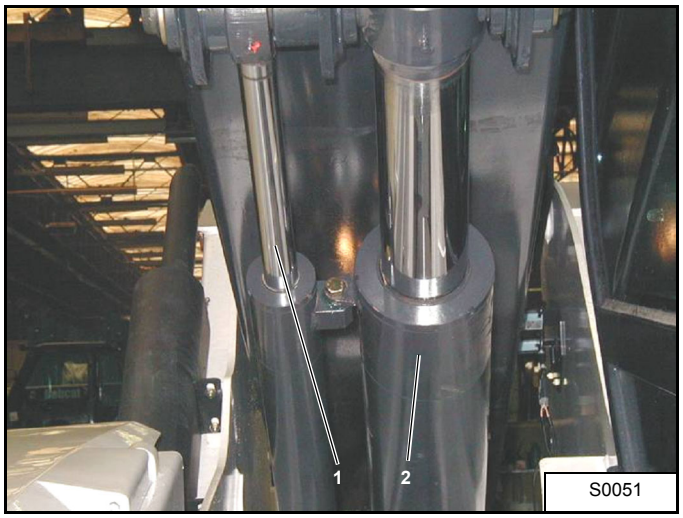
***Figure 15***



## Compensation cylinder

This is mounted beside the raising/lowering cylinder. Its purpose is to regulate the flow of hydraulic fluid of the tilt cylinder when the boom is being raised or lowered. (Horizontality of the forks).

***Figure 16***

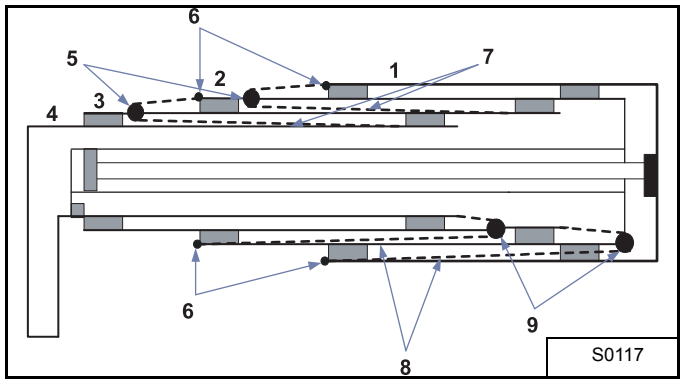



| Ref. | Description |
|---|---|
| 1 | Compensation cylinder |
| 2 | Lift cylinder |

## Mechanical kinematics of the boom

The boom's kinematics have not been changed from the previous version.

***Figure 17***

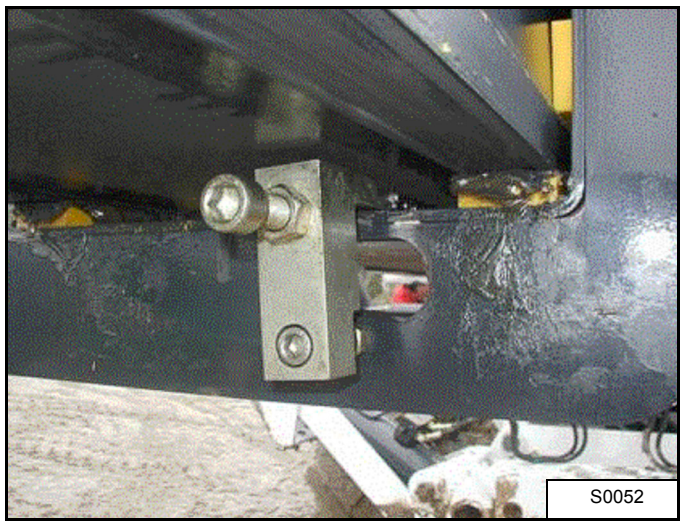



| Ref. | Description |
|---|---|
| 1 | Element 1 |
| 2 | Element 2 |
| 3 | Element 3 |
| 4 | Element 4 |
| 5 | Chain rollers |
| 6 | Chain tension adjustment points |
| 7 | Boom extension chains |
| 8 | Boom retracting chains |
| 9 | Chain rollers |

### Tensioner for lower chains

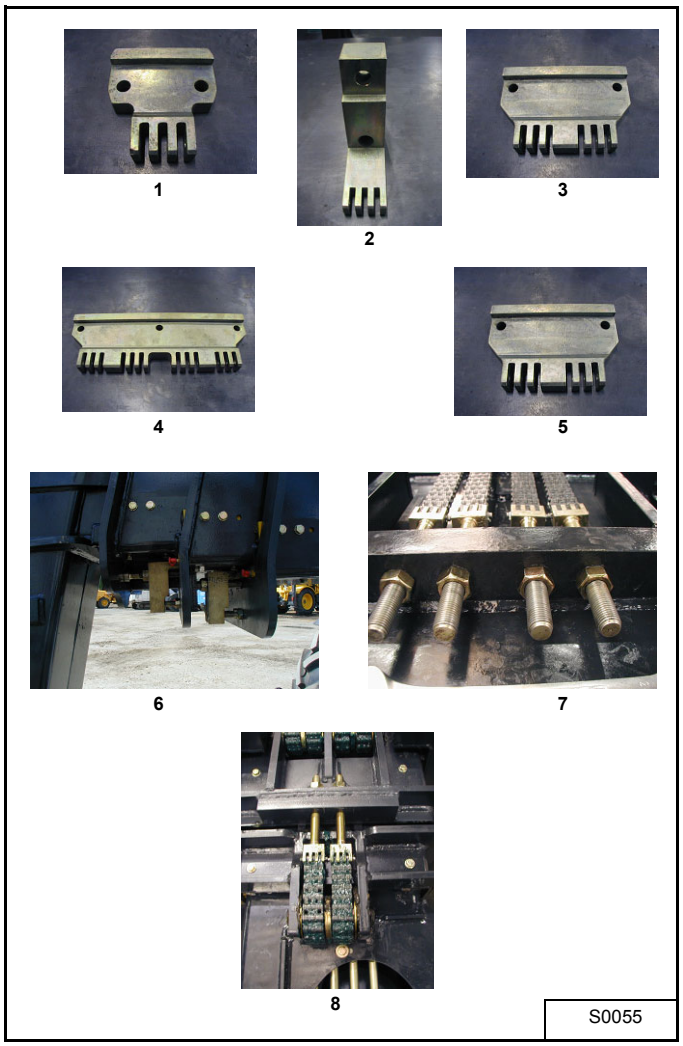
To facilitate the adjustment of the lower chains, tensioners have been installed in front of boom elements 1 and 2.

