DT - Výhybkárna a strojírna, a.s.
Kojetínská 4750/6, 796 01 Prostějov, Czech Republic
www.dtvs.cz

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Manual for the operation and maintenance of tramway turnouts, crossings and rail facilities

3nd Edition

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Manufacturer of tramway turnouts, crossings and rail facilities and publisher of this manual:

DT - Výhybkárna a strojírna, a.s.

(hereinafter the manufacturer)

Approved by: **Ing. Jiří Havlík**
Technical Director

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LIST OF ANNEXES

1 General

This manual contains information on tramway turnouts, crossings and rail facilities (hereinafter referred to as “tramway turnouts and structures” if not further specified), requirements for their installation and operation, including maintenance
It is binding on all persons who carry out the activities specified below on the above-mentioned tramway turnouts and structures. The manufacturer assumes no responsibility for activities and their consequences performed in a different way and strongly warns that failure to comply with the provisions of this manual may result in the rejection of the claim, including the possible recovery of related damages.

Before starting any work on the frog, the relevant personnel must be familiar with the instructions in this manual.

1.1 Overview of the most important symbols

This document includes three categories of safety guidelines:

DANGER! **Ignoring these instructions can result in loss of life.**

WARNING! **Ignoring the instructions can cause serious injury or substantial damage to the property.**

NOTICE! **Ignoring the instructions can cause damage to the property or injury.**

1.2 Manufacturer's address

DT - Výhybkárna a strojírna, a.s.
Kojetínská 4750/6
796 01 Prostějov
Czech Republic

Contacts to the service personnel are available on the website DT - Výhybkárna a strojírna, a.s.:http://www.dtvs.cz/

1.3 Contact form for technical sales support - Your opinion

Company DT – Výhybkárna a strojírna, a.s. will be happy to receive **feedback from its customers**, especially your comments, suggestions and experience with the product gained from its operation. Please send us a copy of this form at:

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Kojetínská 4750/6
796 01 Prostějov
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Comments, suggestions and experience:

Name: …….

Organization: …….

Contact (phone, e-mail):

2 Introduction

2.1 Tramway track substructure layout

The shape and dimensions of the tramway track substructure are designed depending on the local conditions of the tramway track routing, the subsoil properties and the materials from which the tramway track substructure is to be constructed, the track layout and the proposed tramway track superstructure.

The substructure of the tramway track shall ensure performance throughout its planned lifetime under the design operating load of the track. The carrying capacity of the substructure of the tramway track must comply with the design load of the rail and road transport.

The substructure of the tramway track must ensure that the leachate is drained away and that the track superstructure is stable and flexible for the design life. The subgrade and construction of the tramway track substructure shall be protected against the effects of climatic influences, chemical de-icing agents, groundwater and stray currents, or other influences that may reduce the safety and reliability of structures and equipment.

3 Technical conditions of tramway track operability

For tram turnouts and structures, the specified track gauge and geometric track position must be provided. The values of the mmaximum permissible rail tear and wear specified by the operator's internal operating instructions must not be exceeded.

Tramway turnouts and structures that have any of these defects must not be operated:

a) tongue, stock rail or frog fracture,

b) tongue tip abuts against the stock rail with play more than 3 mm,

c) block, barrier or signalling equipment has defects or damages that can endanger the safety of railway operation or railway transport,

d) height of the tongue tear and wear is more than 8 mm.

Drainage structures and equipment must ensure permanent drainage of surface and leachate waters and their function must not cause a reduction in the stability and load capacity of the track superstructure or roadbed.

Technical documentation of tramway track construction and facilities includes:

a) drawing documentation and technical data on track routing, location of buildings, geometric data, design, type and production data on buildings and facilities and their age,

b) records of performed inspections, measurements and their results.

4 Tramway track superstructure system

The superstructure system is listed according to the type of rail used 57R1, NT1, NT3, 60R1, 60R2, 62R1, 62R2, 59R1, 59R2, or other.

Type of track structures	
Single turnout	J
Single-curve turnout	OBL-J
Double-curve turnout	OBL-J
Symmetrical turnout	J
Diamond crossing	K
Combination	KOMB
Single crossover	JKS
Double crossover	DKS
Multiple rail turn	VKO
Diamond crossing with double slip	C
Diamond crossing with single slip	B
Expansion equipment	ZD
Parts of track structures	
Switch	VA
Common frog	JS
Double frog	DS
Other related equipment	
Switch boxes	DT2, DT4, DT6, DT7, DT9, DT10

5 Transport, handling and storage of tram turnouts and structures

5.1 Transport of tramway turnouts and structures

Railway platform wagons are used for the transport of individual parts of tramway turnouts and structures (assembled switch with switch box, frog and rails) or the transport is performed by lorry on the customer's request.

5.2 Handling assembled parts of tramway turnouts and structures

Loading and unloading of assembled parts of tramway turnouts and structures (switches, frogs, crossings etc.) must be carried out either by a single crane with the help of a handling beam or by two runabout cranes using steel cables. The way of displacement of the turnout structure depends on the distance of the installation from the place of installation and on the used technological equipment

Suspension of the assembled parts of the turnout structures fastened to sleepers must be carried out by hanging by the rails. The deviation of the suspension ropes from the vertical direction shall not be greater than ± 20° in the longitudinal direction parallel to the turnout part axis (in order to prevent the movement of the sleepers at very high thrust) and max. 35° in the transverse direction perpendicular to the turnout part axis (see Figure 1).

Other available techniques may also be used for unloading, provided that the requirements for load handling are met.

Transport and installation work must be carried out in such a way that parts of the turnout structures are not deformed and their geometry is not broken The assembled part of the turnout structure must not be hung with harnesses with hooks engaged in the rail foot.

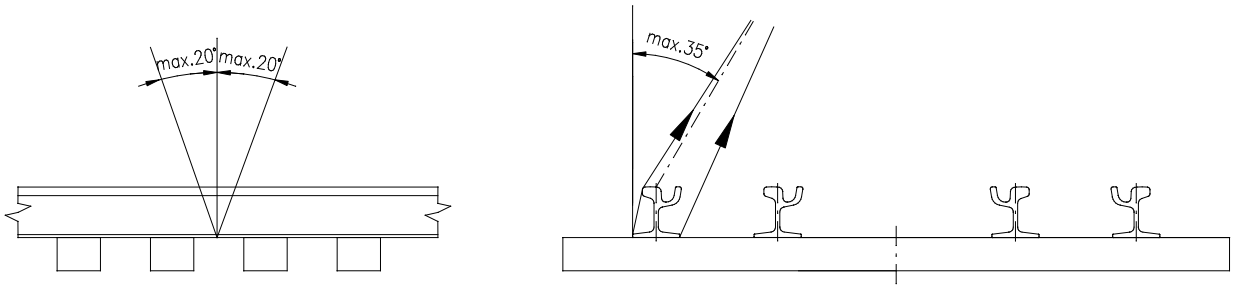


Figure 1 - Orientation drawing for handling tramway turnouts and structures, Diagram of harnesses

Due to the different design of the groove turnouts and structures, it is not possible to predetermine the places of harnessing. These places are then marked with stickers on the rails (see Figure 2).

Figure 2 – Sticker to mark the harness point

Harness points are based on the first turnout handling in the factory before shipment (see Figure 3).

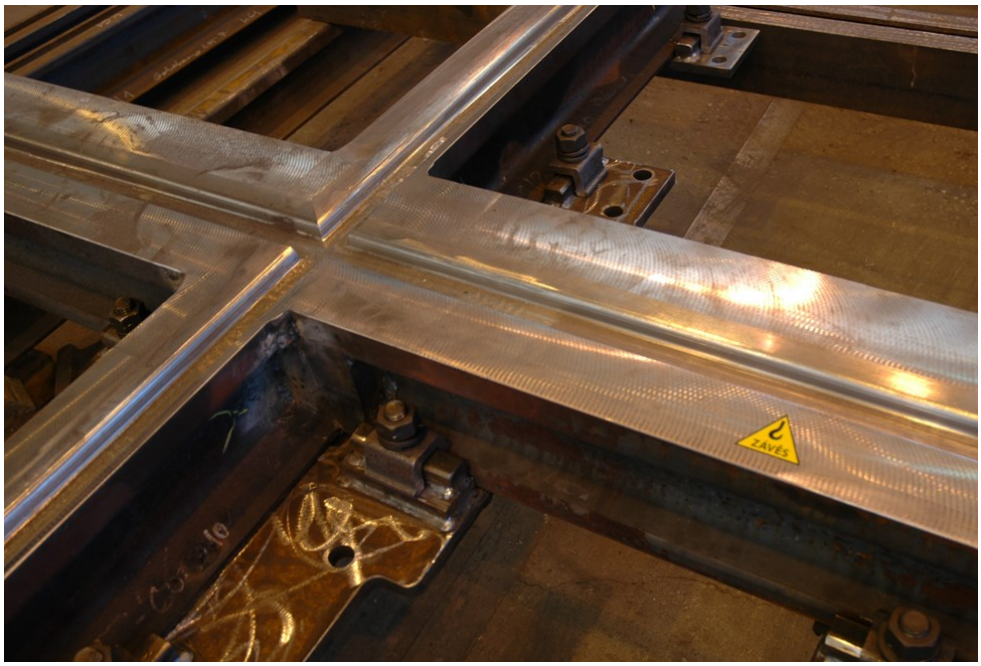


Figure 3 - Harness location marking

5.3 Storage of tramway turnouts and structures

Tramway turnouts and structures or their parts shall be stored on a paved, levelled surface. The reinforcement and the shape of the surface must ensure that, during the storage period, the turnouts are positioned in a way that the sleepers do not suffer from negative bending moment (tensile stress at the top of the sleeper) generated by the steel part of the turnouts. If it is not possible to ensure sufficient flatness of the storage area, balanced scaffolding made of rails corresponding to the load carrying capacity can also be used under the bottom layer of the turnout part. Turnout parts can be placed on top of each other in max. three layers.
For switches with mounted switch boxes, care should be taken when loading on a semi-trailer, railway wagon or storage area, as switch must be sufficiently vertically underlayed due to overlap of the drain pipe.
Steel parts of turnouts without mounted timber or concrete sleepers must be underlayed with crossers approximately 4 m apart. The assembled parts of the turnouts with mounted sleepers can be placed on top of each other in max. three layers.

The spatial position of the tramway turnout after installation for the technology vehicles running must comply with these conditions until the start of operation:

The connection of old and new rails in joint must be made with transition rails.
In the case where the height difference of the rail heads is less than 5 mm, the connection can be made with transition fishplates, compensating for the difference in rail head heights. The rail joint must be connected by at least two fish bolts. The difference between the rail crowns, or their running edges, must not exceed 1 mm in joint. Before entering technological vehicles, it is necessary to pay increased attention to the adjustment of the vertical alignment transitions of the rail between the old and new rail bed.

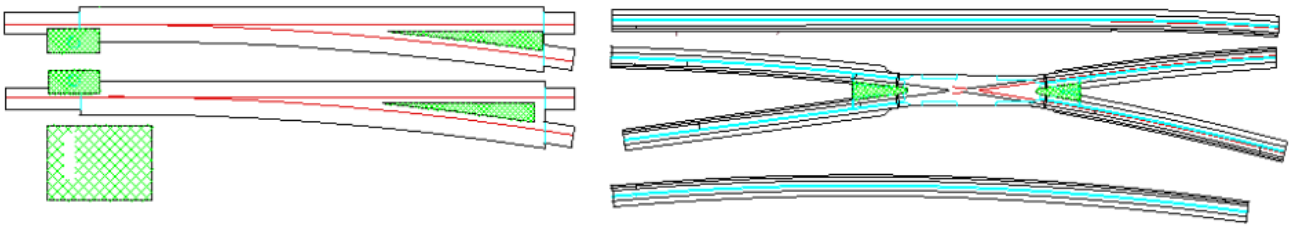
6 Installation of tramway turnout

Upon acceptance of the delivery at the place of destination, the buyer (customer) will verify the number and specification of the delivered parts according to the shipped parts report.

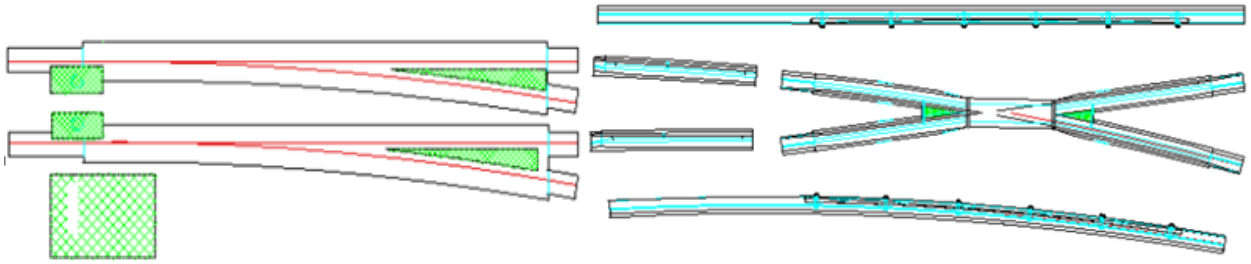
Tramway turnout is supplied by customer's request as:

6.1 Not pre-assembled tramway turnout

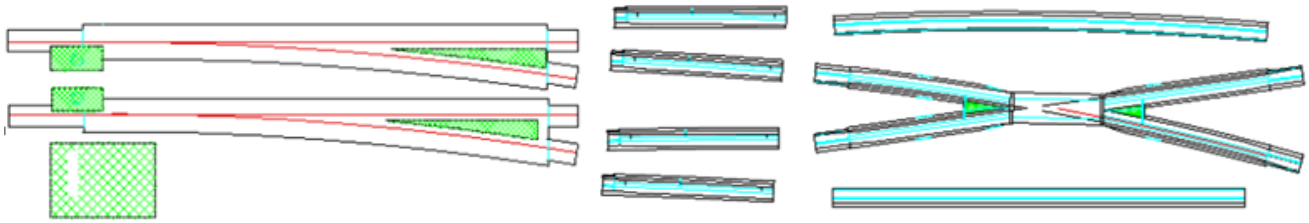
a) two half switches, block device, separately supplied frog, check rails, track fastenings



b) two half switches, block device, middle part consisting of 2 pcs of rails, 2 pcs of rails joint with check rails, separately supplied frog and track fastenings

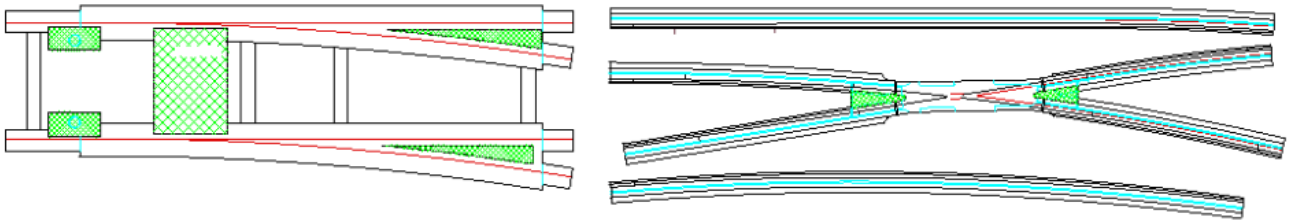


c) two half switches, block device, middle part consisting of 4 pcs of rails, separately supplied frog, check rails and track fastenings

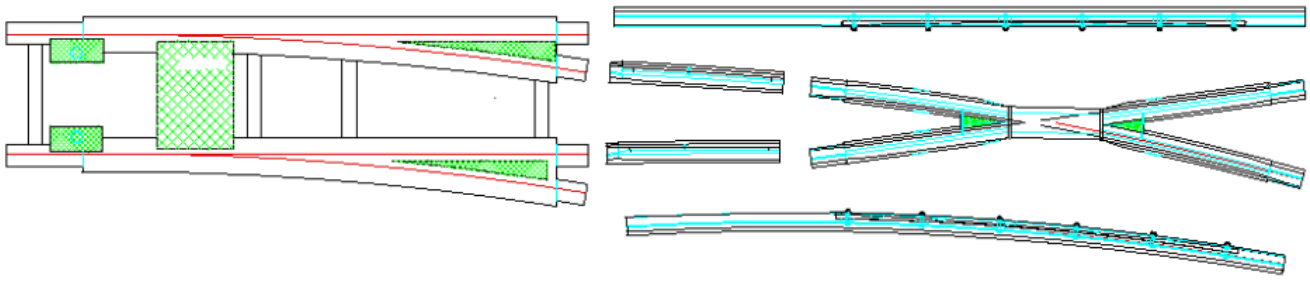


6.2 Partly pre-assembled tramway turnout

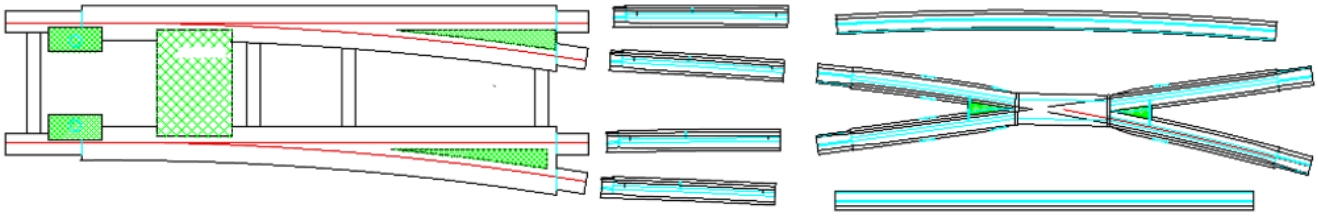
a) switch mounted completely with gauge bars and switch box, separately supplied frog, check rails and track fastenings



b) switch mounted completely with gauge bars and switch box, middle part consisting of 2 pcs of rails, 2 pcs of rails joint with check rails, separately supplied frog and track fastenings

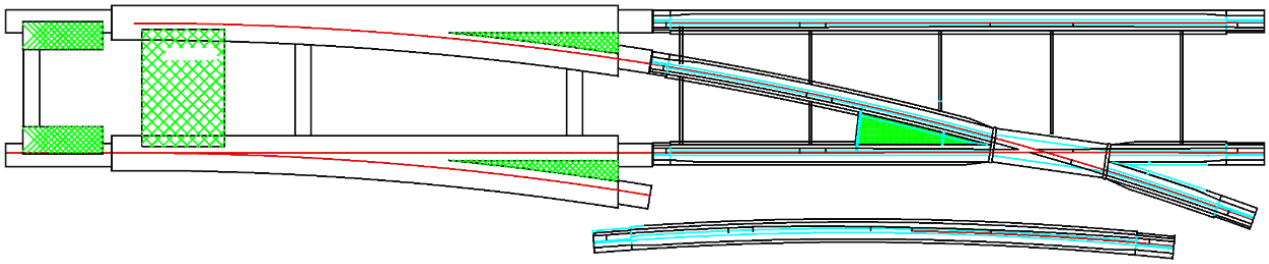


b) switch mounted completely with gauge bars and switch box, middle part consisting of 4 pcs of rails, separately supplied frog, check rails and track fastenings



6.3 Pre-assembled tramway turnout

– weldment of switch, frog and rails, separately supplied curved check rail, track fastenings



Note:
In case of delivery according to 5.2 and 5.3 incl. switch box equipped with drainage channels for possible placement on one or the other side of the outer box, these channels must be mounted **according to the longitudinal inclination of the tramway turnout installation,** either directly in the factory or in the track.

ad 6.1. Installation of not pre-assembled tramway turnout:

a) two half switches, block device, separately supplied frog, check rails, track fastenings

- lay out the wooden or concrete sleepers according to the layout drawing of the turnout
- using the band, draw the centre points of the sole plates on rail feet
- lay out the polyethylene pads and sole plates, insert rubber pads into ribbed baseplates
- fix the base plates to the rail (switch, frog) using fasteners
- counter-lay two halves of switch using angle bar to 90° and to the gauge in the front and at the heel, assembly using gauge bars. The gauge bars and their position are marked with numbers
- to the assembled switch, put 1 pcs of outer straight running rail (rail with check rail) using string, check the construction length including joints for welds.
- position the frog, align it with a gauge bar. Check the construction length of the turnout and the distance from the turnout beginning until the mathematical point of the crossing in the frog (MK). Check the rail counter-laying using angle bar to 90°.
- set the curved rail (rail with check rail). Set the rail in the gauge using gauge bar.
- check the counter-laying of rail ends to 90°
- if necessary, adjust the contact between the inner rails and the frog by grinding the foot
- check the construction dimensions of installed switch parts, assembly gauge bars according to numbers, double check the gauge, or adjust the gauge using steel washers, fasten the joints with fishplates
- carry out a general check of the construction dimensions of the installed turnout according to the drawing documentation, check the tightness of all screws