***Figure 18***



## Hooking up the chains

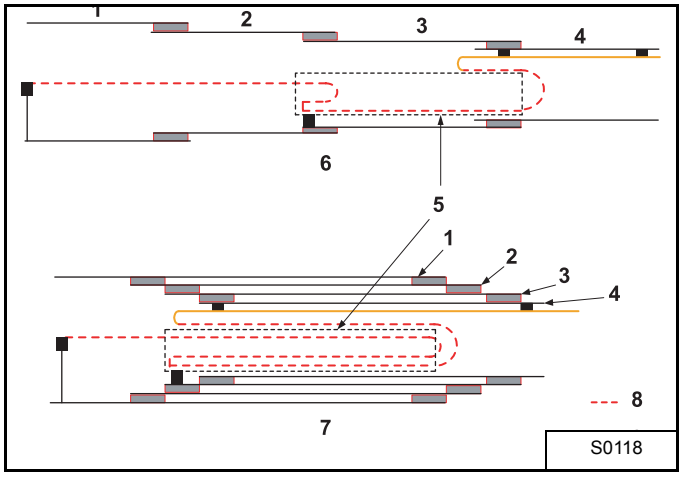
*Figure 19*




| Ref. | Description |
|---|---|
| 1 | Hookup for 1 chain located inside element 4 |
| 2 | Hookup for 1 chain located under the boom |
| 3 | Attachment of the 4 chains on element 1 |
| 4 | Hookup for 4 chains located on element 3 |
| 5 | Hookup for 2 chains located on element 4 and inside element 3 |
| 6 | Hookup of retraction chains |
| 7 | Hookup of retraction chains located on element 3 |
| 8 | Hookup of extension chains located on element 1 |

## Hydraulic kinematics of the boom

*Figure 20*




| Ref. | Description |
|---|---|
| 1 | Element 1 |
| 2 | Element 2 |
| 3 | Element 3 |
| 4 | Element 4 |
| 5 | Cassette |
| 6 | Telescoped boom |
| 7 | Retracted boom |
| 8 | Hoses in chains? |
| 9 | Rigid? |

## Electric enclosure

In this new design the location of the electric enclosure at the boom end was changed.

It is now located on the left side of the boom tip. Previously it was positioned under the boom tip.

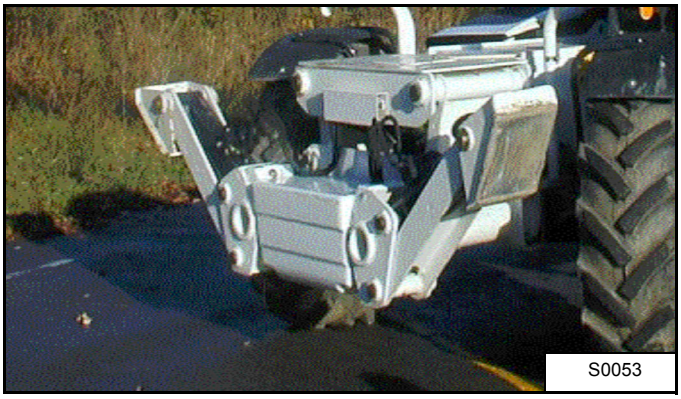
*Figure 21*


## Feature of the T40170

In order to have a true 17 meters on stabilisers as well as on tyres, a 500 kg front counterweight was built in.

It is positioned between the two stabilisers.

*Figure 22*




For removal, two holes are provided for positioning the forks.

## Attachments

All attachments from former versions are applicable for the new models T40140 and T40170.

# SPECIFIC PROCEDURES - V2 BOOM

## Safety

**WARNING**

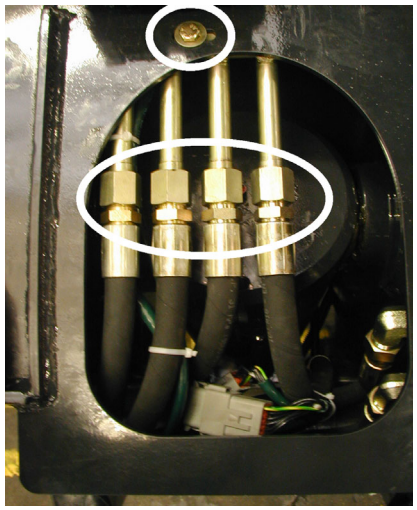
**All handling operations must be done with maximum safety, including the slinging and chocking of removed components.**

## Removal and installation of the chains/hoses cassette

### Removal

1. Disconnect the hydraulic lines at the front and rear of the boom, as well as the electrical connectors **[Figure 23]** and **[Figure 24]**.

***Figure 23***



S0068

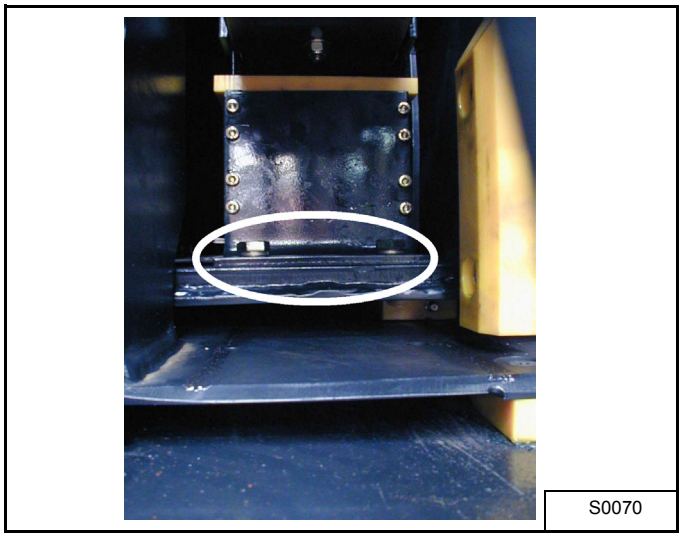
***Figure 24***

S0069

2. Remove the attachment screws from the flat face to which the elbow connections are attached **[Figure 24]**.
3. Fully extend the boom and remove the 2 attachment screws located on top of the last element holding the lines rigid, except for the screw located at the head of the boom **[Figure 23]**.
4. Retract the boom gently and remove the remaining screw **[Figure 23]**.

5. Remove the 2 attachment screws located at the rear of the cassette **[Figure 25]**.

***Figure 25***




6. Extract the cassette through the rear of the boom.
7. Check the thickness of the pad of the cassette
8. Proceed with the work to be done.

**Installation**

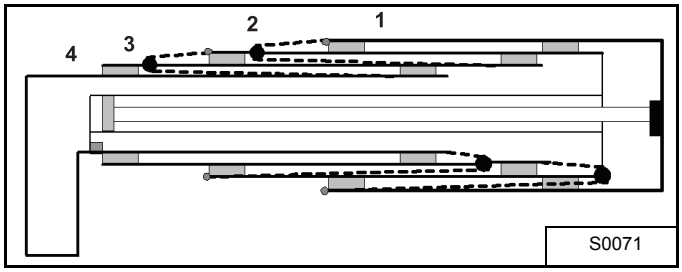
1. Place the cassette inside the boom.
2. Install the attachment screws for the rigid lines located at the head of the boom **[Figure 23]**.
3. Attach the cassette in element No. 3 **[Figure 25]**.
4. Connect the hoses to the rigid lines and attach the support to the side faces of element 1 **[Figure 24]**.
5. Connect the electrical harnesses.
6. At the front, connect the hoses to the rigid lines, as well as the electrical harnesses **[Figure 23]**.
7. Start the motor, gently extend the boom all the way, then install the 2 attachment screws located on top of the last element.
8. Activate the tilt movement and run it through a series of cycles to check for leaks.

**⚠ WARNING**

**Use Loctite on the threads when tightening the screws.**

## Removal and installation of boom elements

***Figure 26***




The kinematics **[Figure 26]** refers to a 4-element boom (T40170). The 3-element kinematics (T40140) is identical, but with one less element.

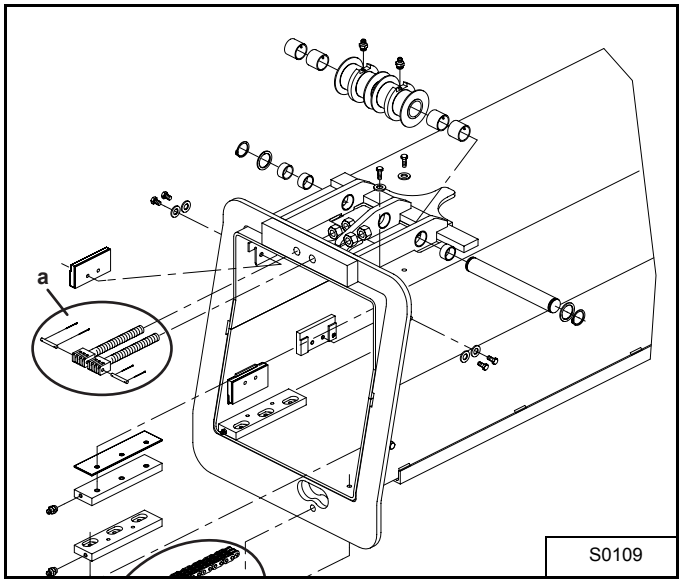
**IMPORTANT**

Place the machine in an environment where work can be done properly and the removed elements can be handled in complete safety.

**Remove elements 2 and 3 (T40140) or 2, 3 and 4 (T40170)**

1. Raise the boom until it is horizontal.
2. Remove the "chains-hoses" cassette. See “Removal and installation of the chains/hoses cassette” on page 12.
3. Remove the telescoping cylinder. See “Removal and installation of the telescoping cylinder” on page 25.
4. Remove the 2 or 4 nuts and locknuts (a) from the attachment points of the extension chains (upper chains) **[Figure 27]**.
   - The number will be different depending on the type of machine (3 or 4 elements).

***Figure 27***



5. Remove the split pins from the link pins on chain rods and stretch the chains on the boom (b) **[Figure 27]**.

6. Remove the attachment screws from the boom front pads and take out the pads, marking their position if they are going to be reinstalled **[Figure 28]**.

***Figure 28***


7. Remove the attachment screws at the rear and inside the element for the retraction chain hookup parts **[Figure 29]** et **[Figure 30]**.