- carry out a possible adjustment of position and fan-shaping of wooden or concrete sleepers
- drill holes in wooden sleepers and turn the sleeper screws to the prescribed tightening torque of 180–220 Nm (in case of use of double elastic rings Fe6), or to another one if prescribed in the drawing documentation of the turnout
- turn the sleeper screws to concrete sleepers to the prescribed tightening torque of 180-220 Nm (in case of use of double elastic rings Fe6), or to another one if prescribed in the drawing documentation of the turnout
- test the switching and seating of the tongues in the switch with the help of the switch box
- check the geometry of the structure according to the drawing documentation, check the completeness
- weld joints with regard to the welding technology used, always after total directional and height adjustment and checking of the building dimensions of the turnout
- carry out the acceptance of the turnout according to the drawing documentation

b) two half switches, block device, middle part consisting of 2 pcs of rails, 2 pcs of rails joint with check rails, separately supplied frog and track fastenings

- lay out the wooden or concrete sleepers according to the layout drawing of the turnout
- using the band, draw the centre points of the sole plates on rail feet
- lay out the polyethylene pads and sole plates, insert rubber pads into ribbed baseplates
- fix the base plates to the rail (switch, frog) using fasteners
- counter-lay two halves of switch using angle bar to 90° and to the gauge in the front and at the heel, assembly using gauge bars. The gauge bars and their position are marked with numbers
- to the assembled switch, put 1 pcs of outer straight running rail (rail with check rail) using string, check the construction length including joints for welds.
- position the inner straight running rail to the frog, position the frog. Position using the gauge bar. Check the construction length of the turnout and the distance from the turnout beginning until the mathematical point of the crossing in the frog (MK) Check the rail counter-laying using angle bar to 90°.
- set the outer curved rail between the switch and the frog
- set the curved rail (rail with check rail). Set the rail in the gauge using gauge bar.
- check the counter-laying of rail ends to 90°
- if necessary, adjust the contact between the inner rails and the frog by grinding the foot
- check the construction dimensions of installed switch parts, assembly gauge bars according to numbers, double check the gauge, or adjust the gauge using steel washers, fasten the joints with fishplates
- carry out a general check of the construction dimensions of the installed turnout according to the drawing documentation, check the tightness of all screws
- carry out a possible adjustment of position and fan-shaping of wooden or concrete sleepers
- drill holes in wooden sleepers and turn the sleeper screws to the prescribed tightening torque of 180–220 Nm (in case of use of double elastic rings Fe6), or to another one if prescribed in the drawing documentation of the turnout
- turn the sleeper screws to concrete sleepers to the prescribed tightening torque of 180-220 Nm (in case of use of double elastic rings Fe6), or to another one if prescribed in the drawing documentation of the turnout
- test the switching and seating of the tongues in the switch with the help of the switch box
- check the geometry of the structure according to the drawing documentation, check the completeness
- weld joints with regard to the welding technology used, always after total directional and height adjustment and checking of the building dimensions of the turnout

- carry out the acceptance of the turnout according to the drawing documentation

c) two halves of switch, block device, middle part consisting of 4 pcs of rails, separately supplied frog, check rails and track fastenings

- lay out the wooden or concrete sleepers according to the layout drawing of the turnout
- using the band, draw the centre points of the sole plates on rail feet
- lay out the polyethylene pads and sole plates, insert rubber pads into ribbed baseplates
- fix the base plates to the rail (switch, frog) using fasteners
- counter-lay two halves of switch using angle bar to 90° and to the gauge in the front and at the heel, assembly using gauge bars. The gauge bars and their position are marked with numbers
- to the assembled switch, put 1 pc of outer straight running rail (rail with check rail) using string, check the construction length including joints to weld
- position the inner straight running rail to the frog, position the frog. Position using the gauge bar. Check the construction length of the turnout and the distance from the turnout beginning until the mathematical point of the crossing in the frog (MK) Check the rail counter-laying using angle bar to 90°.
- set the outer curved rail between the switch and the frog
- set the curved rail (rail with check rail). Set the rail in the gauge using gauge bar.
- check the counter-laying of rail ends to 90°
- if necessary, adjust the contact between the inner rails and the frog by grinding the foot
- check the construction dimensions of installed switch parts, assembly gauge bars according to numbers, double check the gauge, or adjust the gauge using steel washers, fasten the joints with fishplates
- carry out a general check of the construction dimensions of the installed turnout according to the drawing documentation, check the tightness of all screws
- carry out a possible adjustment of position and fan-shaping of wooden or concrete sleepers
- drill holes in wooden sleepers and turn the sleeper screws to the prescribed tightening torque of 180–220 Nm (in case of use of double elastic rings Fe6), or to another one if prescribed in the drawing documentation of the turnout
- turn the sleeper screws to concrete sleepers to the prescribed tightening torque of 180-220 Nm (in case of use of double elastic rings Fe6), or to another one if prescribed in the drawing documentation of the turnout
- test the switching and seating of the tongues in the switch with the help of the switch box
- check the geometry of the structure according to the drawing documentation, check the completeness
- weld joints with regard to the welding technology used, always after total directional and height adjustment and checking of the building dimensions of the turnout
- carry out the acceptance of the turnout according to the drawing documentation

ad 6.2. Installation of partly pre-assembled tramway turnout:

a) switch mounted completely with gauge bars and switch box, separately supplied frog, check rails and track fastenings

- lay out the wooden or concrete sleepers according to the layout drawing of the turnout
- using the band, draw the centre points of the sole plates on rail feet
- lay out the polyethylene pads and sole plates, insert rubber pads into ribbed baseplates
- fix the base plates to the rail (switch, frog) using fasteners

- to the assembled switch, put 1 pcs of outer straight running rail (rail with check rail) using string, check the construction length including joints for welds.
- position the frog, align it with a gauge bar. Check the construction length of the turnout and the distance from the turnout beginning until the mathematical point of the crossing in the frog (MK). Check the rail counter-laying using angle bar to 90°.
- set the curved rail (rail with check rail). Set the rail in the gauge using gauge bar.
- check the counter-laying of rail ends to 90°
- if necessary, adjust the contact between the inner rails and the frog by grinding the foot
- check the construction dimensions of installed switch parts, assembly gauge bars according to numbers, double check the gauge, or adjust the gauge using steel washers, fasten the joints with fishplates
- carry out a general check of the construction dimensions of the installed turnout according to the drawing documentation, check the tightness of all screws
- carry out a possible adjustment of position and fan-shaping of wooden or concrete sleepers
- drill holes in wooden sleepers and turn the sleeper screws to the prescribed tightening torque of 180–220 Nm (in case of use of double elastic rings Fe6), or to another one if prescribed in the drawing documentation of the turnout.
- turn the sleeper screws to concrete sleepers to the prescribed tightening torque of 180-220 Nm (in case of use of double elastic rings Fe6), or to another one if prescribed in the drawing documentation of the turnout
- test the switching and seating of the tongues in the switch with the help of the switch box
- check the geometry of the structure according to the drawing documentation, check the completeness
- weld joints with regard to the welding technology used, always after total directional and height adjustment and checking of the building dimensions of the turnout
- carry out the acceptance of the turnout according to the drawing documentation

b) switch mounted completely with gauge bars and switch box, middle part consisting of 2 pcs of rails, 2 pcs of rails joint with check rails, separately supplied frog and track fastenings

- lay out the wooden or concrete sleepers according to the layout drawing of the turnout
- using the band, draw the centre points of the sole plates on rail feet
- lay out the polyethylene pads and sole plates, insert rubber pads into ribbed baseplates
- fix the base plates to the rail (switch, frog) using fasteners
- to the assembled switch, put 1 pc of outer straight running rail (rail with check rail) using string, check the construction length including joints to weld
- position the inner straight running rail to the frog, position the frog. Position using the gauge bar. Check the construction length of the turnout and the distance from the turnout beginning until the mathematical point of the crossing in the frog (MK) Check the rail counter-laying using angle bar to 90°.
- set the outer curved rail between the switch and the frog
- set the curved rail (rail with check rail). Set the rail in the gauge using gauge bar.
- check the counter-laying of rail ends to 90°
- if necessary, adjust the contact between the inner rails and the frog by grinding the foot
- check the construction dimensions of installed switch parts, assembly gauge bars according to numbers, double check the gauge, or adjust the gauge using steel washers, fasten the joints with fishplates
- carry out a general check of the construction dimensions of the installed turnout according to the drawing documentation, check the tightness of all screws
- carry out a possible adjustment of position and fan-shaping of wooden or concrete sleepers

- drill holes in wooden sleepers and turn the sleeper screws to the prescribed tightening torque of 180–220 Nm (in case of use of double elastic rings Fe6), or to another one if prescribed in the drawing documentation of the turnout
- turn the sleeper screws to concrete sleepers to the prescribed tightening torque of 180-220 Nm (in case of use of double elastic rings Fe6), or to another one if prescribed in the drawing documentation of the turnout
- test the switching and seating of the tongues in the switch with the help of the switch box
- check the geometry of the structure according to the drawing documentation, check the completeness
- weld joints with regard to the welding technology used, always after total directional and height adjustment and checking of the building dimensions of the turnout
- carry out the acceptance of the turnout according to the drawing documentation

c) switch mounted completely with gauge bars and switch box, middle part consisting of 4 pcs of rails, separately supplied frog, check rails and track fastenings

- lay out the wooden or concrete sleepers according to the layout drawing of the turnout
- using the band, draw the centre points of the sole plates on rail feet
- lay out the polyethylene pads and sole plates, insert rubber pads into ribbed baseplates
- fix the base plates to the rail (switch, frog) using fasteners
- to the assembled switch, put 1 pc of outer straight running rail (rail with check rail) using string, check the construction length including joints to weld
- position the inner straight running rail to the frog, position the frog. Position using the gauge bar. Check the construction length of the turnout and the distance from the turnout beginning until the mathematical point of the crossing in the frog (MK) Check the rail counter-laying using angle bar to 90°.
- set the outer curved rail between the switch and the frog
- set the curved rail (rail with check rail). Set the rail in the gauge using gauge bar.
- check the counter-laying of rail ends to 90°
- if necessary, adjust the contact between the inner rails and the frog by grinding the foot
- check the construction dimensions of installed switch parts, assembly gauge bars according to numbers, double check the gauge, or adjust the gauge using steel washers, fasten the joints with fishplates
- carry out a general check of the construction dimensions of the installed turnout according to the drawing documentation, check the tightness of all screws
- carry out a possible adjustment of position and fan-shaping of wooden or concrete sleepers
- drill holes in wooden sleepers and turn the sleeper screws to the prescribed tightening torque of 180–220 Nm (in case of use of double elastic rings Fe6), or to another one if prescribed in the drawing documentation of the turnout.
- turn the sleeper screws to concrete sleepers to the prescribed tightening torque of 180-220 Nm (in case of use of double elastic rings Fe6), or to another one if prescribed in the drawing documentation of the turnout.
- test the switching and seating of the tongues in the switch with the help of the switch box
- check the geometry of the structure according to the drawing documentation, check the completeness
- weld joints with regard to the welding technology used, always after total directional and height adjustment and checking of the building dimensions of the turnout
- carry out the acceptance of the turnout according to the drawing documentation

ad 6.3. Installation of pre-assembled turnout:

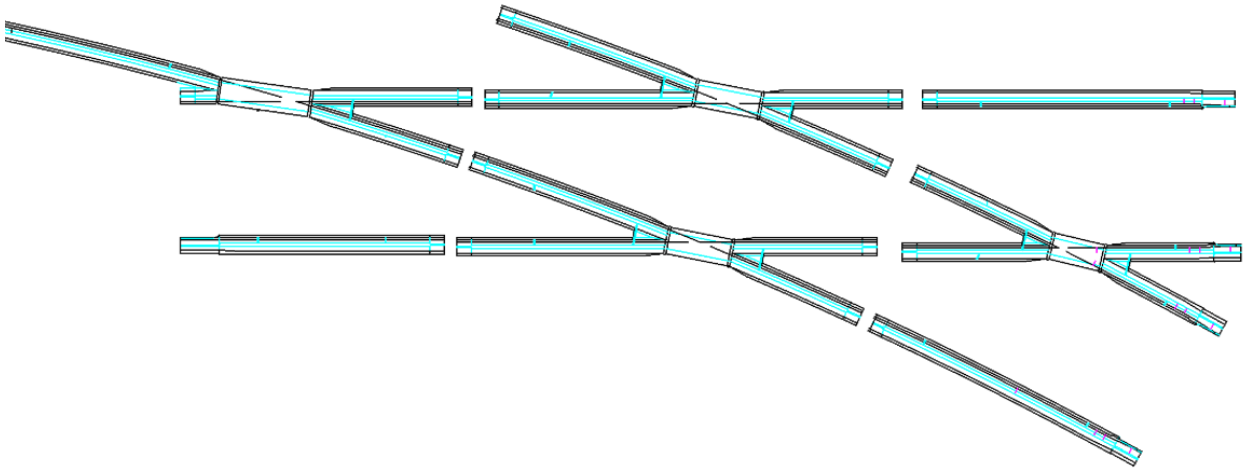
- lay out the wooden or concrete sleepers according to the layout drawing of the turnout
- using the band, draw the centre points of the sole plates on rail feet
- lay out the polyethylene pads, sole plates and rubber pads into baseplates for curved rail
- position weldment – switches, frogs and straight rails according to the construction plan
- gauge check, gauge bars, set at factory, must not be dismantled
- check the constructional dimensions of the installed parts of the switch
- position the outer curved rail on the gauge with the frog, mount the gauge bars, measure the gauge
- check the gauge according to the drawing documentation with a calibrated gauge bar, which must be marked with a calibration mark
- carry out a general check of the construction dimensions of the installed turnout according to the drawing documentation, check the tightness of all screws
- carry out a possible adjustment of position and fan-shaping of wooden or concrete sleepers
- fasten the base plates to the rail using fasteners
- drill holes in wooden sleepers and turn the sleeper screws to the prescribed tightening torque
- turn the sleeper screws to the prescribed tightening torque in concrete sleepers
- test the switching of tongues in the switch in the switch with the help of the switch key and electric point operating apparatus (if the switch box is equipped with an electric point operating apparatus)
- check the geometry of the structure according to the drawing documentation, check the completeness
- weld joints with regard to the welding technology used, always after total directional and height adjustment and checking of the building dimensions of the turnout
- carry out the acceptance of the turnout according to the drawing documentation

7 Installation of tramway crossing

Crossing is supplied as:

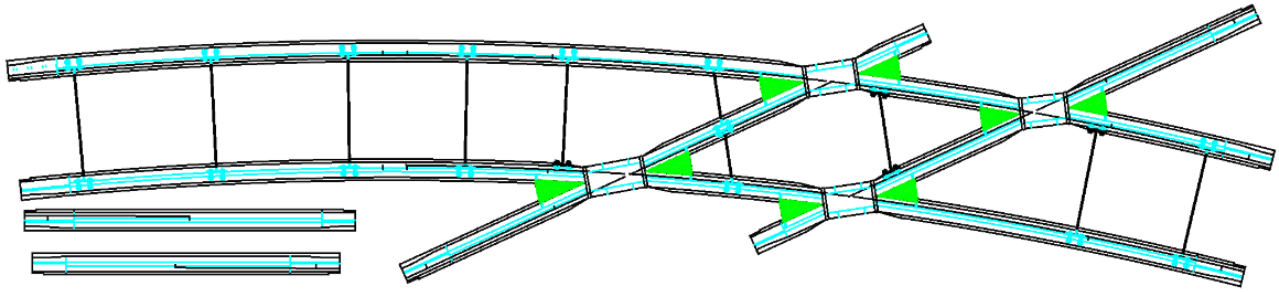
7.1 Not pre-assembled tramway crossing

- frogs, rails (check rails), track fastenings



7.2 Partly pre-assembled tramway crossing

- central section complete, branch closure rails (check rails) dismantled



Installation:

ad 7.1 Not pre-assembled tramway crossing

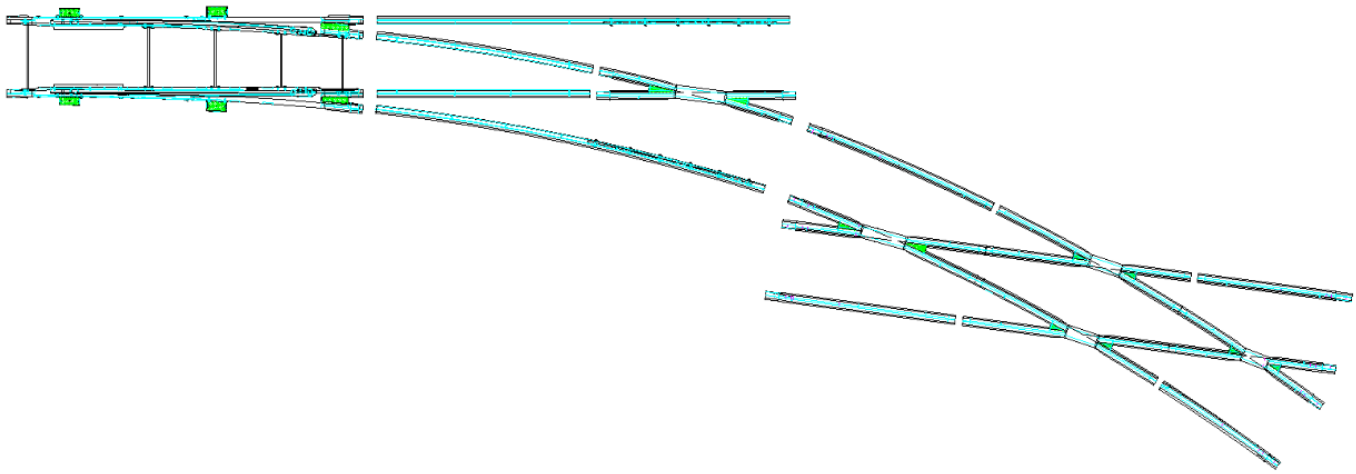
- using the band, draw the centre points of the sole plates on rail feet
- lay out the sole plates and polyethylene pads, insert rubber pads into ribbed baseplates
- position the crossing according to the layout
- carry out a general check of the construction dimensions according to the drawing documentation
- check the straightness of the running edges
- check the geometry of the structure according to the drawing documentation, check the completeness
- weld joints with regard to the welding technology used, always after total adjustment and checking of the building dimensions of the crossing
- carry out the acceptance of the tramway crossing to the drawing documentation

ad 7.2 Partly pre-assembled tramway crossing

- assemble the central section and the dismantled closure rails using gauge bars, the gauge bars and their position are marked with numbers
- using the band, draw the centre points of the sole plates on rail feet
- lay out the polyethylene pads, sole plates and insert rubber pads into sole plates
- position the crossing according to the layout
- carry out a general check of the construction dimensions according to the drawing documentation
- check the straightness of the running edges
- check the geometry of the structure according to the drawing documentation, check the completeness
- weld joints with regard to the welding technology used, always after total adjustment and checking of the building dimensions of the crossing
- carry out the acceptance of the tramway crossing according to the drawing documentation

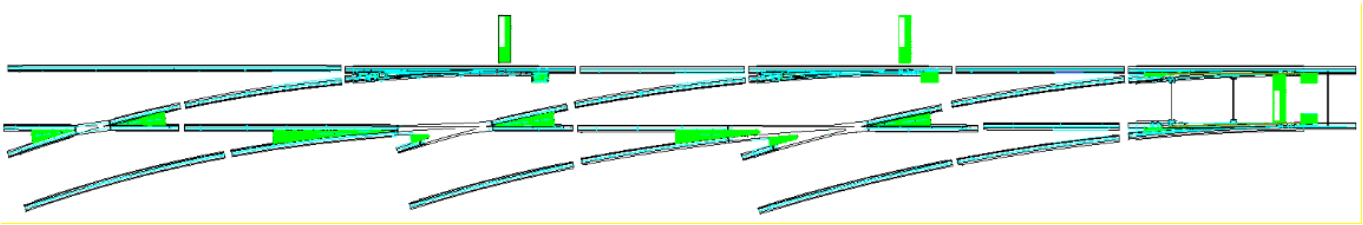
8 Installation of tramway combination, multiple track branching a diamond crossing

Typically, the **combination of a tramway system** consists of the following parts - one or two turnouts and a crossing. The crossing is made of four frogs or alternatively as a crossing of blocks and running rails.



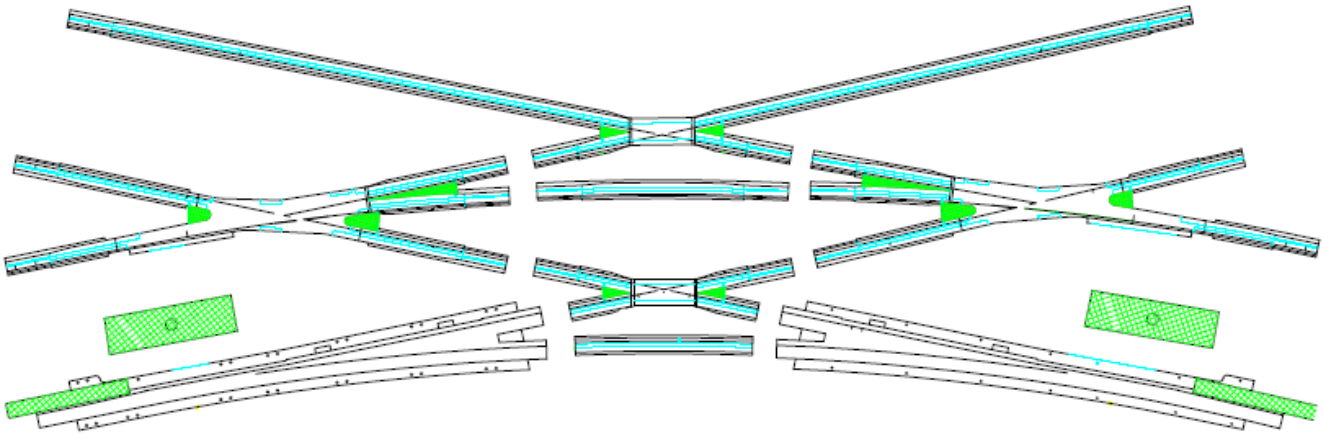
The installation of the combination is governed by the layout drawing of the tramway system. The assembly of the combination is governed by the assembly procedures described in the previous section of tramway turnouts and crossings installation.

Multiple track branching consists of one switch and, according to the number of required branching, of the appropriate number of half switches, of frogs and running rails.



The installation of the multiple track branching is governed by the layout drawing or by the drawing documentation of the tramway system. The assembly of the multiple track branching is governed by the assembly procedures described in the previous section of tramway turnouts and crossings installation.

The **diamond crossing** consists of half-switches, frogs and running rails.



The assembly of the diamond crossing is governed by the assembly procedures described in the previous section of tramway turnouts and crossings installation.

Weld joints with regard to the welding technology used, always after total adjustment and checking of the building dimensions.

9 Welding joints of tramway turnouts and structures

9.1 Temperature limitation for welding joints of turnout structures

Welding work can only be carried out in the track under favourable climatic conditions and at an air temperature of at least +5 °C (the temperature is measured 10 cm above the ground). Welding of tongues which are heated by rod heaters can also be done even at 0 °C and above.

When welding the closing welds of railroad lines without additional tension adjustments, the rail temperature is:
in rails with open railway bed (long-welded rail) from +15 °C to +25 °C,
in rails with embedded railway bed from +10 °C to +28 °C.
If it is necessary to weld in adverse climatic conditions (accidents), technological conditions of welding must be ensured, guaranteeing the quality of welds and overlays (e.g. preheating, protection against rain and snow).

The minimum permissible rail temperature is set:
– for flash butt welding -10 °C,
– for aluminothermic welding -3 °C,
– for arc welding 0°C.
Another condition for starting electric arc welding is a wind speed of less than 50 km/h.

If the rail temperature is below +10 ° C, the rails must be tempered. Both rails are heated in length of about 50 cm from rail surface to 30 – 50 °C with preheating burner. During flash butt welding the rails are not tempered.

10 Maintenance of tramway turnouts, structures and their parts

The manual includes performing preventive, control and maintenance work necessary for the safety and smoothness of the operation of tramway structures built into the track.

The operator must keep records of the inspections and adjustments made to the turnout during the warranty period and to provide them to the manufacturer on request.

10.1 Switch

– check of the tightening of the screws at the hinge point	once every 14 days
– check of the tightening of the screws of the shims, rigidity of tongue fixing at the heel	once every 14 days
– check of tongue switching by latch test according to relevant standards	once a month
– cleaning of functional sliding surfaces from impurities and subsequent lubrication with ecological lubricant, lubrication intervals according to the number of switchings	ca. after 100 switchings, min. once a month
– check of mechanical wear of running and holding surfaces, overall cohesion of the structure	once a week
– check of the tightening of the screws on the covers and tie rods of switch box	once every 14 days
– cleaning the interior of the ad switch box	twice a year
– lubrication and maintenance of the switch box according to the maintenance manual (manual supplied with the box)	once every 14 days

In the case of tramway structures equipped with the DT tongue adapter, the maintenance of this adapter is governed by the instructions given in Annex 4 of this manual.

10.2 Frog

– check of the vee	daily
– check of the width and depth of the grooves for wear	once a week

10.3 Intermediate rails

– check of wear of running and holding surfaces	once a week

10.4 Overall inspection of the structure

–cohesion check, weld check	once every 14 days
– check of cant of individual railroad lines within six months of installation	twice a year
– check of the gauge in the branch and straight line within six months of installation	twice a year

10.5 Switch boxes

– inspection according to the User Instructions for the individual types of switch boxes supplied

10.6 Laps

Laps within the permissible range:

Running surfaces require inspection at regular intervals. It is recommended to grind the burrs and laps resulting from the operation, greater than 1 mm. Regular grinding, which removes laps or other unevenness caused by running in the rail or overlay, prevents cracks and crumbling on the running surfaces both on non-overlaid structures and on overlays at overlaid structures. In the case of austenitic overlays, grinding is important at the time when the welds are being hardened. At this stage, laps and loss of material associated with hardening can occur shortly after the start of operation, see Annex 1.

The grooves must be kept clean by regular cleaning depending on the weather conditions. When cleaning, concentrate mainly on coarse dirt that could compromise the safety of operation or cause abrasive wear on the rails and damage to the overlays on bottom and sides of grooves of welded structures.

An example of a lap is shown in Figure 4.

Figure 4 - a lap

10.7 The procedure for replacing the interchangeable tongue

Replacement of interchangeable tongue must be done according to the instructions in Annex no. 1 to this document.

10.8 The procedure for replacing the interchangeable frog insert

Replacement of interchangeable frog insert must be done according to the instructions in Annex no. 2 to this document.

10.9 Procedure for solving rail fractures or welds using seam welding of a rail insert for structures with cladding (CrNi, CrMn) when using AT welding or Innershield welding methods

In the event of a rail or weld fracture occurring, this location shall, where necessary, be secured against mutual lateral and vertical displacement of the two parts by fish plates. In the case of fracture in the weld, shaped plates are used. Measure and mark the locations for rail section cut-out with the fracture so that the cut-out locations are in between sleepers. The fish plate for fracture repair must not be drilled, with ends cut off by saw or grinding.
The damaged area is cut and replaced with a fish plate. The distance between the two cuts must be equal to the length of the fish plate, increased by the size of both joints for welds. Before welding both welds, it is necessary to grind off the overlays from ends of the rails in the length of approx. 50 mm from both sides of the future weld. It is then possible to weld both welds.
After cleaning the whole finished weld and grinding the weld head and the groove, the cladding is made in the groove so that the cladding is continuous without interruptions.

10.10 Cladding procedure

10.10.1 Austenitic cladding (CrNi, CrMn)

The maintenance and regeneration of claddings must comply with instructions stated in Appendix 1 to this document.

10.10.2 Martensitic-bainitic cladding

This section is processed based on information and experience of testing institutes and companies engaged in production, welding and cladding of rail steel. It is not a binding procedure but only the manufacturer's recommendation for executing welding of switch parts and track structures made under the below stated qualities of rail steel used in production of switches and track structures.

R200 (Hardness 200 to 240 HB)

- Preheating to 300 °C in the area of the future cladding, and 100 mm before and after the cladding
- Electrode welding with quality according to EN 14700: E Z Fe 1, e.g. OK Weartrode 30
  EN 14700: E Fe1, e.g. OK Weartrode 35
- Cladding hardness in the 3rd layer: 290 HB or 330 HB
- Cored wire welding with quality according to EN 14700: T Z Fe 3, e.g. OK Tubrodur 35 O M
- Cladding hardness: 290 to 380 HB

R220G1 (Hardness 220 to 260 HB)

- Preheating to 300 °C in the area of the future cladding, and 100 mm before and after the cladding
- Electrode welding with quality according to EN 14700: E Z Fe 1, e.g. OK Weartrode 30
  EN 14700: E Fe1, e.g. OK Weartrode 35
- Cladding hardness in the 3rd layer: 290 HB or 330 HB
- Cored wire welding with quality according to EN 14700: T Z Fe 3, e.g. OK Tubrodur 35 O M
- Cladding hardness: 290 to 380 HB

R260, R260V (Hardness 260 to 300 HB or 260 to 330 HB)
- Preheating to 400 °C in the area of the future cladding, and 100 mm before and after the cladding
- Electrode welding with quality according to EN 14700: E Fe1, e.g. OK Weartrode 35
- Cladding hardness in the 3rd layer: 330 HB
- Cored wire welding with quality according to EN 14700: T Z Fe 3, e.g. OK Tubrodur 35 O M
- Cladding hardness: 290 to 380 HB

R350HT (Hardness 350 to 390 HB)
- Preheating to 400 °C in the area of the future cladding, and 100 mm before and after the cladding
- Electrode welding with quality according to EN 14700: E Fe1, e.g. OK Weartrode 35
- Cladding hardness in the 3rd layer: 330 HB
- Cored wire welding with quality according to EN 14700: T Z Fe 3, e.g. OK Tubrodur 35 O M
- Cladding hardness: 290 to 380 HB

Dillidur 400V, Dillidur 400T (Hardness 360 to 440 HB)
- Preheating to 100 °C in the area of the future cladding, and 100 mm before and after the cladding
- If the temperature during cladding increases over 200 °C, it is necessary to stop welding until the temperature decreases to approx. 120 °C. Long-term overheating over 200 °C must be prevented by gaps in the cladding (a cooling system must not be installed) since the hardness and the abrasion resistance of the base material is then reduced.
- Electrode welding with quality according to EN 14700: E Fe1, e.g. OK Weartrode 35
- Cladding hardness in the 3rd layer: 330 HB
- Cored wire welding with quality according to EN 14700: T Z Fe 3, e.g. OK Tubrodur 35 O M
- Cladding hardness: 290 to 380 HB

11 Occupational health and safety, environmental issues

11.1 Assessment of risks related to occupational health and safety

The manufacturer declares that, in relation to operation and maintenance of tram switches, intersections and track equipment according to these instructions, it is not aware of any specific safety risks associated with these activities that would have to be specifically addressed in these instructions. These are common activities performed during construction, assembly and maintenance work on the rail surface. When performing the activities, the implementation company and their workers must comply with regulations for occupational health and safety related to this type of activity performed in accordance with applicable legislation (e.g. use of personal protective equipment, storage, work with lifting equipment).

11.2 Assessment of risks related to the impact on the working conditions and the environment

The operation and maintenance of tram switches, intersections and track equipment according to these instructions do not have a negative impact on the environment when operated correctly. During their design and development, the best available technologies were used and the environmental requirements were respected to the maximum possible extent. During their operation, no waste is generated.

The manufacturer is certified according to EN ISO 14001.

During transport and handling with switches, intersections and track equipment according to these instructions, packaging (wooden crates, wooden pallets, wooden interlays, tying wire, tying slings, or other suitable fixing material) is used that meets the conditions for having packaging on the market in accordance with applicable legislation in the Czech Republic. The manufacturer is involved in the Ekokom waste disposal system. All packaging and materials are for single use only, designated according to ČSN 770052-2. After use, other waste must be properly sorted and handed over to persons authorised to dispose of it in accordance with applicable legislation. Materials used for packaging are fully recyclable. The environmental soundness of the delivered material for the production of packaging is documented by the manufacturer.

During assembly and maintenance of tram switches, intersections and track equipment according to these instructions, hazardous and other waste in compliance with the applicable legislation may be generated, in particular:

120101	Ferrous metal filings and turnings
150103	Wooden packaging
150110*	Packaging containing residues of hazardous substances
150202*	Absorption agents
170101	Concrete
170204*	Glass, plastic and wood containing hazardous substances
170405	Iron and steel

Note: (*) designation of hazardous waste

This waste must be sorted and handed over to persons authorised to dispose of it in accordance with applicable legislation.

During disposal after the end of the life cycle of tram switches, intersections and track equipment according to these instructions, hazardous and other waste is generated, in particular:

120101	Ferrous metal filings and turnings
150202*	Absorption agents
170101	Concrete
170106*	Mixtures or separate fractions of concrete containing hazardous substances
170204*	Glass, plastic and wood containing hazardous substances
170405	Iron and steel
200138	Wood not listed under 200137*

Note: (*) designation of hazardous waste

This waste must be sorted and handed over to persons authorised to dispose of it in accordance with applicable legislation. The above stated obligations must be ensured by respective companies in accordance with the concluded contract.

12 Final part

For each installation of the assembled tramway turnout and structure the contractor shall process its technological process based on the type of transport and installation machinery used. This procedure must respect the general standards and the above-mentioned working procedures. It is also necessary to take into account the regulations and specific conditions of the site.

13 Related standards and regulations

Act no. 183/2006 Coll.	Spatial Planning Act and Building Code (Building Act)
Act no. 22/1997 Coll.	Act on technical requirements for products
Act no.266/1994 Coll.	Railways Act

Government Regulation no. 163/2002 Coll. Government Regulation laying down technical requirements for selected construction products

Decree no. 173/1995 Coll.	Decree issuing the Traffic regulations of railways
ČSN 736405	Projecting of tramway lines
ČSN 280318	Track gauge and contour lines for tramways
ČSN 280318	Track gauge and contour lines for tramways
ČSN 736412	Geometrical arrangement of track for tramway lines
TPD 63/02	Tramway rail structures
TPD 352/2022	Setting and electrical control cabinets for tram switches

TP and TPD of manufacturers of materials and parts used in the manufacture of tramway structures

Instructions for users of individual types of switch boxes

This operating and maintenance manual has been prepared in accordance with the above regulations valid in the Czech Republic. For deliveries abroad, the user must respect any different requirements arising from the applicable local legislation and regulations.

All the above standards, regulations and documents are considered as amended.

Annex no. 1

Maintenance instructions for hard surfaced areas (Cr-Mn and Cr-Ni)

1. Basic information about the types of overlays used

Due to the expected excessive wear, tram turnouts and structures can be provided with CrNi-type overlays on the bottom and sides of the grooves or CrMn with a CrNi intermediate layer on the bottom of the grooves. These types of overlays have been developed for welding new parts of tram turnouts and structures, where the groove for overlay is created by machining. The hardness of the surface of the overlays after welding reaches approx. 200 to 260 HB (25 HRC) and the overlays are strengthened up to 400 to 550 HV (40 to 51.5 HRC) by the operating load.. Overlaying technology can also be used for wornrails, where the maximum height and side wear is 6 mm, which is the height of the overlay on new products.

2. The procedure for overlay maintenance

2.1 Overlay hardening stage

The overlays have a lower hardness after welding. Due to their ability to harden during driving, they are hardened on the surface up to the above values. This corresponds to adequate wear of the overlays. In time, this process depends on the type of travel and load. Prior to hardening, laps may occur on the surface of the overlays, or flakes and similar defects which can be removed by grinding or polishing. Therefore, it is necessary to inspect the welds at regular intervals (but initially more often), according to the Transport Company's practices, and to regrind any laps and incompleteness in order to prevent their spread. During inspections, pay attention to the vees and the areas of AT welds.

2.2 Stages after hardening - full functionality of the overlay

After reaching almost the maximum surface hardness, there is a period during which the overlay should not show the formation of larger laps or other defects. Even during this period, it is necessary to check the condition and integrity of the overlays from time to time and to grind as needed. Even in this period, the overlay still strengthens, but only to a small extent, and there is a corresponding reasonable wear.

2.3 Stage after depletion of overlay plasticity

After depletion of the plasticity of the overlay surface, the most stressed areas of the overlay will show the greatest wear, where imperfections such as flakes, cracks and small crumbles may form. During further running, they may partially or sometimes completely disappear due to running. In these cases, it is not yet necessary to repair them by welding. However, if these defects do not disappear anymore and tend to expand or the overlay shows excessive wear (greater than 6 mm), it is necessary to proceed with welding.

3. Overlay regeneration

The object must be in a suitable technical condition before welding on in the track. In the rain, workplace must be protected with a shelter. Welding on in the track requires lockout. The principles of work safety in the track, general principles of work safety and fire protection must be observed during work.

When regenerating overlaid surfaces, worn during operation, it is necessary to use the same welding consumable as the material of the original overlay or an alternative welding consumable from another manufacturer.

3.1 Surface cleaning and preparation for overlaying

Before performing the regeneration, it is necessary to clean the entire groove from all impurities, grease and moisture, grind burrs, laps and remove defects in the overlay. If the rail material at the

overlay interface is oxidized, this surface must be cleaned by grinding to eliminate defects. The places of greatest wear and the occurrence of defects shall be recorded and drawn in the welding log, including dimensioning; possible photo documentation, which is not necessary.

3.2 Temperature mode during overlaying

Keep the preheating temperature and during overlaying in the range of 90 ÷ 110°C in length exceeding approx. 100 mm on each side from the overlaid place (preheating has a favourable effect on the structure in the TOO under the overlay and it is suitable to apply it to remove moisture in overlaying places) . Check the temperature at a distance of approx. 20 mm around the circumference of the overlay with a contact thermometer.

3.3 Overlay regeneration at the bottom of the groove

In case of used CrNi overlay - weld on the required number of overlay layers with ESAB OK Tubrodur 200 O D (14.71) tubular wire, diameter 1.6 mm, or with ESAB OK 67.45 electrode (or Böhler FOX A7), diameter 5 (4 mm, 3.2 mm), up to the required height. The welder selects the electrode diameter as needed. The height of the overlay should be approx. 6 mm.

In the case of the used CrMn overlay with CrNi intermediate layer - if the original overlay on the bottom is rutted or damaged and ground to the base rail material, it is necessary to restore the CrNi intermediate layer with Böhler FOX A7 electrode (or OK 67.45), diameter 5 mm (4 mm, 3. 2 mm). The welder selects the electrode diameter as needed. Weld the intermediate layer so that its thickness is approx. 2 mm. After welding on, level the surface of the intermediate layer by regrinding.

If it is only necessary to restore the shape of the CrMn overlay, without the CrNi intermediate layer being damaged, weld on the required number of overlay layers with Böhler BMC-FD tubular wire, diameter 1.6 mm, or alternatively with a Böhler FOX BMC electrode, diameter 5 mm (4 mm, 3.2 mm), up to the required height. The welder selects the electrode diameter as needed. The overall thickness of the overlay should be approx. 6 mm.

Laying of the welding beads must be performed side by side and on top of each other in layers up to the required height and width of the overlay on the surrounding unworn surfaces. The overlay on the bottom of the groove must have a sufficient allowance for grinding in such a way that after fine grinding, there are no unwelded places, i.e. defects like the missing material. The weld beads must be placed in the groove parallel to the driven edge. The size of the weld bead overlap is equal to 1/3 of the width of the weld bead. The connection of individual weld beads must be "graded" - always in a different place of the overlay.

Slag must be removed from each welded bead and the surface cleaned with a wire disc mounted in a grinder or a with steel brush. Visible defects (pores, cracks, poorly connected places, welded slag, etc.) must be ground to a clean material and re-welded with another weld bead. The transition of the overlay to the base material must be smooth without weld undercut, overflowing material or large spatter.

The overlaying or overlay repairs at the bottom of the groove shall be recorded and drawn in the welding log, including dimensioning; possible photo documentation, which is not necessary.