***Figure 29***

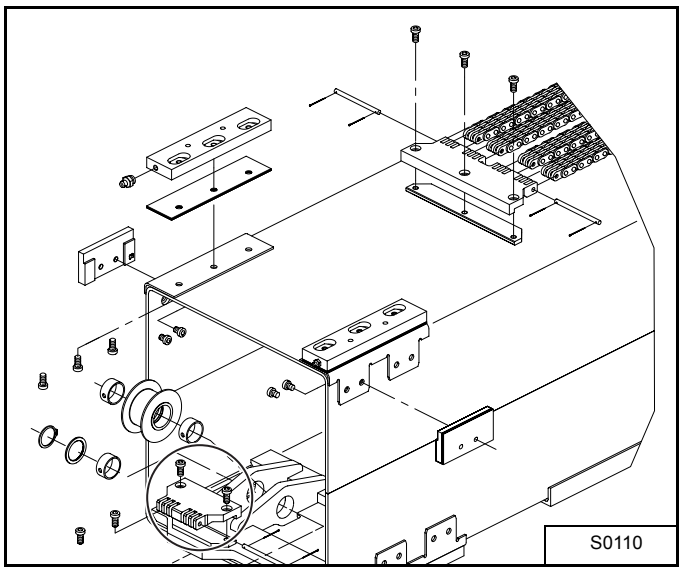
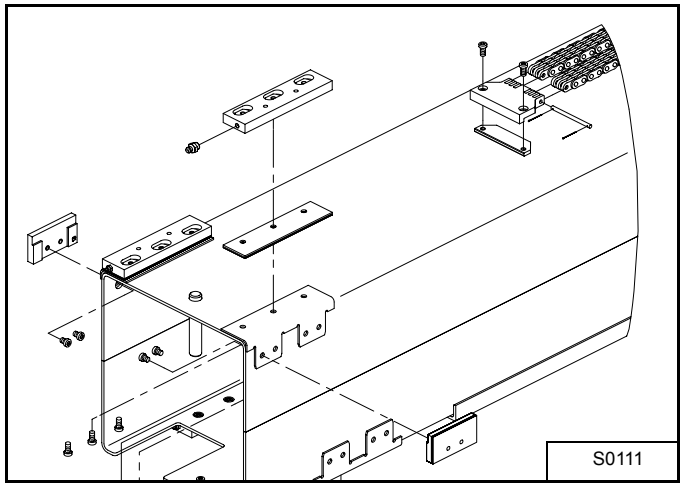



***Figure 30***




8. Attach the element at its front, and using a handling device pull horizontally on the element or set of elements.

**WARNING**

**Caution: when the element or set of elements is out far enough, sling it by its rear part so that it stays balanced when it is released from the fixed boom (or element 1).**

The removal of the other elements is done in the same way as before, but it is important to place all elements on a stable structure in order to prevent any accidents.

**IMPORTANT**

The reinstallation and adjustment of the pads will be done according to a specific procedure. See “Replacing boom pads” on page 18.

**WARNING**

**The handling operations must be done with maximum safety, making sure that the subassemblies to be removed are correctly slung.**

## Checking the tension of the telescoping chains

1. Retract the boom all the way, hold the control for a moment, then block the boom so that it can not come out.
2. Check the tightness of the tension screw of each of the two extension chains.
   - The torque should be between 2.5 and 3 daN.m.
   - Both chains should have identical tension.

*Figure 31*

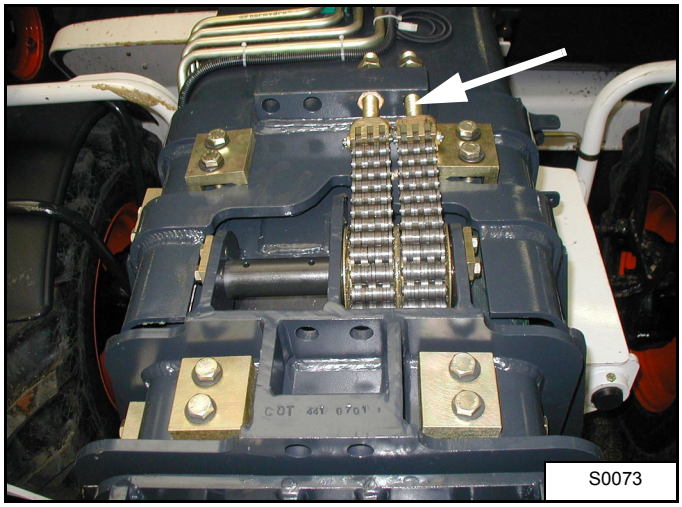
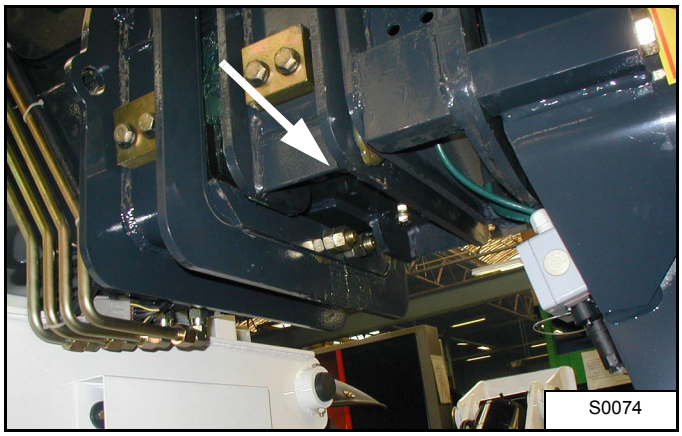



*Figure 32*




3. Run the boom all the way out, hold the control for a moment, then block the boom so that it can not retract.
4. Check the tightness of the tension screw of each of the two return chains.
   - The torque should be between 2.5 and 3 daN.m.
   - Both chains should have identical tension.

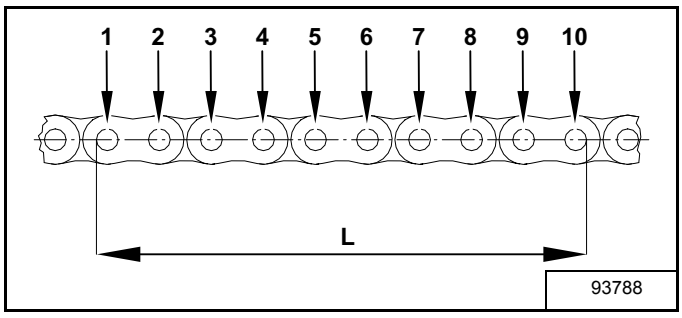
**IMPORTANT**

The nuts should screw freely onto the tensioners.