3.4 Regeneration of overlays on the sides of the groove (running edge, flange)

When regenerating overlays on the sides of the groove or any other defects in the base material outside the overlay, e.g. on the top of rails, blocks, groove edges, vees or rail flange, the same temperature regime applies as when regenerating the bottom of the groove. Weld on the required number of overlay layers with ESAB OK Tubrodur 200 O D (14.71) tubular wire, diameter 1.6 mm, or with ESAB OK 67.45 electrode (or Böhler FOX A7), diameter 5 (4 mm, 3.2 mm), up to the required height and thickness. The welder selects the electrode diameter as needed. The

thickness of the overlay should be approx. 6 mm, height along the entire side of the groove and on the driven edge.

The overlay on the sides of the groove must have a sufficient allowance for grinding in such a way that after fine grinding, there are no unwelded places, i.e. defects like the missing material. The weld beads must be placed on top of each other on the side of the groove parallel to the driven edge. The connection of individual weld beads must be "graded" - always in a different place of the overlay. The number of weld layers depends on the extent of overlay regeneration.

Slag must be removed from each welded bead and the surface cleaned with a wire disc mounted in a grinder or a with steel brush. Visible defects (pores, cracks, poorly connected places, welded slag, etc.) must be ground to a clean material and re-welded with another weld bead. The transition of the overlay to the base material must be smooth without weld undercut, overflowing material or large spatter.

The overlaying or overlay repairs on the sides of the groove shall be recorded and drawn in the welding log, including dimensioning from the vees; possible photo documentation during overlaying, which is not necessary.

3.5 Overlay grinding after regeneration

After welding on, grind the overlays to the desired shape so that the overlaid surfaces smoothly transition to non-welded surfaces without sharp edges, notches, undercuts, and unwelded areas. Check the flatness of the overlays and running edges with a steel ruler during grinding. The overlay must be ground to maintain the required depth and width of the grooves. After grinding, visually inspect the surface of the overlays. No visible defects, in particular cracks, welded slag and clusters or rows of pores, must be detected. If they occur, the defects must be ground and repaired. If an insufficient overlay thickness is detected, it must be welded immediately to the required size.

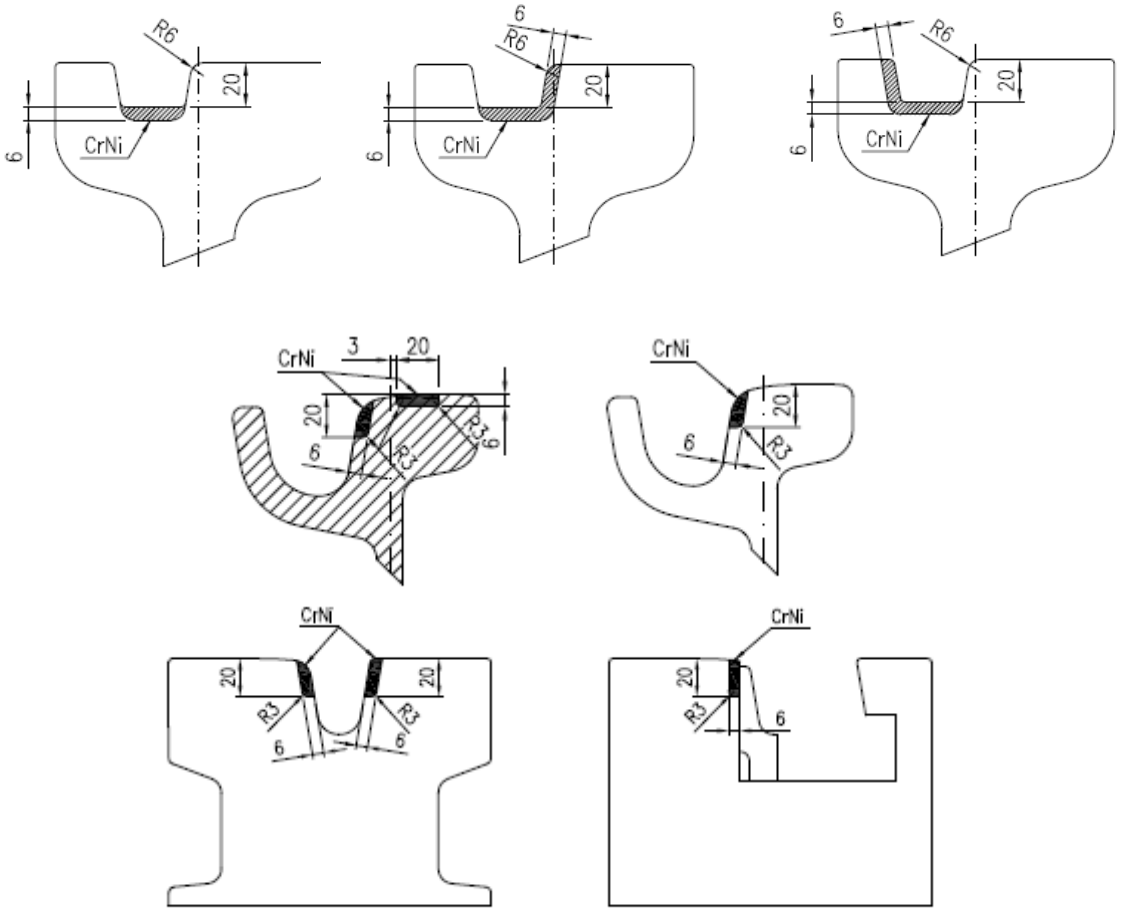


Diagram of the standard design of CrNi overlays at the bottom and on the sides of the grooves

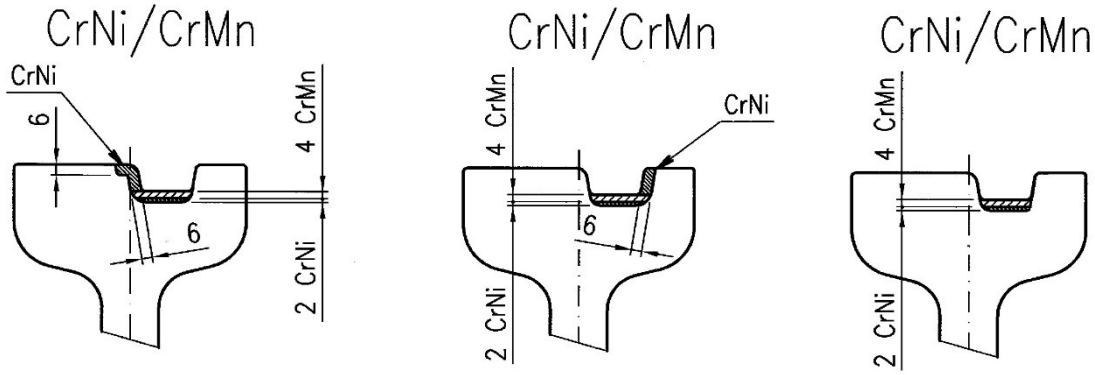


Diagram of standard design of CrMn overlays with CrNi intermediate layer at the bottom of the groove and CrNi on the sides of the groove

3.6 Follow-up maintenance

After regeneration of the overlays or repair of defects, the reworked overlays again have a lower initial surface hardness than the overlays already strengthened by operation. The whole hardening process and the individual phases of hardeningof the overlays and maintenance are repeated again from point 2.1.

4. Qualification of welders

track metal welder

- welding-on of rails manually by electric arc with coated electrode C-E 2/K
- semi-automatic electric arc welding of rails with flux cored wire electrode C-M 2/K

The qualification of welders for individual welding or overlaying operations must meet the internal requirements of the local railway manager and the national legislative requirements at the place of use.

Annex no. 2

Replacement procedure for interchangeable frog inserts made from wear-resistant material (Mn, Dillidur)

Insert mounting

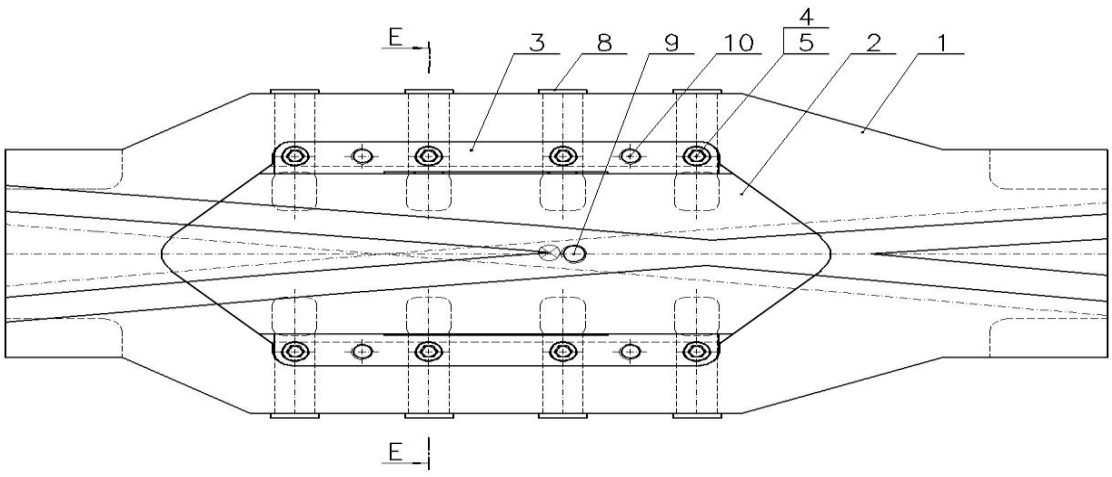
- Clean the entire space of the insert chamber from dirt, coat surfaces and threads with Cu 7439 Plus (Molycote) copper paste or its equivalent.
- Insert M16 cylindrical mounting nuts (pos. 6) into the oval grooves in the bottom of the chamber and position them approximately in the mounting position – coat threads of the nuts with copper paste.
- Align the insert (pos. 2), coat the contact surfaces with copper paste. Check continuity of the geometry of the grooves from the insert (pos.2) to the basic body of the frog (pos.1).
- Insert two wedge shims (pos. 4) coated with copper paste and check the height of the frog.
- Insert and tighten sequentially 8 M16 x 80 Allen 8G fixing screws (pos. 7) with spring washers (pos. 8). Coat the whole screws with copper paste. The tightening torque of the screws is 170 Nm, tighten to a cross. After the tightening, both wedge washers (pos. 4) must be plunged evenly in the basic frog body (pos. 1).
- Check the height and lateral continuity of the insert geometry (pos. 2) in the basic body (pos. 1), the differences should not exceed 0.5 mm. Any unevenness must be manually ground.
- The threads for the forcing-off screws are coated with a copper paste and the nylon caps (pos. 3, 5) are mounted to the base material level.

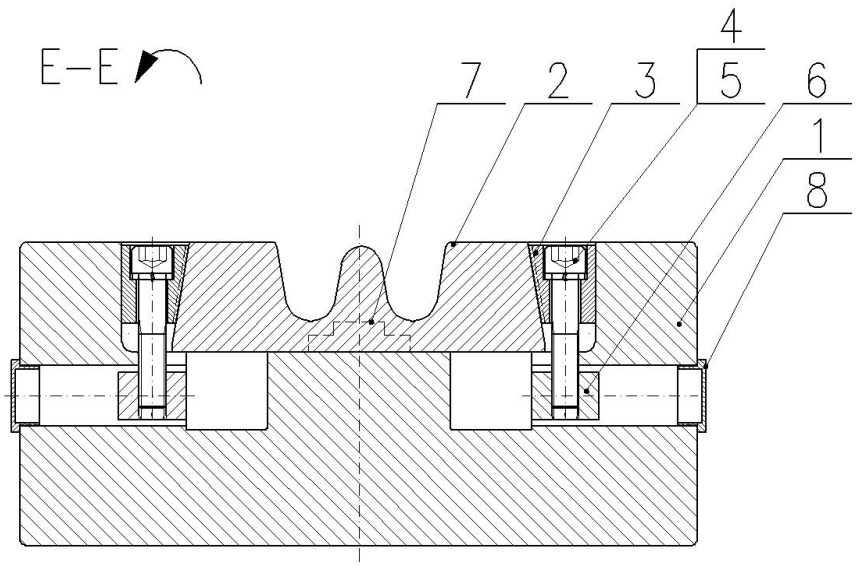
Removing and mounting a new insert

- Loosen 8 M16x 80 Allen screws (pos.7), in case of difficulties, use oil, red brake fluid or WD 40 spray to loosen corroded threads. In the event that this does not help, the screws can be loosened by heating or twisted off (burn the head).
- Remove or drill 4+1 caps (pos. 3 and 5) of the threads of the forcing-off screws, pass the threads through a screw tap (M24, M20) and brush with grease.
- Gradually screw 2 M20 x 80 forcing-off screws into the threads of the wedge shims (pos. 4) and remove them from the frog chamber.
- The M24 x 80 forcing-off screw is screwed into the insert body (pos. 2) and by rotating it and alternate tapping on the insert edge the insert gets pulled out of the basic body chamber (pos. 1). In case of difficult disassembly of the insert due to the contact surfaces caulking, the insert must be removed using brute force or flame cutter.

- Remove the fixing nuts (pos. 6) with any residues of screw in the grooves in the bottom of the frog using the original screws or the hammer point, clean the nuts or replace them with new ones.
- Clean the entire space of the insert chamber with pressurized water, dry and coat with copper paste Cu 7439 plus (Molycote) or its equivalent.
- Insert new M16 cylindrical mounting nuts (pos.6) into the oval grooves in the bottom of the chamber and position them approximately in the mounting position – coat threads of the nuts with copper paste.
- Push in new removable insert (pos. 2), coat the contact surfaces with copper paste. Check continuity of the geometry of the grooves from the insert (pos.2) to the basic body of the frog (pos.1).
- Insert both wedge shims (pos. 4) coated with copper paste and check the height of the frog.
- Insert and tighten sequentially 8 new M16 x 80 Allen 8G fixing screws (pos. 7) with spring washers (pos. 8). Coat the whole screws with copper paste. The tightening torque of the screws is 170 Nm, tighten to a cross. After the tightening, both wedge washers (pos. 4) must be plunged evenly in the basic frog body (pos. 1).
- Check again the height and lateral continuity of the insert geometry (pos.2) in the basic body (pos.1), the differences should not exceed 0.5mm. Any unevenness must be manually ground.
- The threads for the forcing-off screws are coated with a copper paste and the new nylon caps (pos. 3, 5) are mounted to the base material level.

Removable insert tightened to the frog block





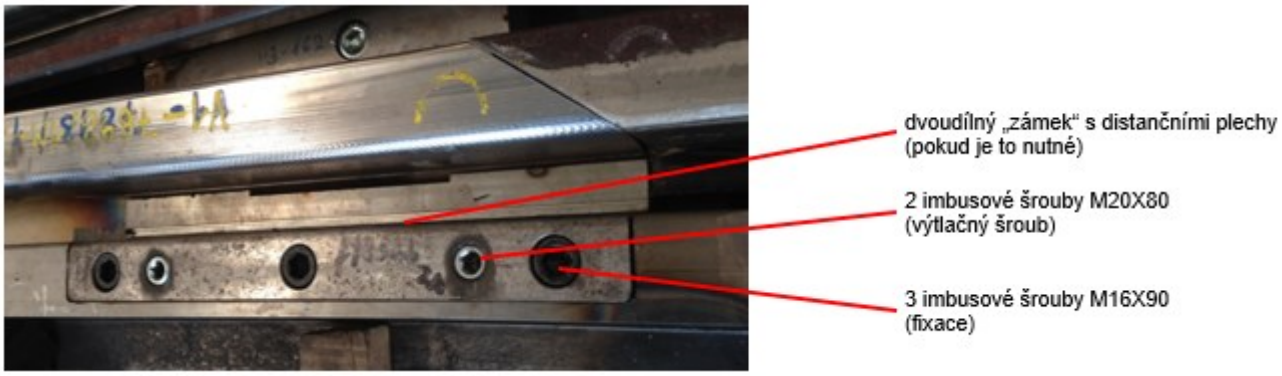
1. BLOK 800
2. VLOŽKA VYMĚNITELNÁ
3. PŘÍLOŽKA KLÍNOVÁ
4. ŠROUB M16x 80–IMBUS
5. PODLOŽKA 16
6. MATICE M16 VÁLC.
7. POUZDRO M24
8. ZÁTKA D43/36
9. KRYTKA M24
10. KRYTKA M20

List of recommended tools for assembly and disassembly of the insert

- 1pcs Allen wrench 14 mm with adapter
- 1pcs Mounting wrench, double-sided, open 36/46 mm
- 1pcs Mounting wrench, double-sided, open 30/36 mm
- 1pcs Torque wrench with a range of approx. 250 Nm - 1/2"
- 1pcs GOLA adapter with Allen bit 14 mm - 1/2"

Annex no. 3

Procedure for replacing the interchangeable tongue

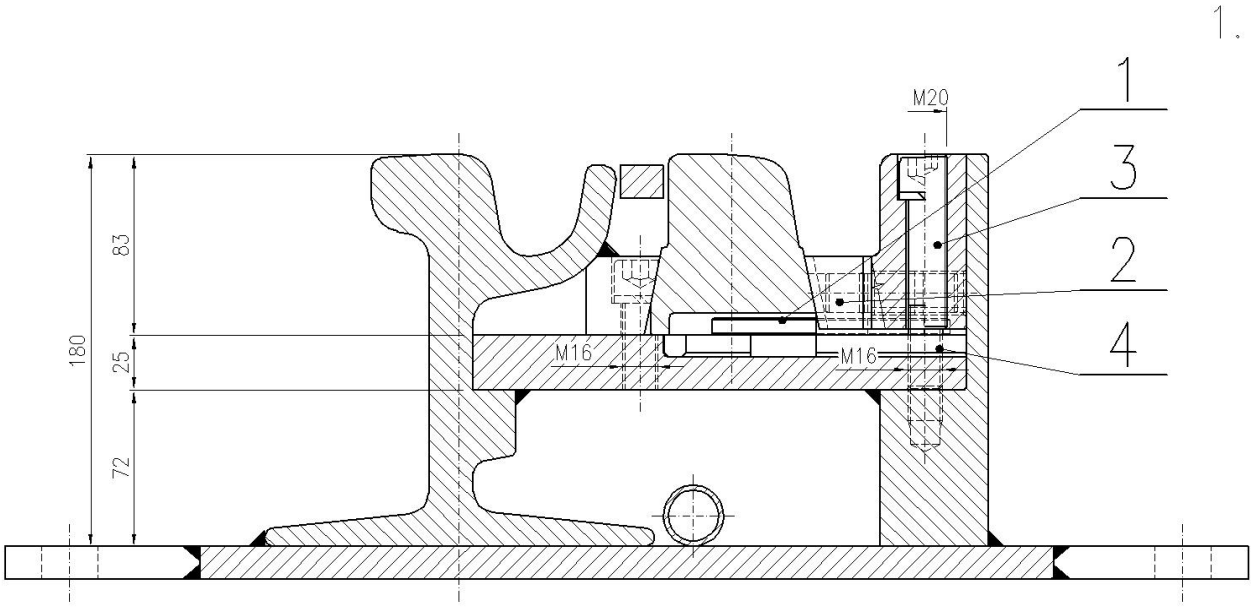


Mounting clamp to tongue:

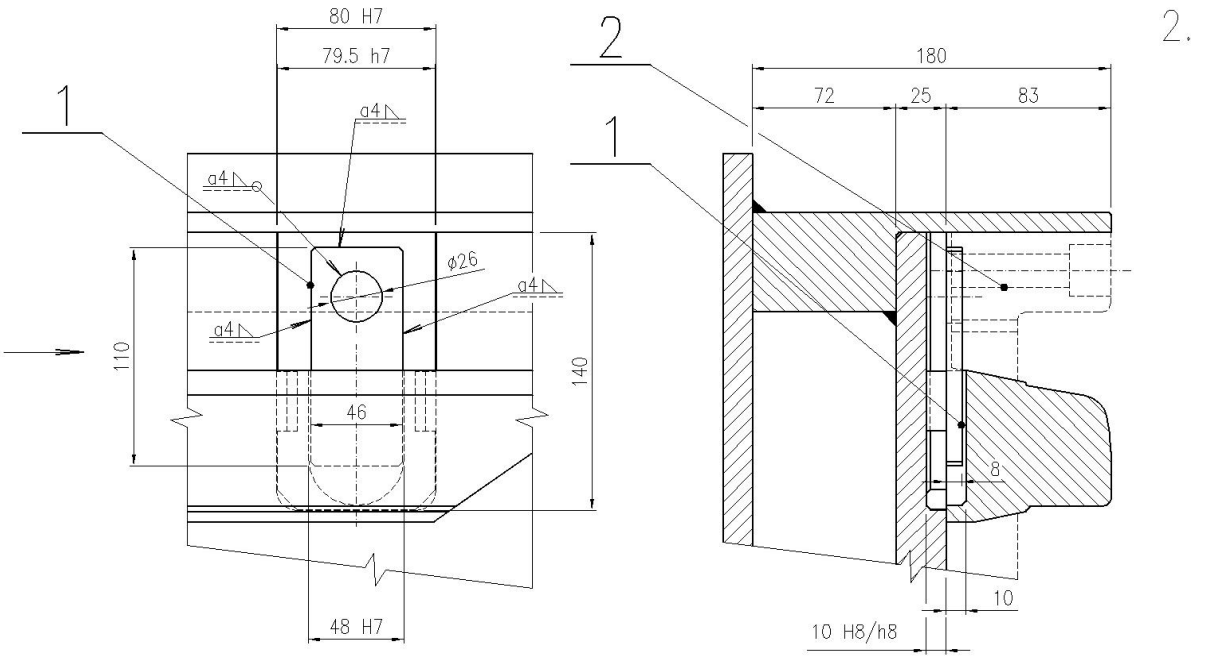
- Position the tongue on the stop (to prevent longitudinal displacement of tongues) attached to the slide plate
- Tighten the tongue in the cube with a drawbar and pull it to the stock rail (part of the operation in placement area of switch box – main drawbar)
- Insert the clamp to the tongue (according to the cut)
- Check the tongue to rail transition to the tongue
- Lubricate the threads of the screws with BEACON 325 grease and slide the spring washer
- Tighten the M16x90 screws alternately to avoid crossing and to hold the entire surface of clamp seated against the side of the tongue heel - measure the gauge given in the drawing documentation
- Measure the gauge using a gauge bar that must be marked with a calibration mark for gauge
- If the tongue is not tightened firmly, it is necessary to replace the spacers to the tongue clamp as needed
- Tighten the screws manually with a wrench - tightening torque Mu = 170Nm

Removing the tongue clamp

- Loosen the M16x90 screws
- Alternately tightening the screws M20x80 pull out the tongue clamp
- Remove the tongue in the main drawbar area (part of the switch box operation)
- Move the tongue out using the mounting lever and pull it out



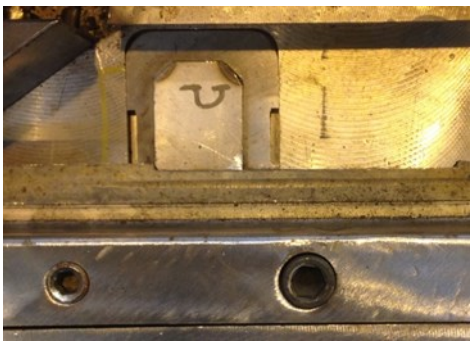
Tightening the clamp to the tongue



Setting to the stop

Legend to the pictures above:

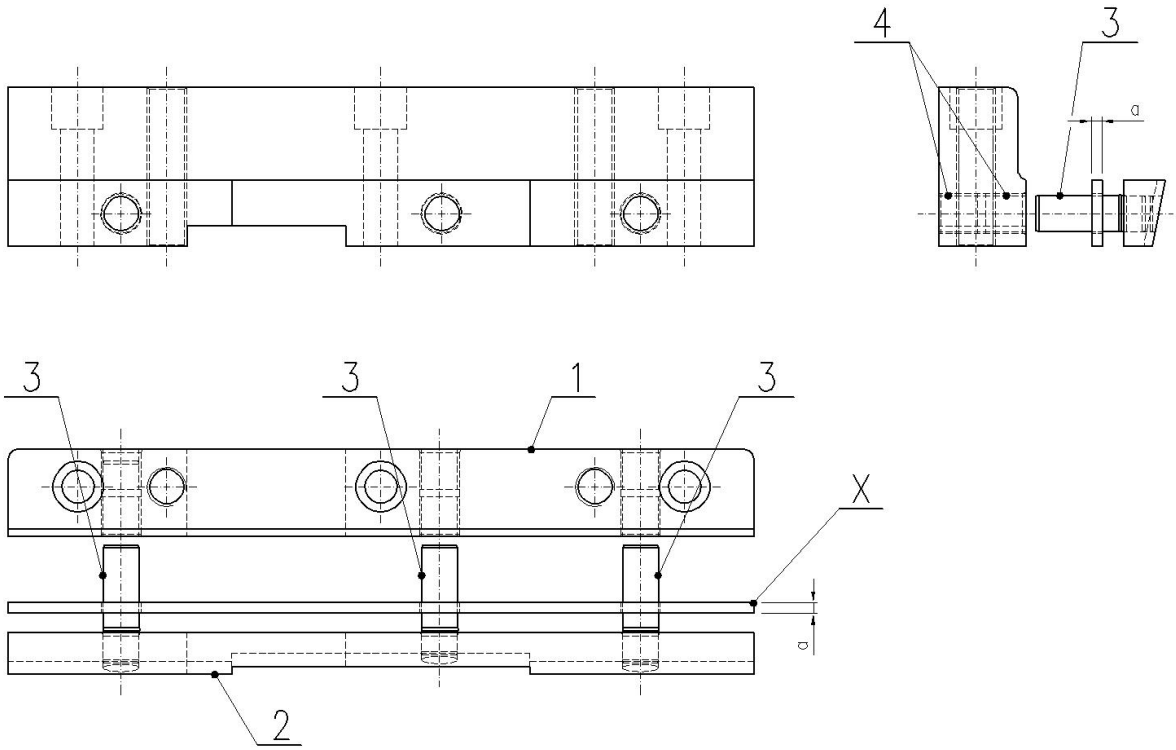
pos. 1 stop + insert – 1 + 1 pcs
pos. 2 clamp to the tongue with spacers
pos. 3 adjusting screw M20x80 DIN 913 – 2 pcs
pos. 4 Allen M16x90 (IMBUS) ČSN 02 1143.57 + spring washer 16 ČSN 02 1740.15 – 3 + 3 pcs
Note: these components are also included in the delivery for 1 spare part of the tongue.



Safety plate with tongue closure (1 half)

Upper part of the safety plate with milling in the rail foot

Two-piece safety plate (not welded)



Clamp to the tongue with spacers

Legend to clamp to the tongue with spacers:

pos. 1 clamp to the tongue – 1 pcs
pos. 2 clamp to the tongue – 1 pcs
pos. 3 pin – 6 pcs
pos. 4 case – 3 pcs
pos. X spacer for size “a” (0.5 – 7 mm) – total 7 pcs

Note: these components are also included in the delivery for 1 spare part of the tongue.

Detailed instructions for disassembly, assembly of the tongue clamp and replacement of the tongue are described in Annex 5 of this document.

Annex no. 4

Instructions for maintaining the tongue adapter DT

During the regular inspection of the turnout, it is also necessary to carry out a visual inspection of the transition areas regarding the formation of burrs and possible laps, including the check of the force connection of the tongue.

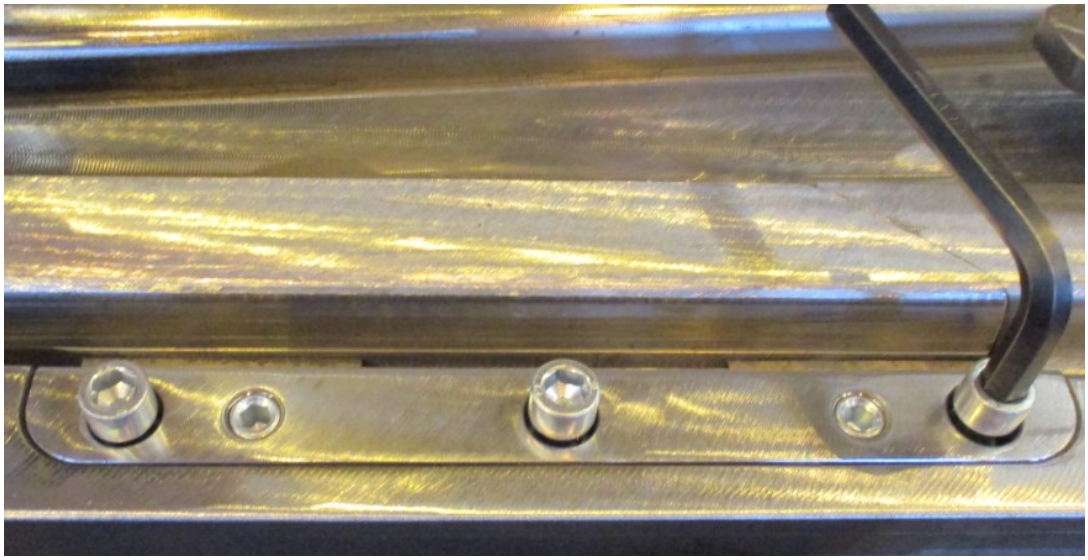
Regular maintenance and possible repairs of the tongue adapter must be carried out once a year - loosen the connecting screws and pressure screws, clean and lubricate with a suitable anti-adhesion agent
(copper paste). Change screws after 3–4 years.

Screw tightening torque Mu = 170 Nm
Copper paste- Cu7439 PLUS
Safety plates do not need to be changed (unless the tongue is removed).

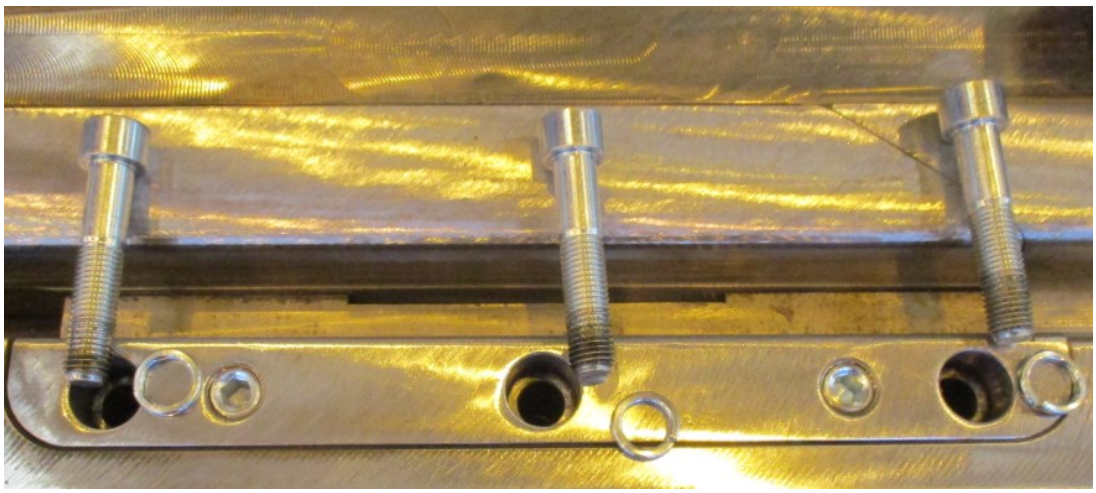
Disassembly and assembly of the tongue clamp

Annex no. 5

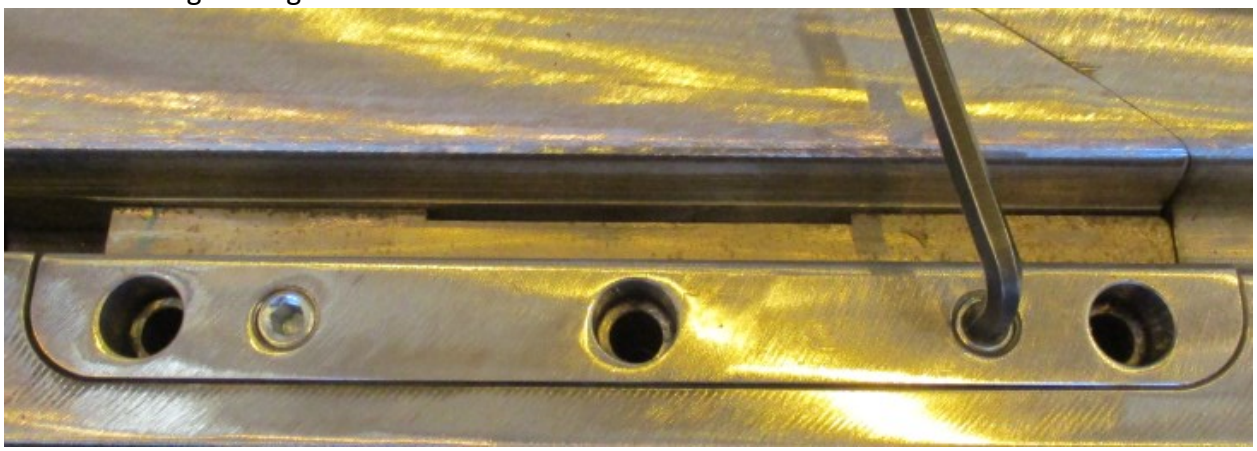
Use 2 Allen keys of the appropriate dimensions to remove the tongue clamp



Loosen the tightening screws



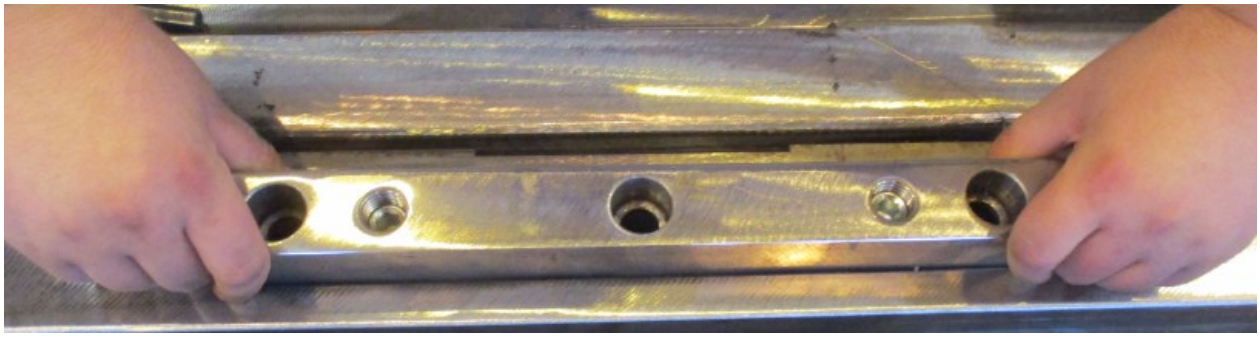
Remove the tightening screws



Tighten the adjusting screws alternately

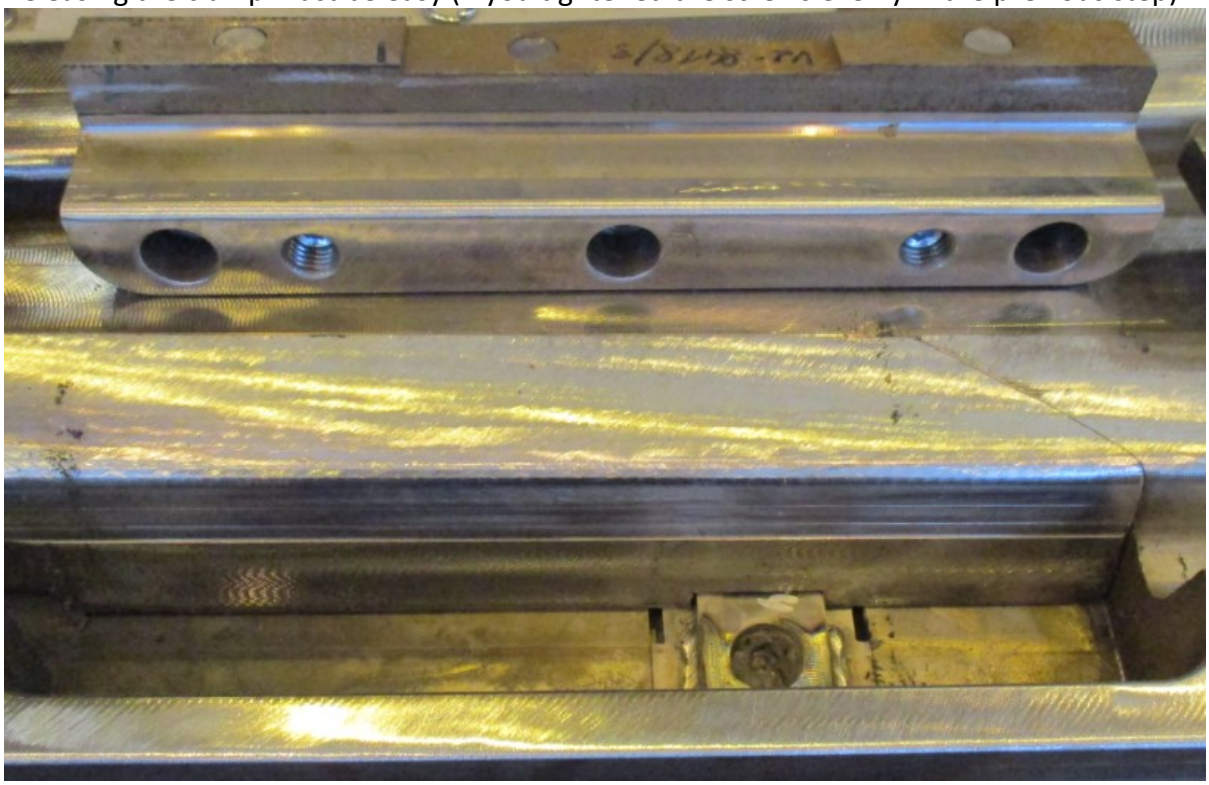
Gently tap the top of the tongue clamp with a hammer before tightening the screws

Alternately and evenly tighten the adjusting screws to release the tongue clamp



Manually pull out the tongue clamp

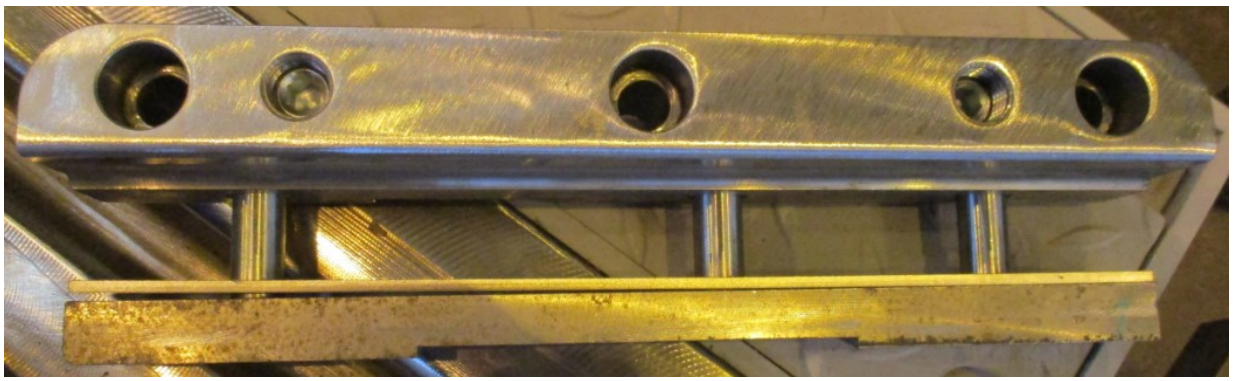
Releasing the clamp must be easy (if you tightened the screws evenly in the previous step)