## Checking the wear of the telescoping chains

1. Take the measurement on the extension chains (exterior).
2. Take the measurement when the boom is completely deployed (telescoped) in the horizontal position.
3. Using a vernier caliper measure the length L of 10 links at the outside of the link pin.

*Figure 33*




**WARNING**

**The measurement must be taken as shown in the diagram, at the outside of the pins of the chain.**

4. The wear is considered normal as long as L is less than 169.50 mm.
5. If L is equal to or more than that value, the chains, pins, rollers, tension rods and attachment screws MUST be replaced.

**IMPORTANT**

- Each time you measure L, write down the date it is checked and the number of hours on the machine.

## Adjusting the extension and retraction chains

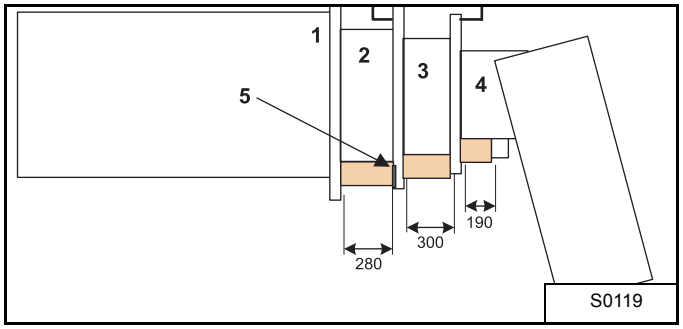
### Tools needed

- 1 wedge 190 mm thick
- 1 wedge 280 mm thick
- 1 wedge 300 mm thick
- 2 x 27 mm open-end spanners

### First

- Extension chains located on the upper part of the boom.
- Retraction chains located under the lower part of the boom.
- Retract the boom while inserting the wedges (insert a 280 mm wedge (300-20=280) between elements 1 and 2) as shown in **[Figure 34]** and use 2 clamps to prevent the elements from coming out.

***Figure 34***

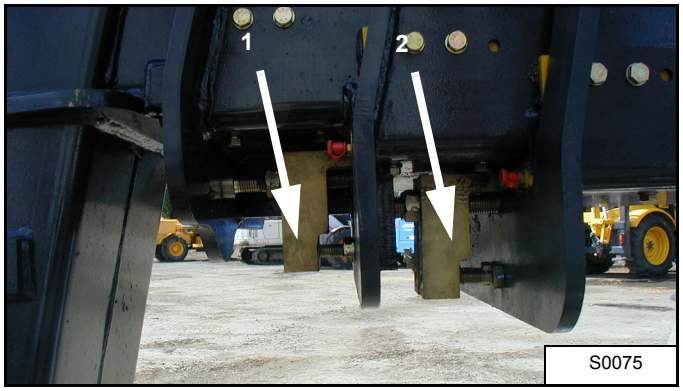



| Ref. | Description |
|---|---|
| 1-4 | Element 1-4 |
| 5 | Welded plate (20 mm) |

### Retraction chains

1. Unscrew the locknuts.
2. Tighten the chain tension screws to a torque of 3 daN.m.
3. Progressively tighten each screw, making sure to keep the tensioner perfectly parallel to the belt of the element **[Figure 35]**.

***Figure 35***




| Ref. | Description |
|---|---|
| 1 | Adjusting retraction chain of element 4 |
| 2 | Adjusting retraction chain of element 3 |

4. Retighten the locknuts

### Extension chains

1. Unscrew the locknuts.
2. Tighten the chain tension screws to a torque of 1.8 daN.m.
3. Progressively tighten each screw.
4. Retighten the locknuts.

***Figure 36***

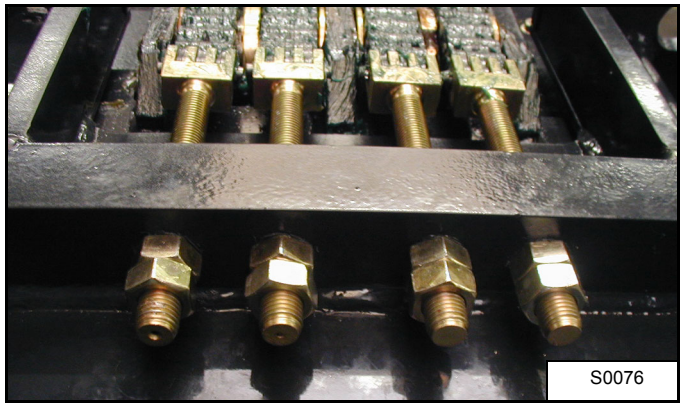
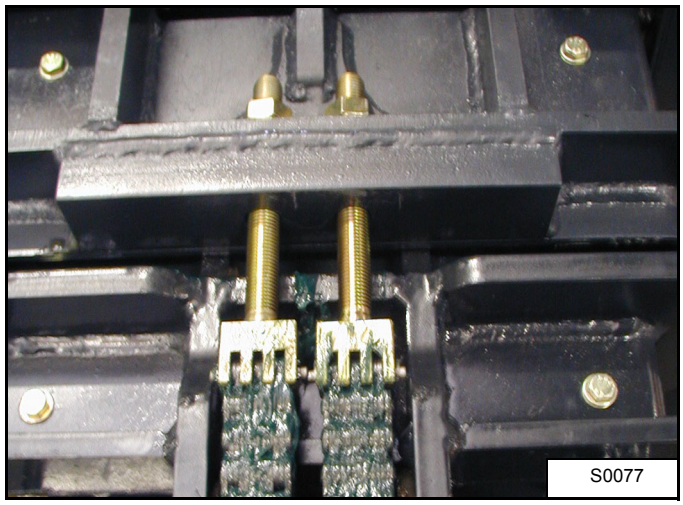



***Figure 37***




5. Remove the clamps.
6. Telescope out slightly to release the wedges.
7. Telescope the boom all the way in and out several times in the horizontal position.