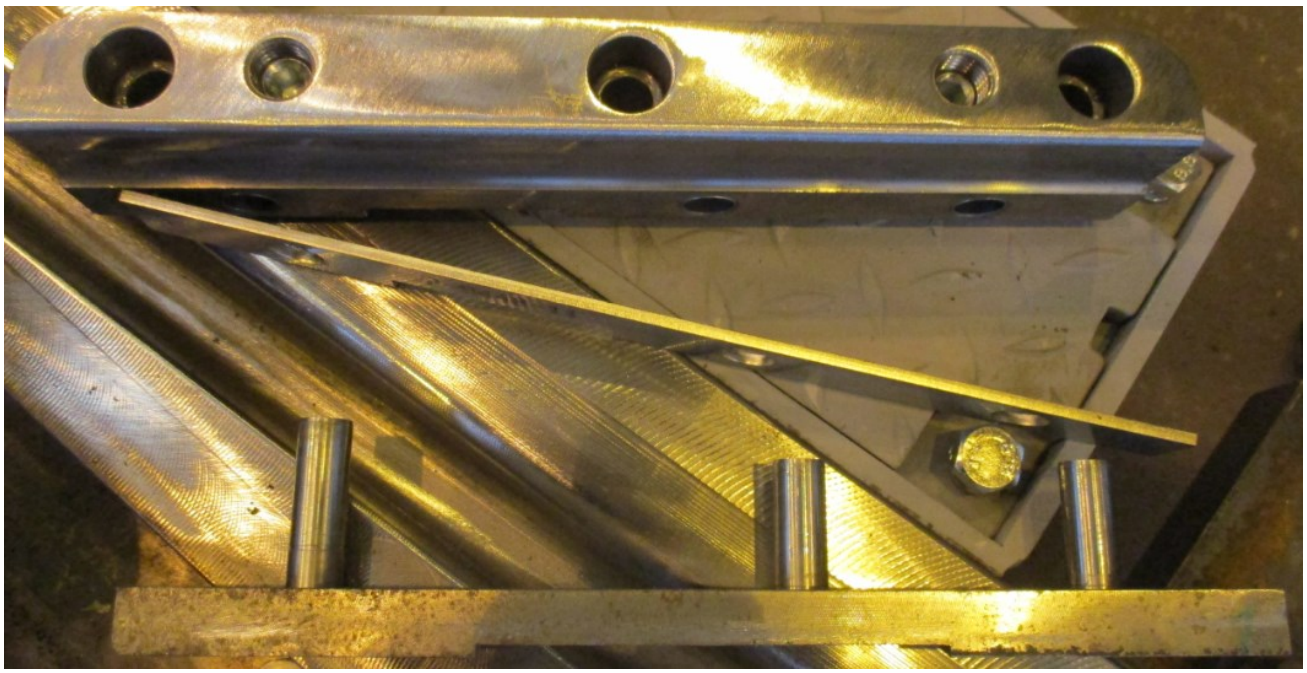
After removing the tongue clamp, clean dirt and grease residues from all surfaces

Lubricate the bottom and walls of the cavity with a thin layer of copper paste- Cu7439 PLUS

First clean the set of the tongue clamp all around

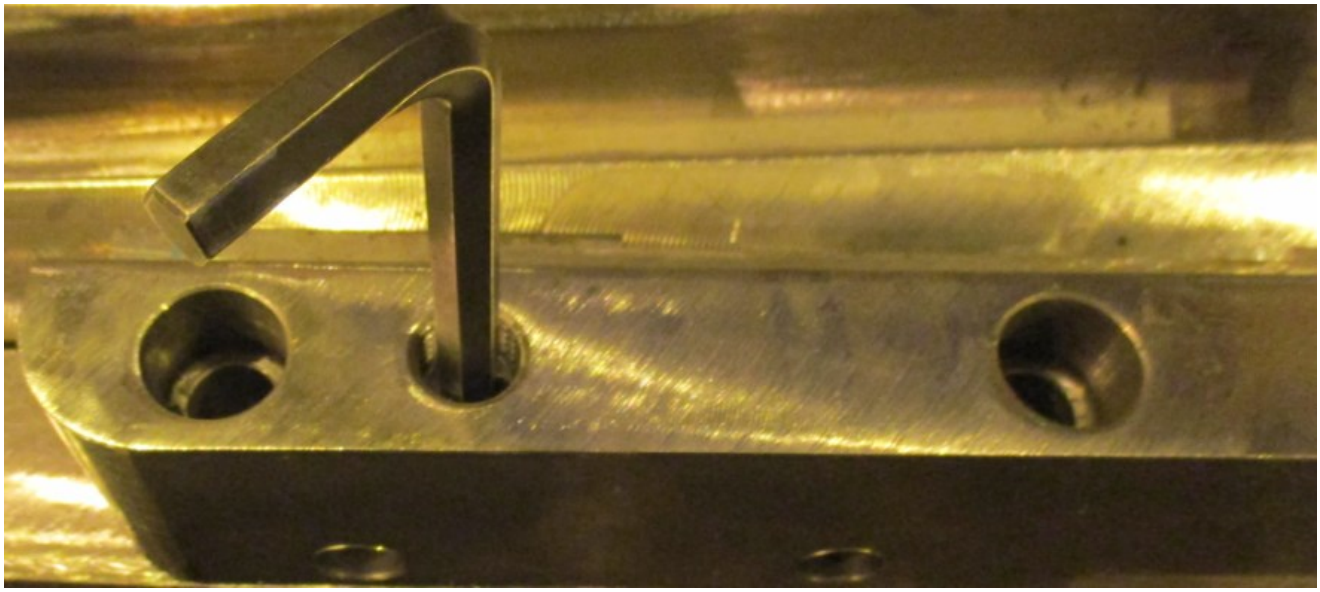


Disassemble the tongue clamp set

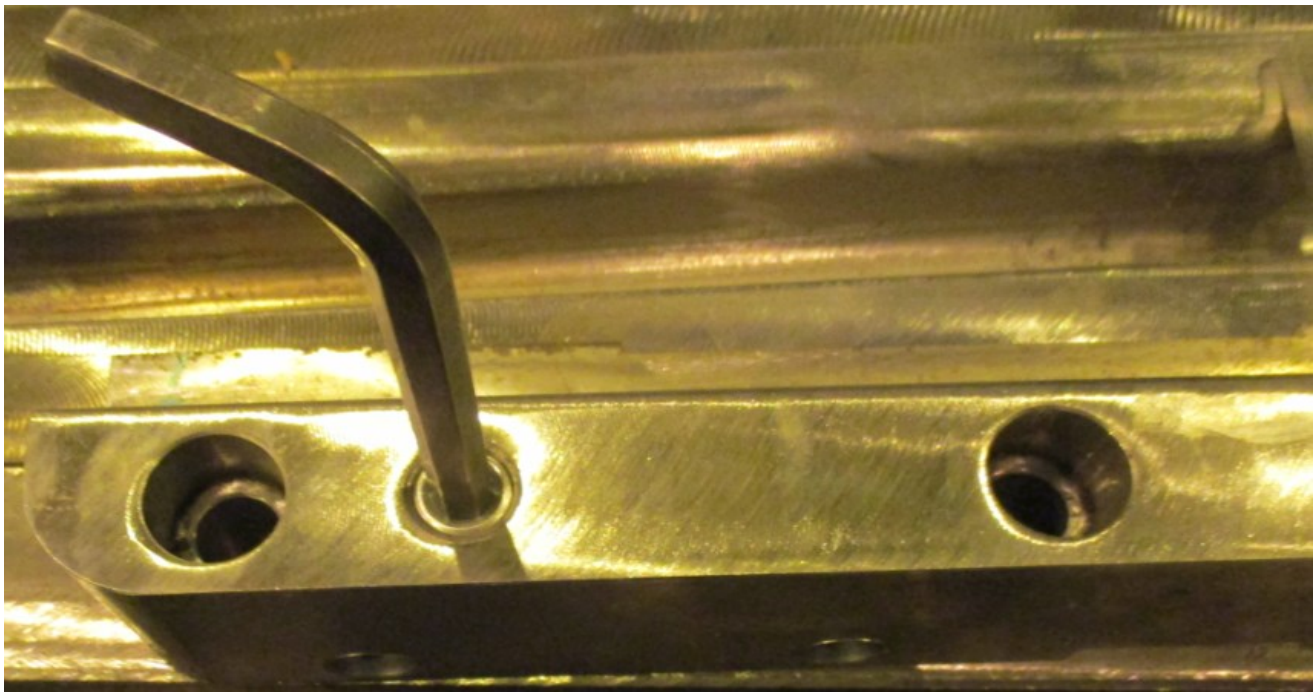


Disassemble the tongue clamp into individual parts, clean, visually inspect, lubricate the individual parts with a thin layer of copper paste- Cu7439 PLUS and reassemble.

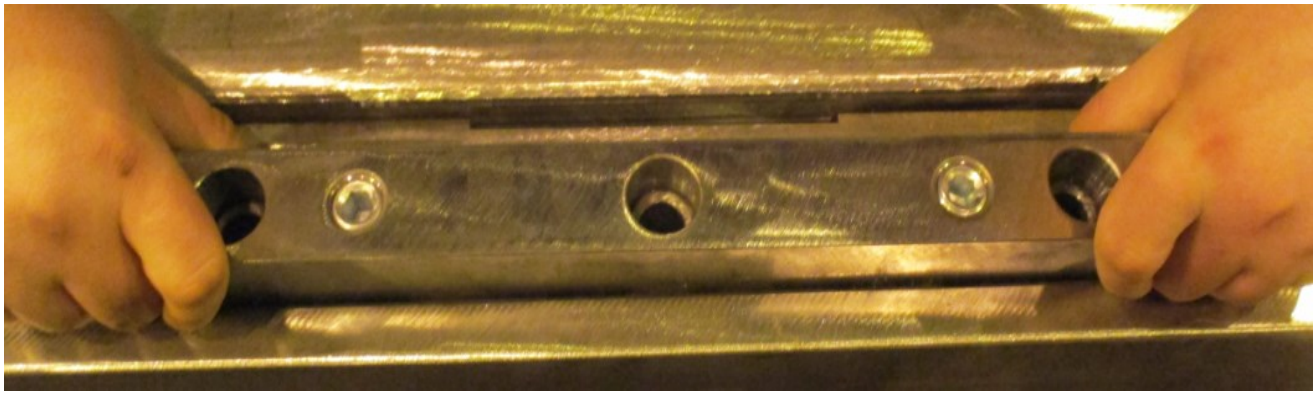
The adjusting screws have been pulled out so far



Loosen the adjusting screws with an Allen key



Loosen the adjusting screws so that the upper edge of the screw does not protrude beyond the upper edge of the tongue clamp



Take the clamp and insert it into the appropriate cavity

The clamp must slide freely into the hole - do not use hammer!

Lubricate the screws with a thin layer of copper paste- Cu7439 PLUS, install the screws with spring washers and start tightening the middle screw first

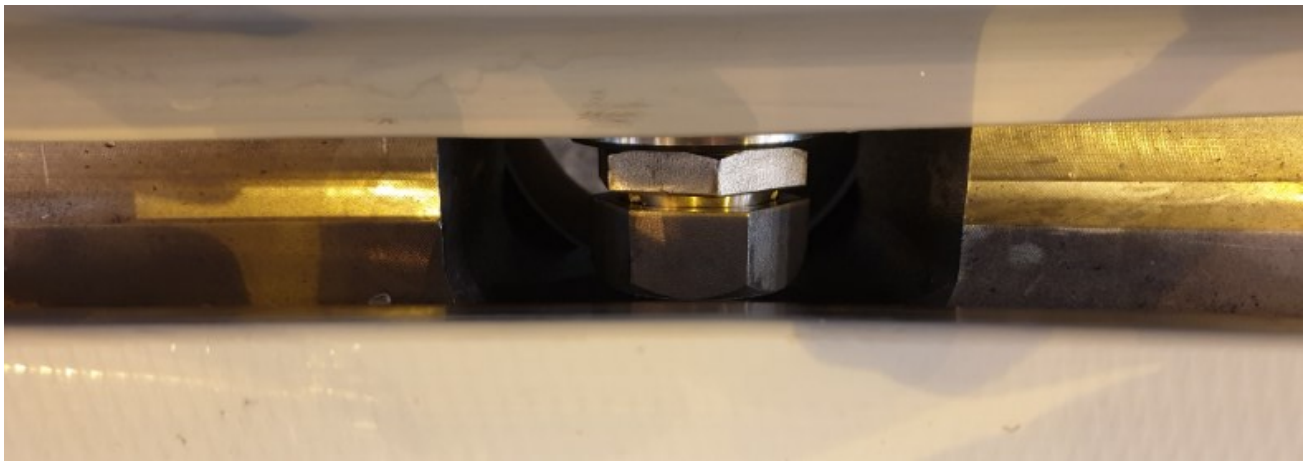
Slightly tighten the middle screw

Tighten both end screws alternately so that the clamp fits evenly

Finally, tighten all screws with a torque wrench to the appropriate tightening torque Mu = 170Nm

Tongue replacement

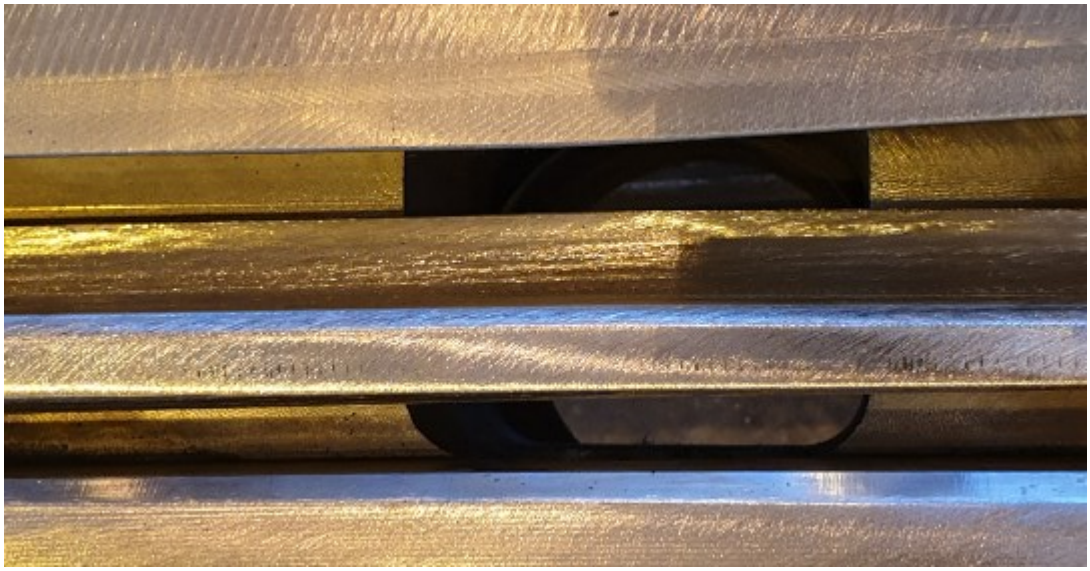
First dismantle the tongue in the main drawbar area (at the switch box)



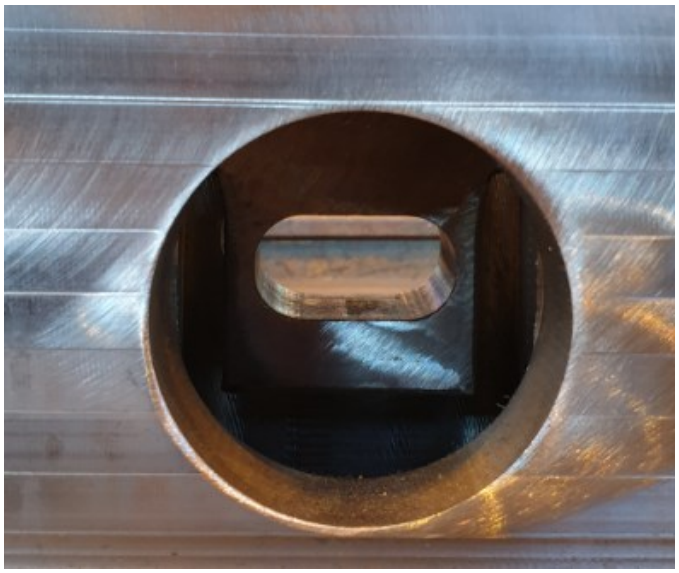
Tongue with attached main drawbar - top view

Use open-jawed spanners of the appropriate dimensions

Side view of the hinge cube with the main drawbar attached



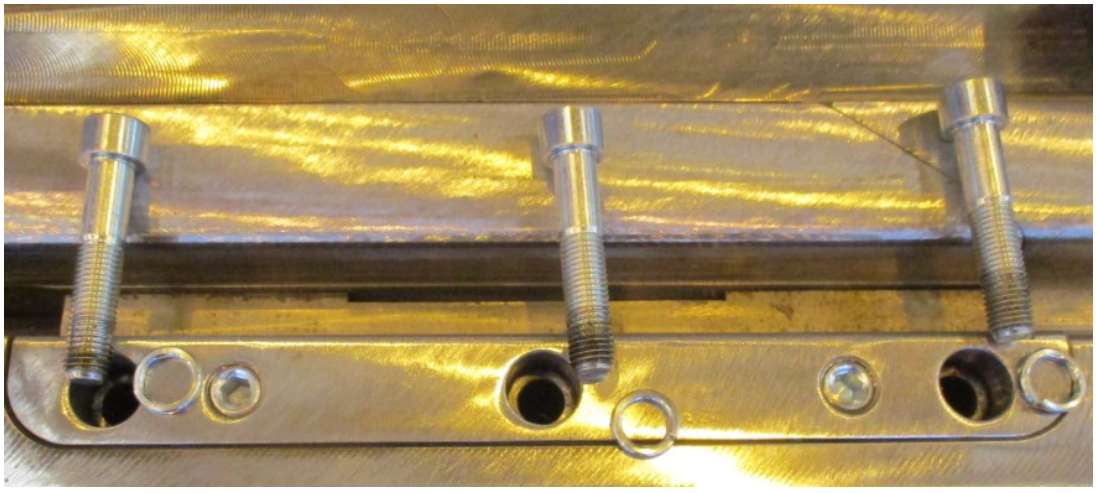
Tongue after removing the main drawbar - top view



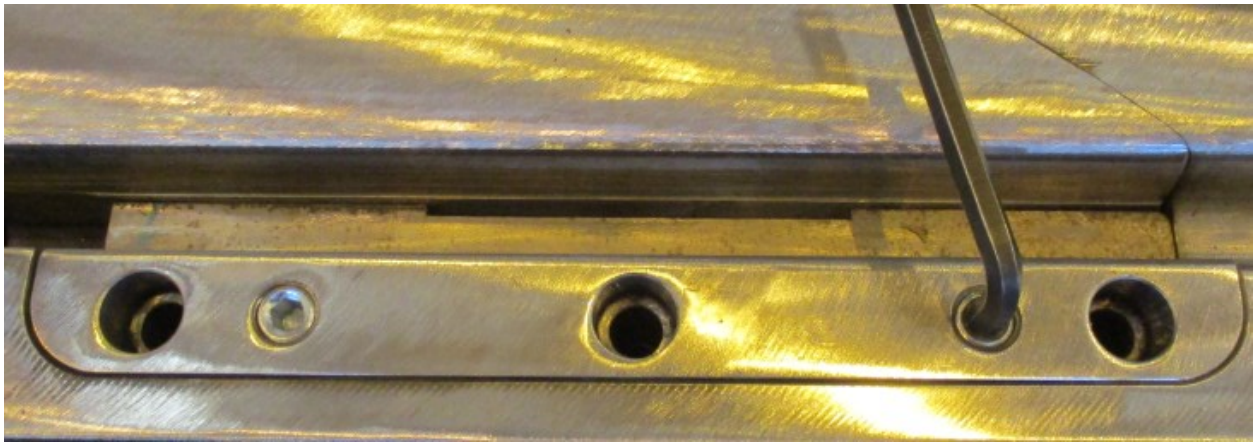
Side view of the hinge cube after removing the main drawbar

Use 2 Allen keys of the appropriate dimensions to remove the tongue clamp

Loosen the tightening screws



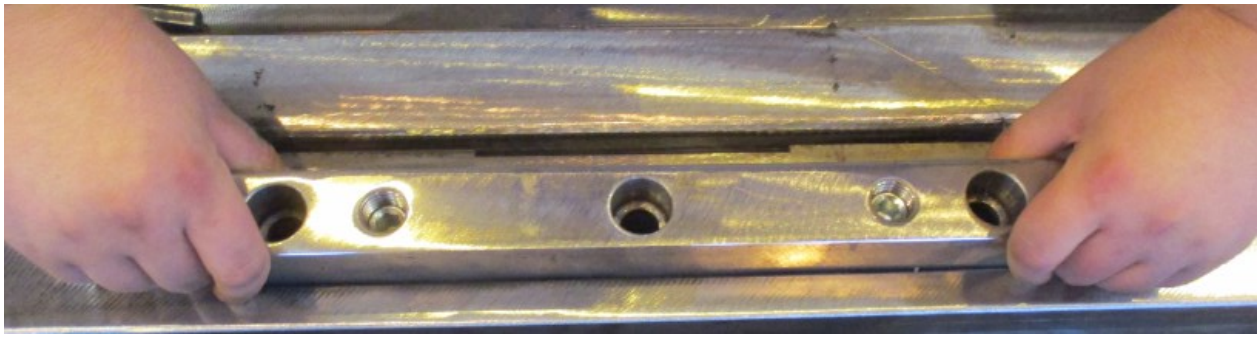
Remove the tightening screws



Tighten the adjusting screws alternately

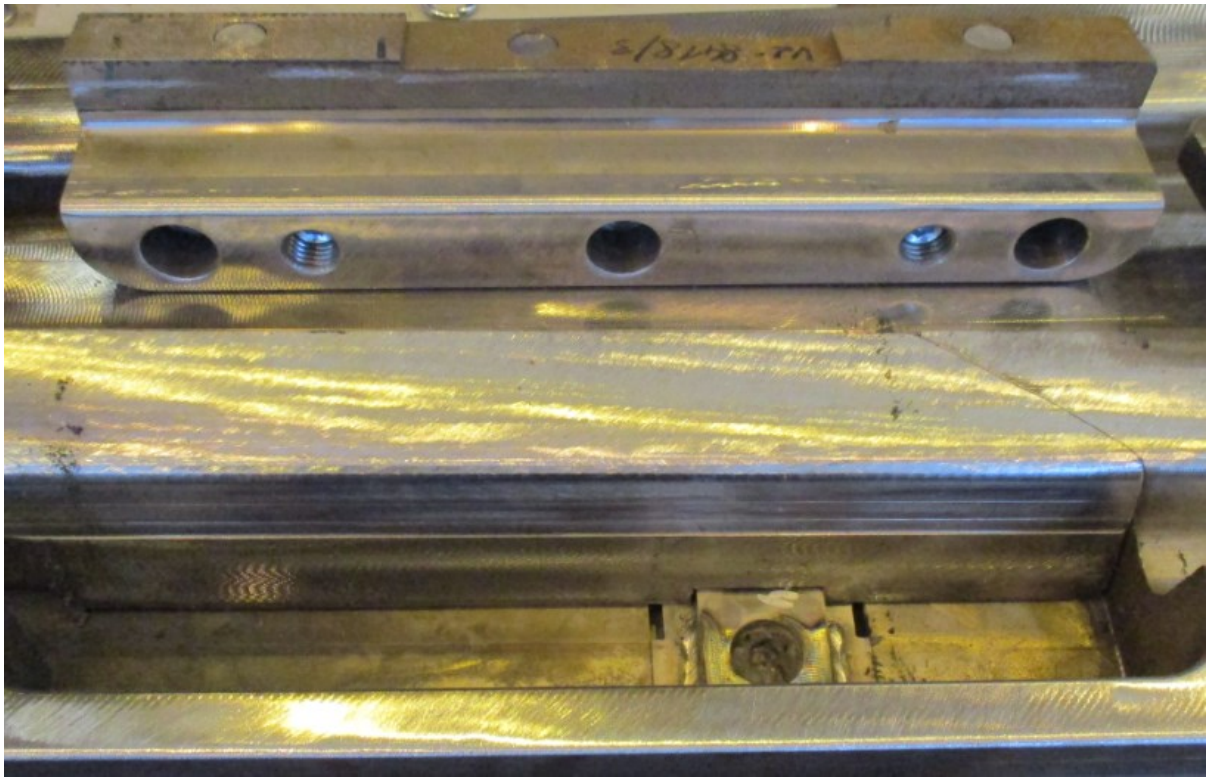
Gently tap the top of the tongue clamp with a hammer before tightening the screws

Alternately and evenly tighten the adjusting screws to release the tongue clamp

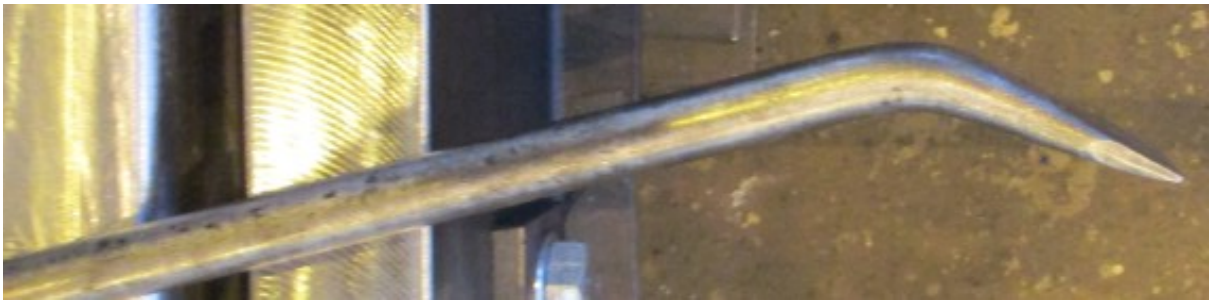


Manually pull out the tongue clamp

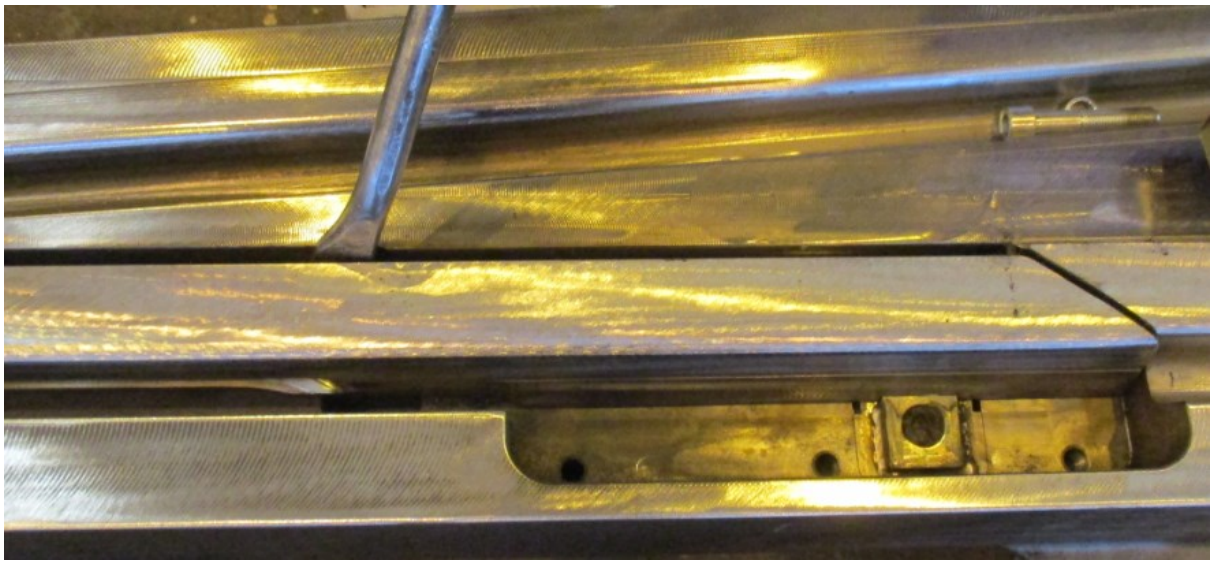
Releasing the clamp must be easy (if you tightened the screws evenly in the previous step)



After removing the tongue clamp, clean dirt and grease residues from all surfaces

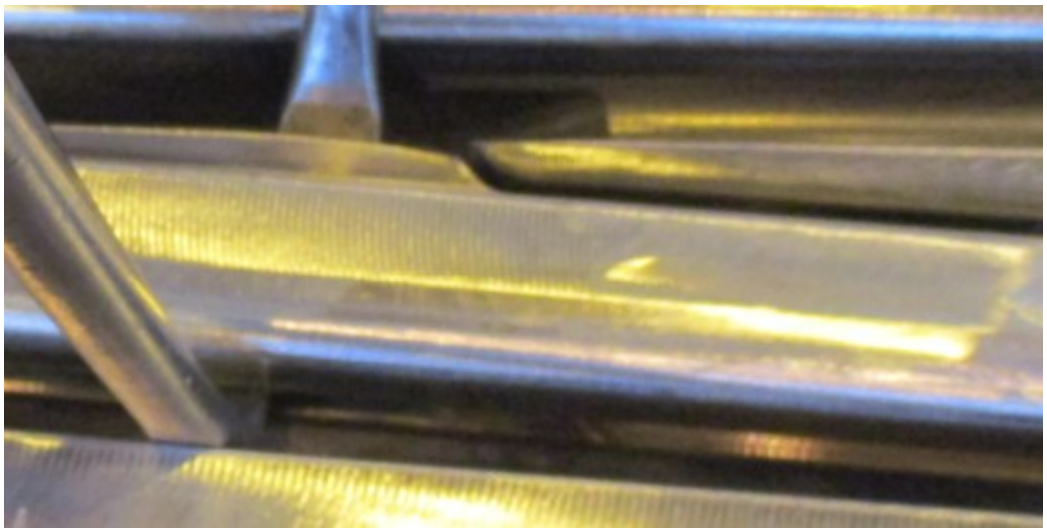


Prepare the mounting lever - we will need 3 pcs

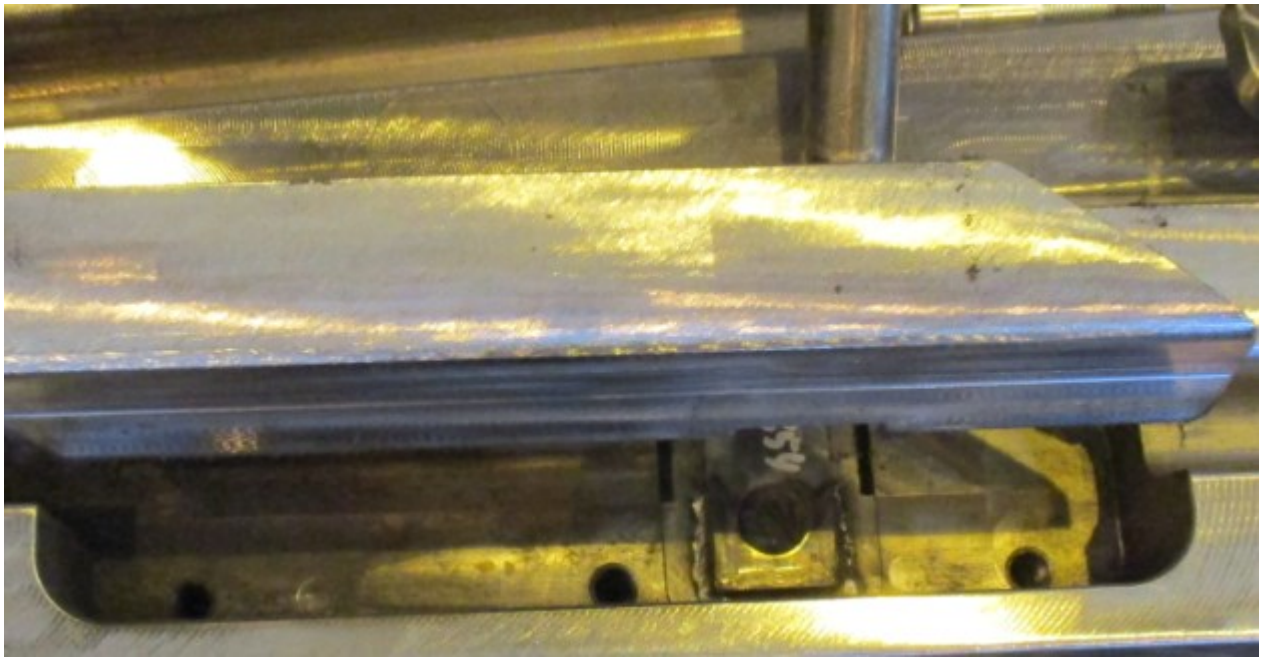


Move the tongue out using the mounting lever

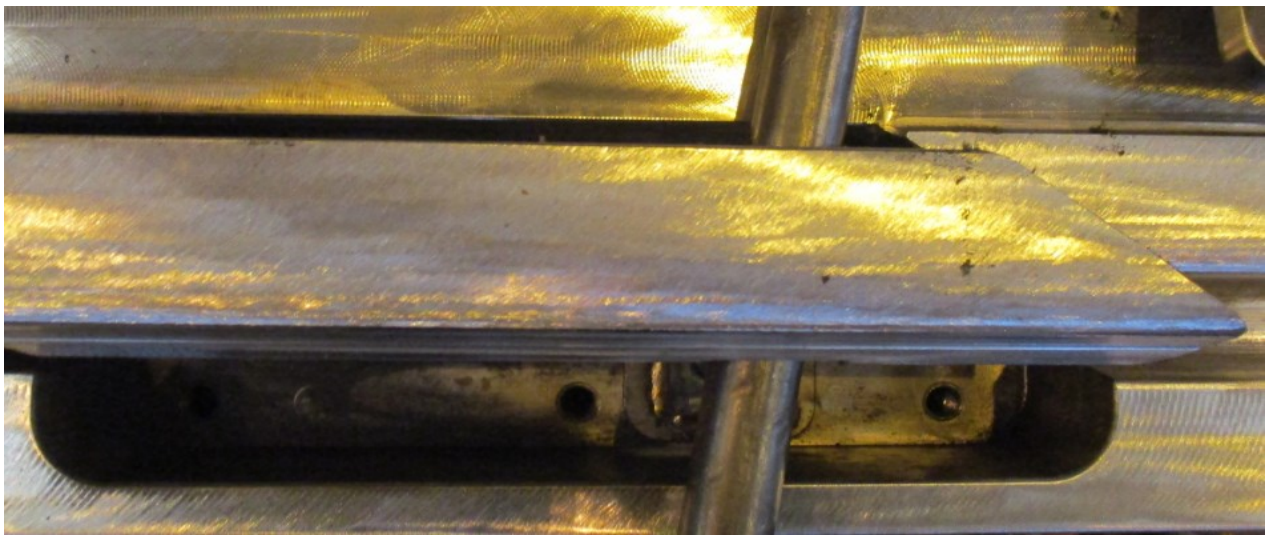
Gently tap the upper edge of the tongue end before attaching the mounting lever



Pick up the tongue in the middle using a pair of mounting levers



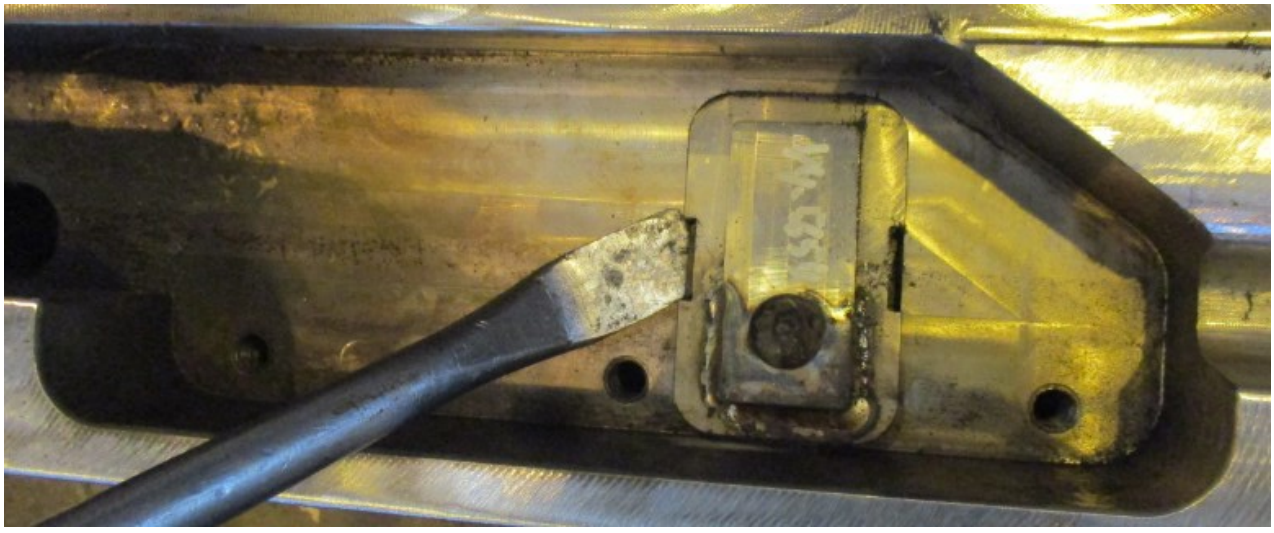
Use a mounting lever to pick up the tongue at the end



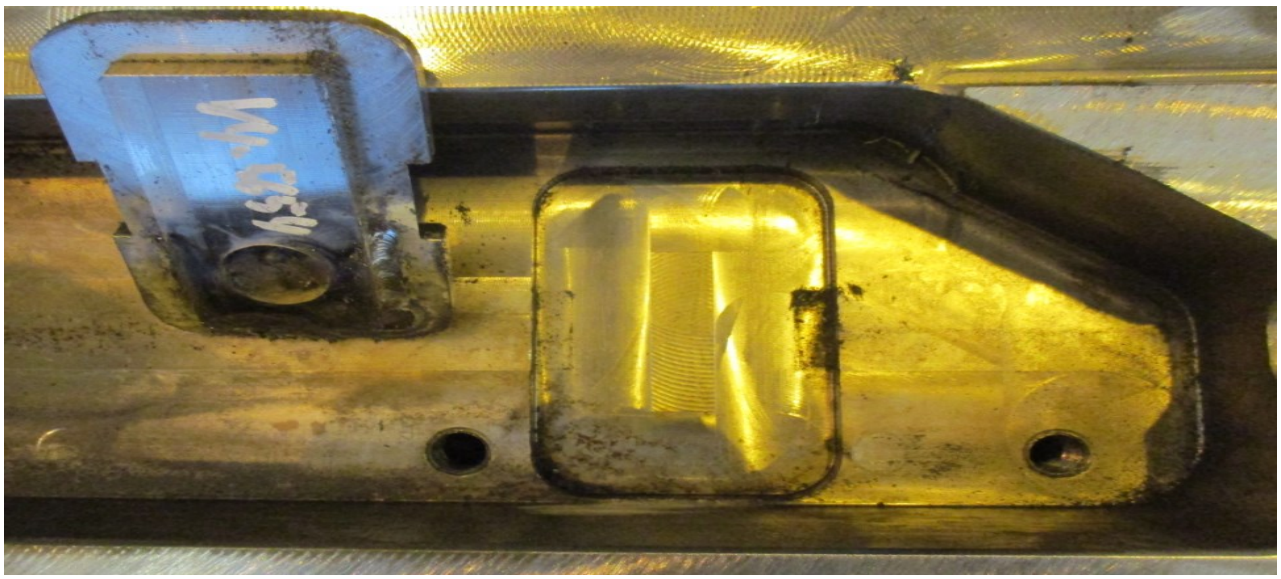
Support the loose end of the tongue with the mounting lever

Use lifting and lashing devices in accordance with the relevant regulations to remove the tongue from the switch area.