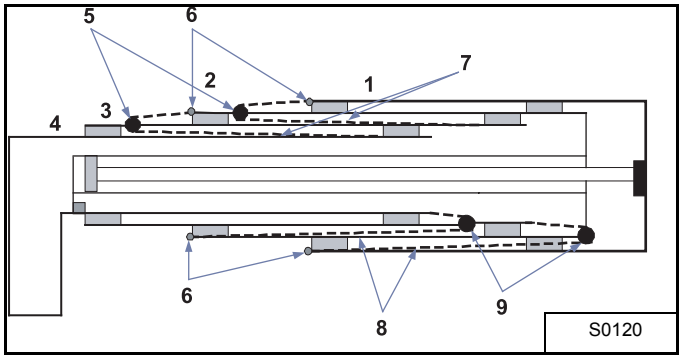
**⚠ WARNING**

**It is important to adhere to the indicated tension torques. The working life of the chains will be affected and therefore safety.**

## Replacing the boom retraction or extension chains

### General views

*Figure 38*



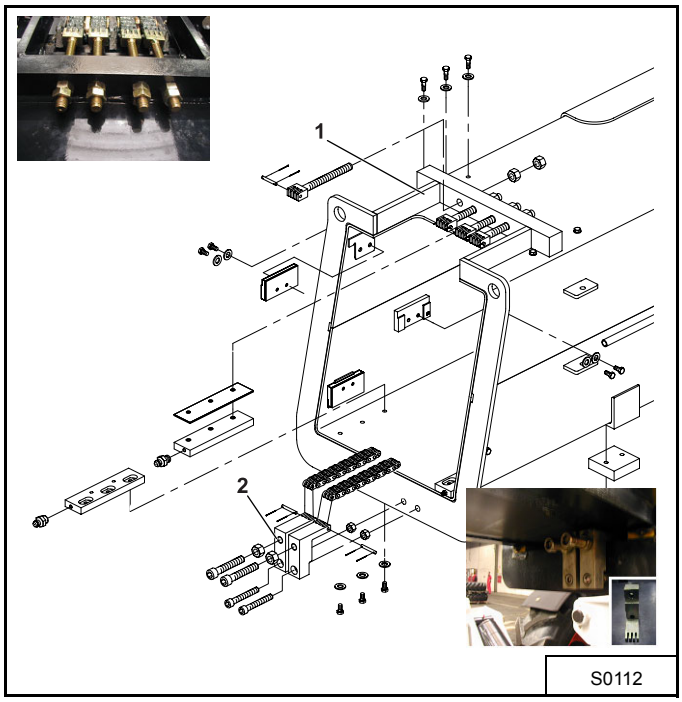

| Ref. | Description |
|---|---|
| 1 | Element 1 |
| 2 | Element 2 |
| 3 | Element 3 |
| 4 | Element 4 |
| 5 | Chain rollers |
| 6 | Chain tension adjustment points |
| 7 | Boom extension chains |
| 8 | Boom retracting chains |
| 9 | Chain rollers |

The extension chains, located at the top of the boom, can only be replaced by removing the boom elements. Therefore, follow the instructions for removing and installing the elements.

When the element is free enough, the other end of the chain can be removed.

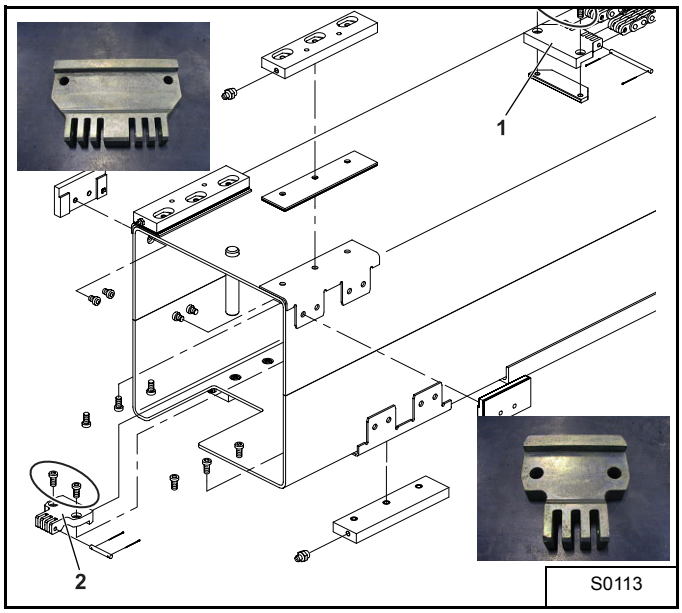
The boom retraction chains, located under the boom, can be replaced without removing the elements.

*Figure 39*




| Ref. | Description |
|---|---|
| 1 | Front attachment of the extension chains |
| 2 | Front attachment of the retraction chains |

*Figure 40*




| Ref. | Description |
|---|---|
| 1 | Interior attachment of the extension chains |
| 2 | Interior attachment of the retraction chains |

### Work on rear of boom

1. If the telescoping cylinder has to be removed. See “Removal and installation of the telescoping cylinder” on page 25.
2. Remove the attachment of the chain hookup part located inside the boom element.
3. Remove the pin from the shaft holding the chain links with their attachments.
4. Hook the new chains to the end of the old ones.

### Work on front of boom

1. Remove the front mounting and uncouple the chains from the mounting parts.
2. Pull and remove the chains until the new chains appear.
3. Re-attach the new chains to their respective hookups.
4. Attach the chain hookups to their respective mounting points.

**WARNING**

**The threads of the screws shown in[Figure 40] must be doped with Loctite and tightened to a torque of 3 daN.m.**

**It is important to adhere to the indicated tension torques. The working life of the chains will be affected and therefore safety.**

**All handling operations must be done with maximum safety, including the slinging and chocking of removed components.**

## Replacing boom pads

Replacing the pads can be done without removing the boom elements.

### Parts

| Designation | Quantity | See |
|---|---|---|
| Upper & lower pad | 24 (depending on No. of elements) | **[Figure 42]** |
| 1 mm shim for long pad | As needed | |
| shim for long pad 2 mm | As needed | |
| shim for long pad 3 mm | As needed | |
| Side pad 11 mm | As needed | **[Figure 41]** |
| Side pad 12 mm | As needed | **[Figure 41]** |
| 13mm side pad | 9 mount on left side | **[Figure 41]** |
| Side pad 14 mm | As needed | **[Figure 41]** |
| Side pad 15 mm | As needed | **[Figure 41]** |
| Screw H8-15 | 38 (depending on No. of elements) | **[Figure 43]** |
| Screw H8-20 | 14 (depending on No. of elements) | **[Figure 43]** |
| Screws for side pads CHC M8-10-CL8.8 | 12 (depending on No. of elements) | **[Figure 43]** |
| Screws for upper and lower rear pads CHC M8-16-CL10.9 DIN7984 | 36 (depending on No. of elements) | **[Figure 43]** |
| Washer | 100 (depending on No. of elements) | |

***Figure 41***

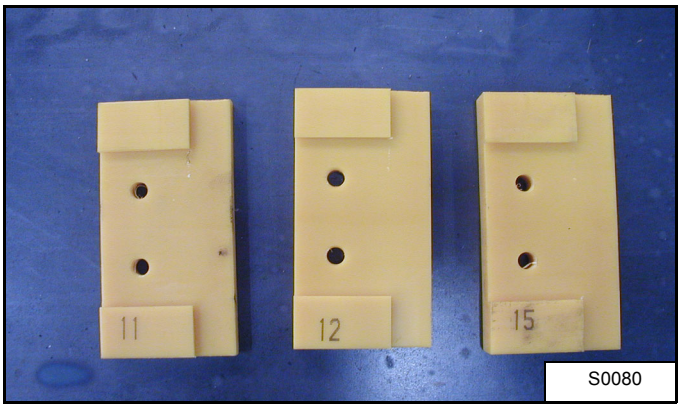



***Figure 42***

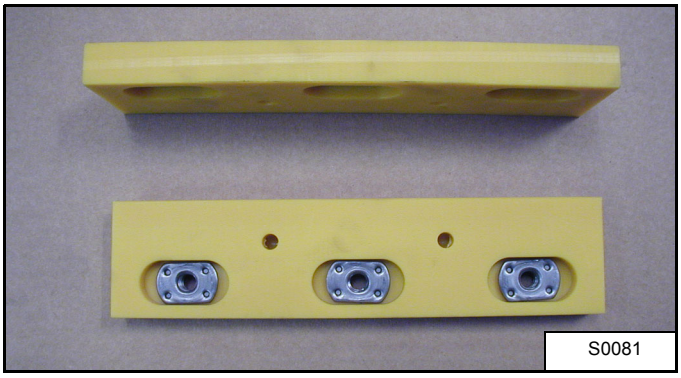
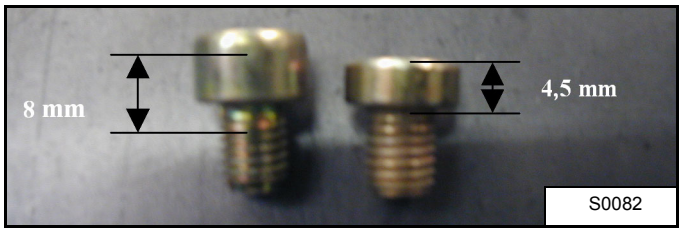


*Figure 43*

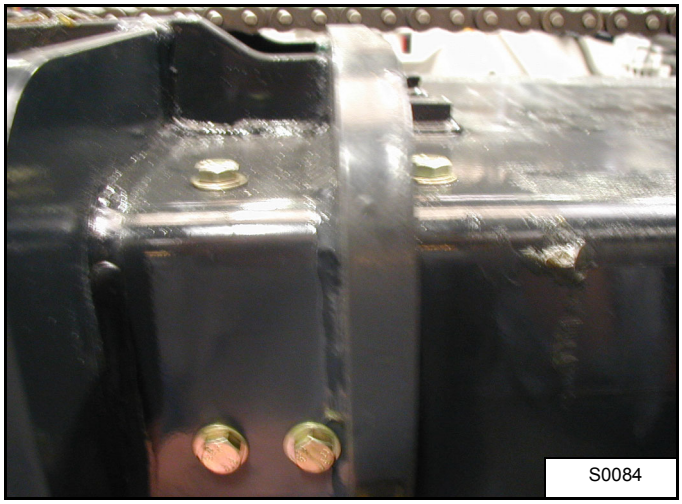



## Front pads of the elements

### *Removing*

1. Remove the attachment screws **[Figure 44]** from the upper pads and pull them out. There are 2 or 3 attachment screws, depending on the element.

*Figure 44*

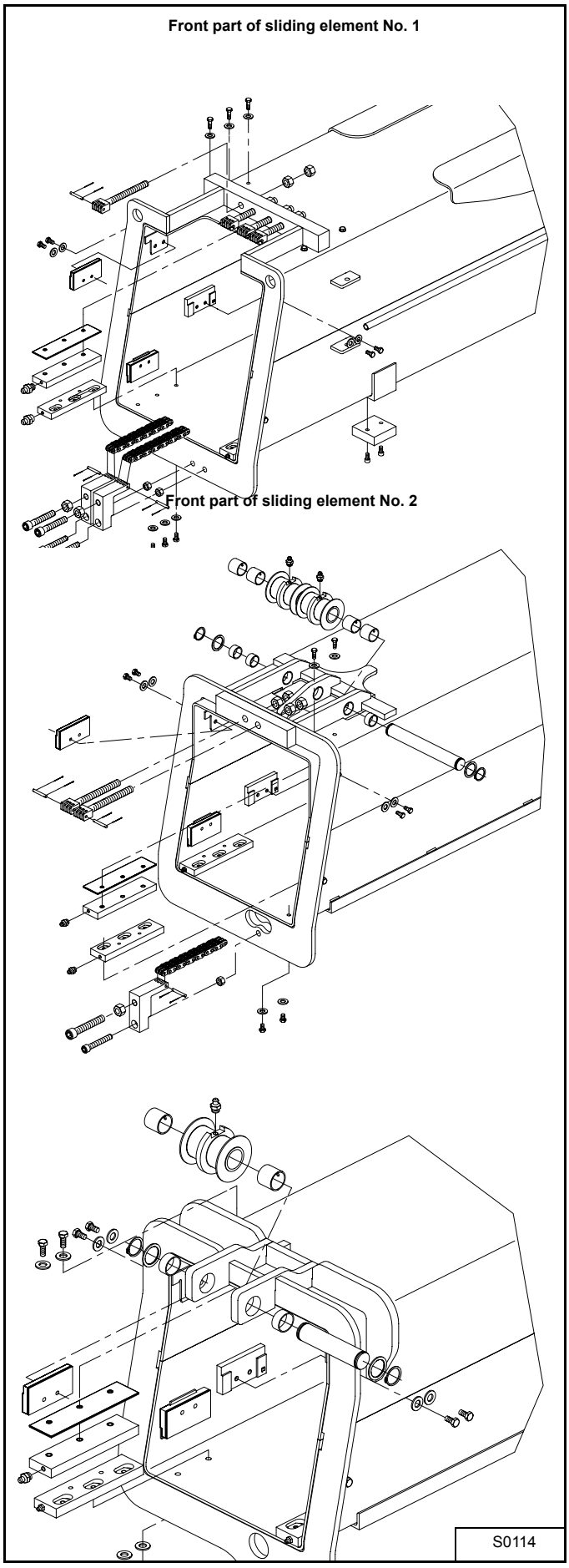



2. Caution - shims may come out with the pads.
3. Remove the attachment screws from the side pads and extract the pads by lifting and pulling for the lower sides, and by raising and pulling for the upper sides.
4. Using a hoist, sling the front part of the element and raise it in order to release the lower part to extract the pads.

### *Installation*

1. With front of boom raised in order to slide in the lower pads (to be mounted without adjustment shim), apply Loctite to the threads of the screws and tighten to a torque of 3 daN.m.
2. Install the front part of the boom and engage the 13mm thick side pads on the left part of the element (viewed from rear of boom) **[Figure 45]**, then tighten the screws using the procedure indicated below.

*Figure 45*



3. Adapt the right side pads by a thickness that allows them to be in contact with the element of the sliding boom, then tighten the screws using the procedure indicated below.

4. Engage the upper pads, using the necessary shims to make contact with the element of the sliding boom, then tighten the screws with a torque of 3 daN.m using Loctite on the threads.

**WARNING**

**Note: the screws of the side pads should be tightened as follows:**

- **tighten until it makes contact with the caisson, then tighten an additional 1/8th turn.**

**Don't forget to reinstall the lubricators on the upper and lower pads.**

### Rear pads of the elements

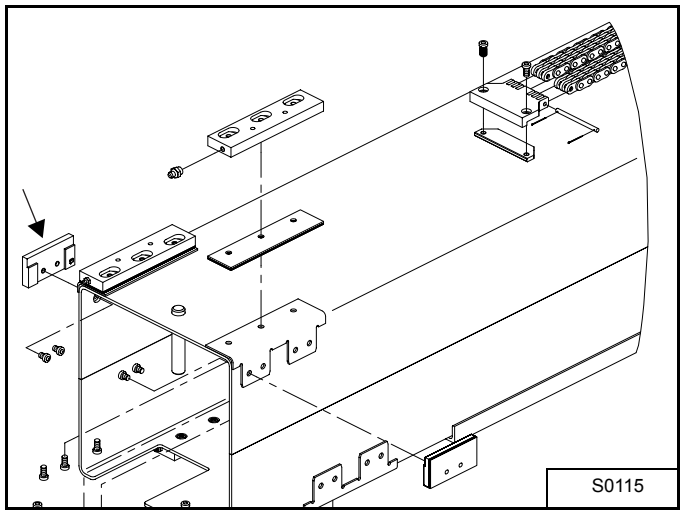
***Removing***

1. Retract the boom, taking care to leave the pad attachment screws accessible.
2. Remove the chains-hoses cassette. See “Removal and installation of the chains/hoses cassette” on page 12.
3. Remove the telescoping cylinder. See “Removal and installation of the telescoping cylinder” on page 25.
4. Remove the attachment screws from the pads.
5. Extract the lower and side pads from each element.
6. Using a hoist, raise the front part of the boom in order to free up the upper rear pads.
7. Remove the attachment screws from the pads.
8. Extract the upper pads.

***Installation***

1. Prepare the lower pads. The number depends on the type of machine (T40140 or T40170).

***Figure 46***




2. Put them in place and tighten the attachment screws (apply Loctite to the threads and tighten to 3 mKg). Do not insert adjusting shim. Take the 13mm side pads and put them in place on the left part of the elements (side toward the cabin), insert and tighten the attachment screws 1/8th turn after the screw makes contact with the caisson.
3. Determine the amount of right side space and select the nearest thickness of pad so that it is in close contact with the boom element; insert and tighten the attachment screws 1/8th turn after the screw makes contact with the caisson.
4. Determine the amount of free space between the elements **[Figure 47]** and select the upper pads, and shims if necessary, so that they are in close contact with the boom element; tighten the attachment screws (apply Loctite to the screw threads and tighten to 3 daN.m).

***Figure 47***