Tap lightly before removing the two-part safety plate

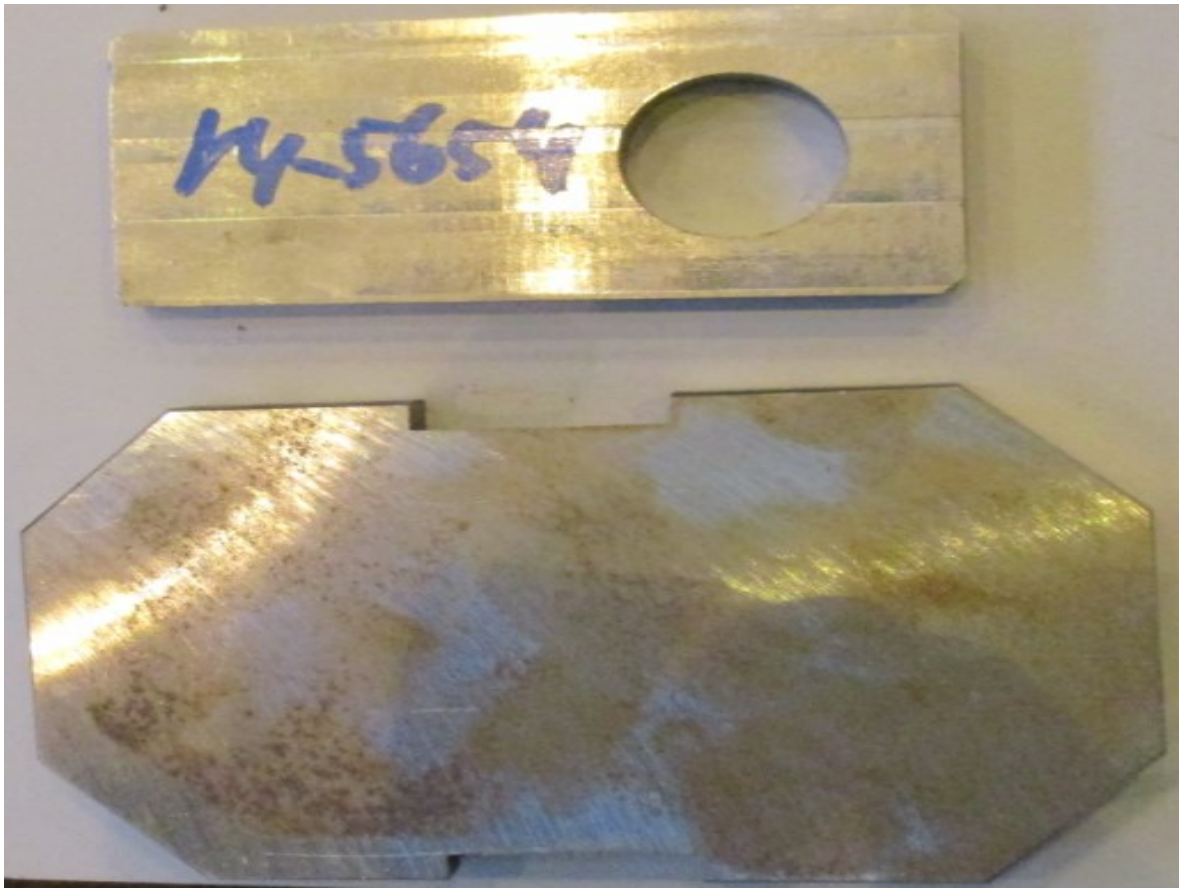


Insert the mounting lever into the recess in the safety plate and lift the plate slightly alternately on both sides

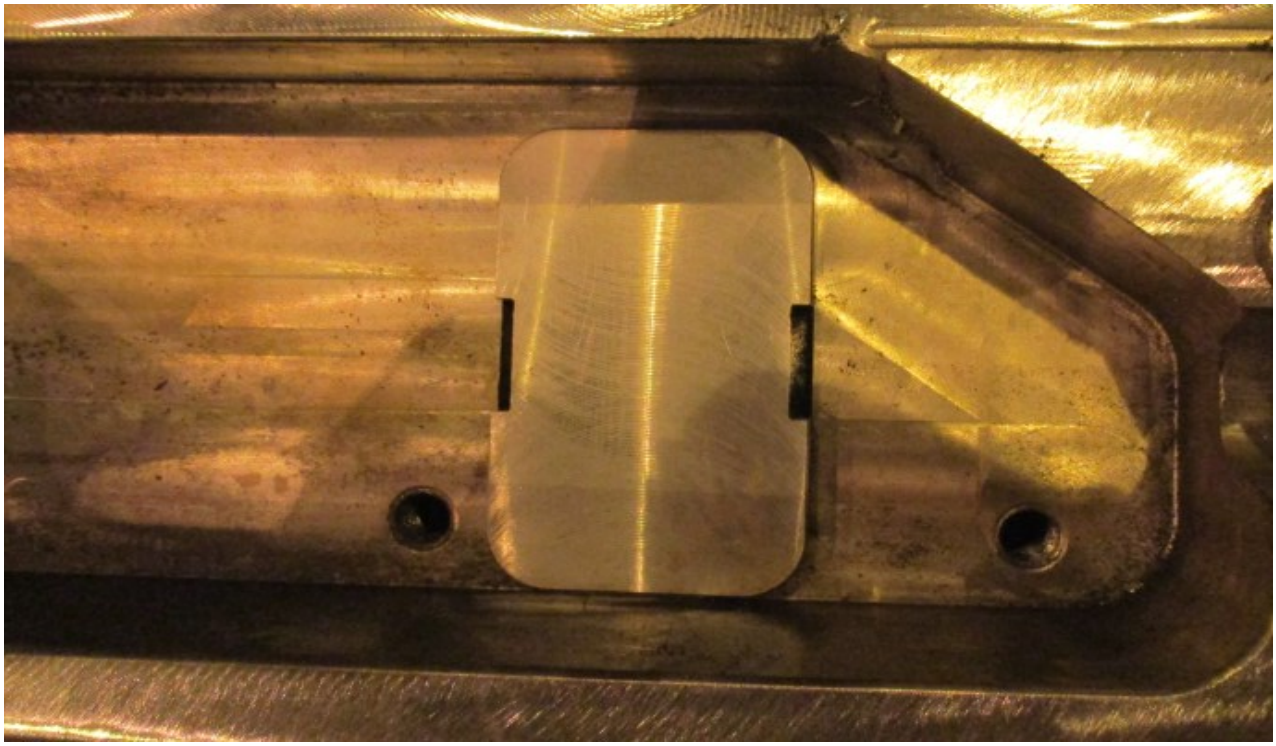


After removing the safety plate, clean the surfaces from dirt and grease residues

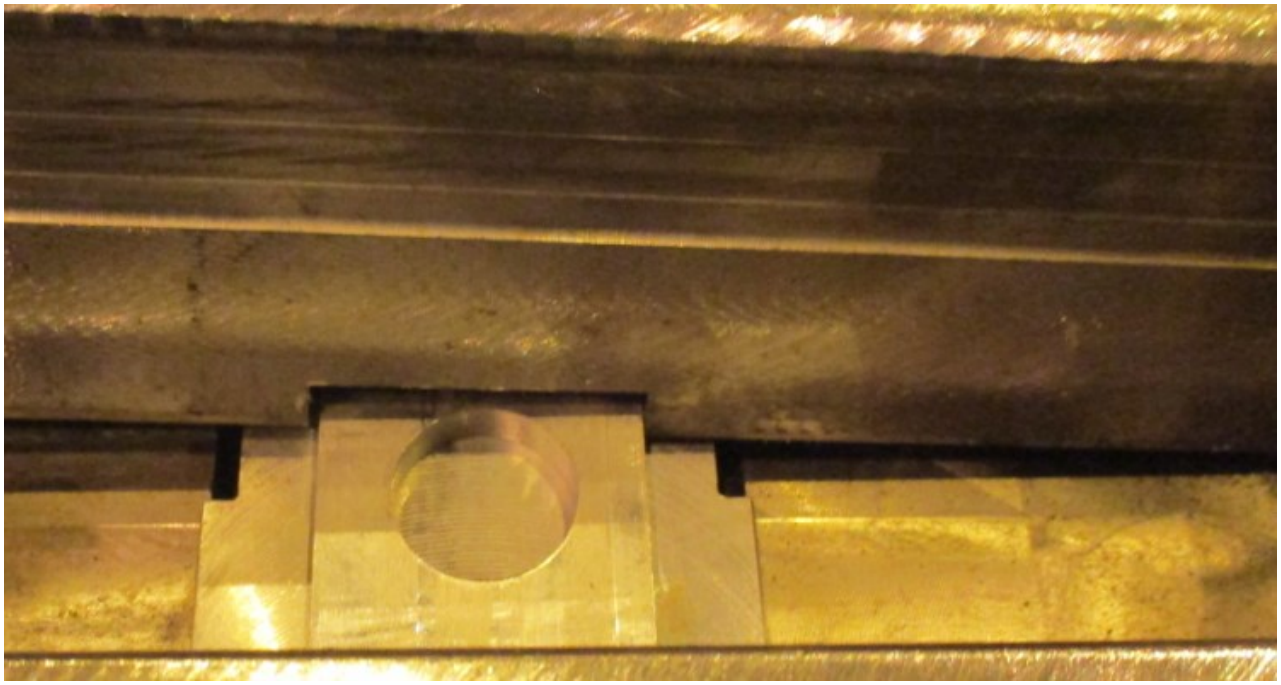
The removed safety plate is a weldment of two plates



Both parts of the safety plate before welding on assembly place



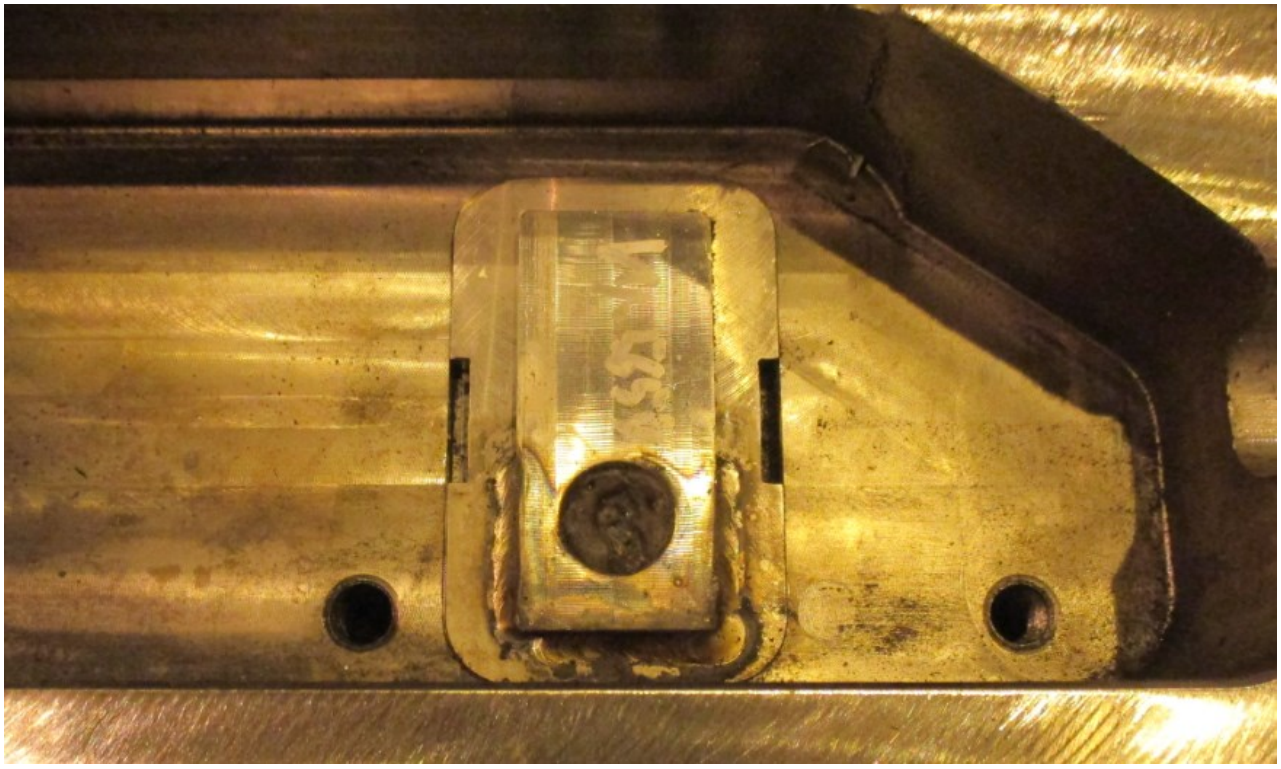
Insert bottom of plate (plate with recess)



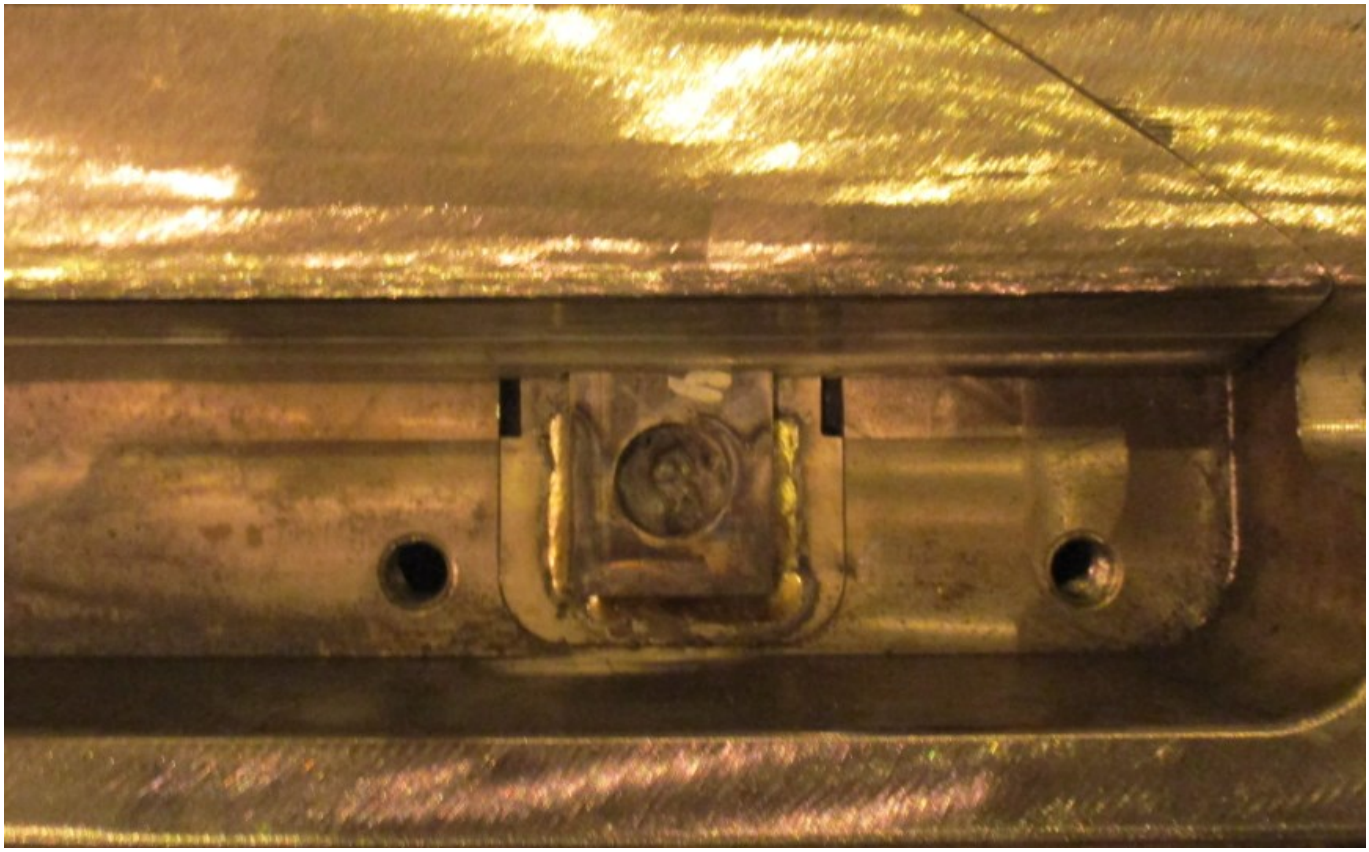
Insert the tongue and mark the position of the upper part of the safety plate in relation to the recess in the tongue

Remove the tongue again as described above.

Remove both parts of the safety plate, assemble according to the markings and weld.



Lubricate the bottom and walls of the cavity with a thin layer of copper paste- Cu7439 PLUS

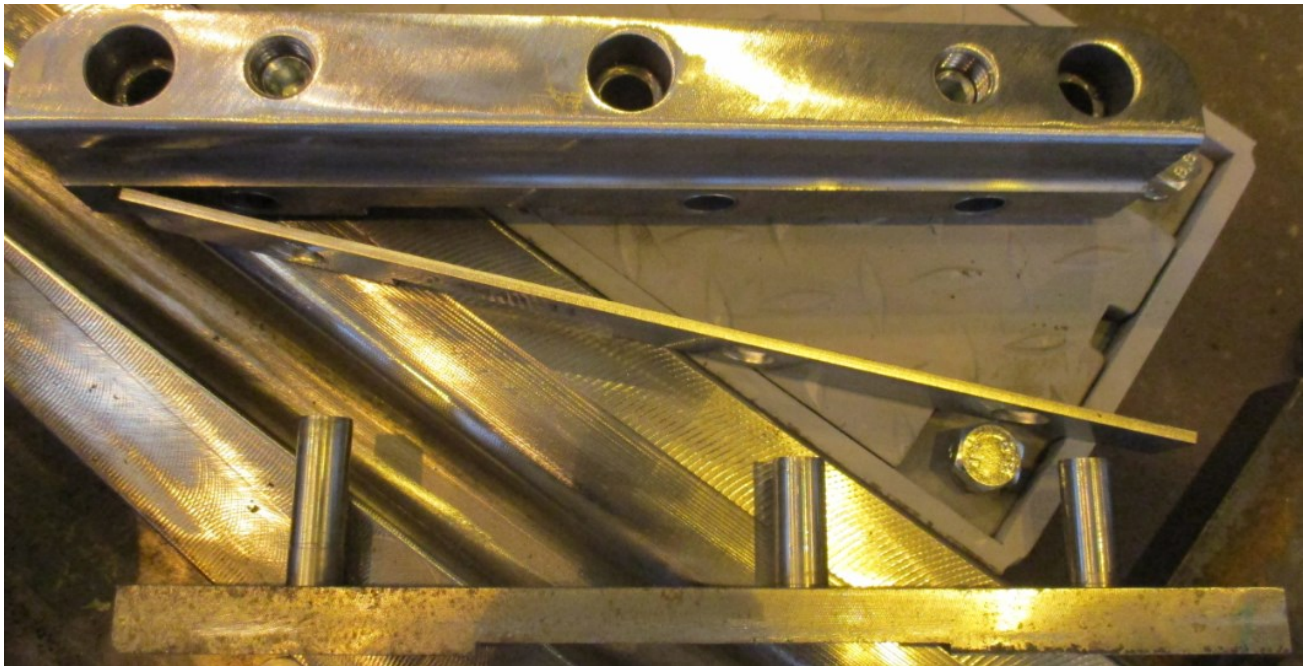


Insert the tongue

Lubricate the walls of the cavity with a thin layer of copper paste- Cu7439 PLUS

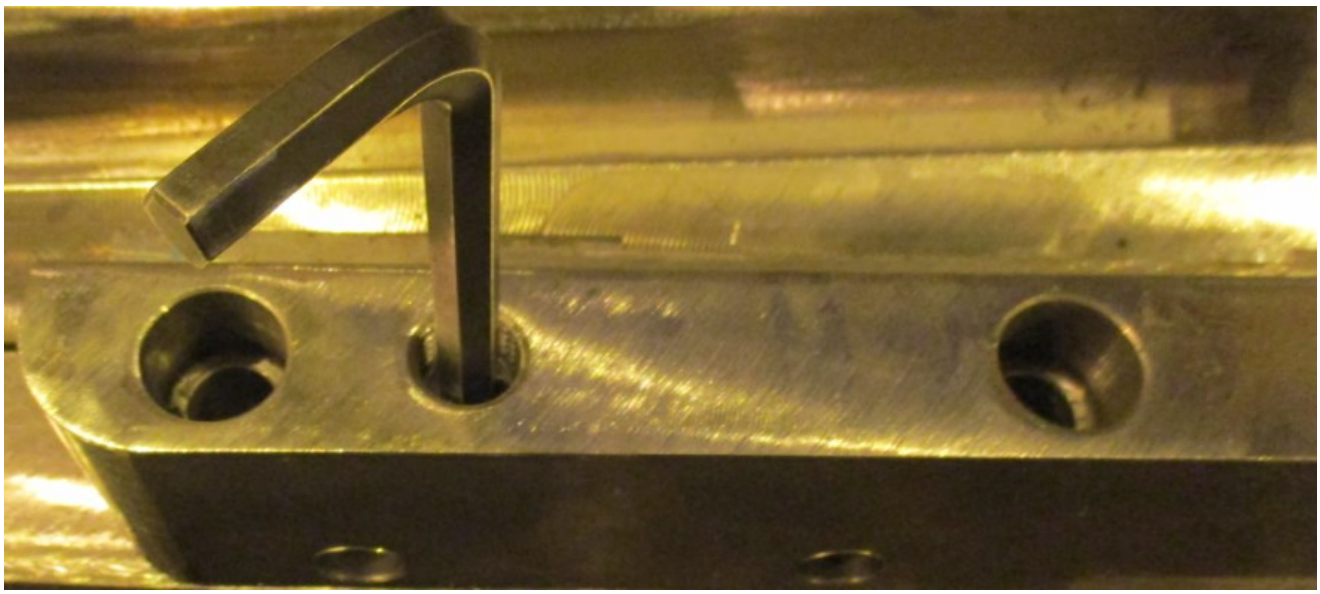
First clean the set of the tongue clamp all around

Disassemble the tongue clamp set

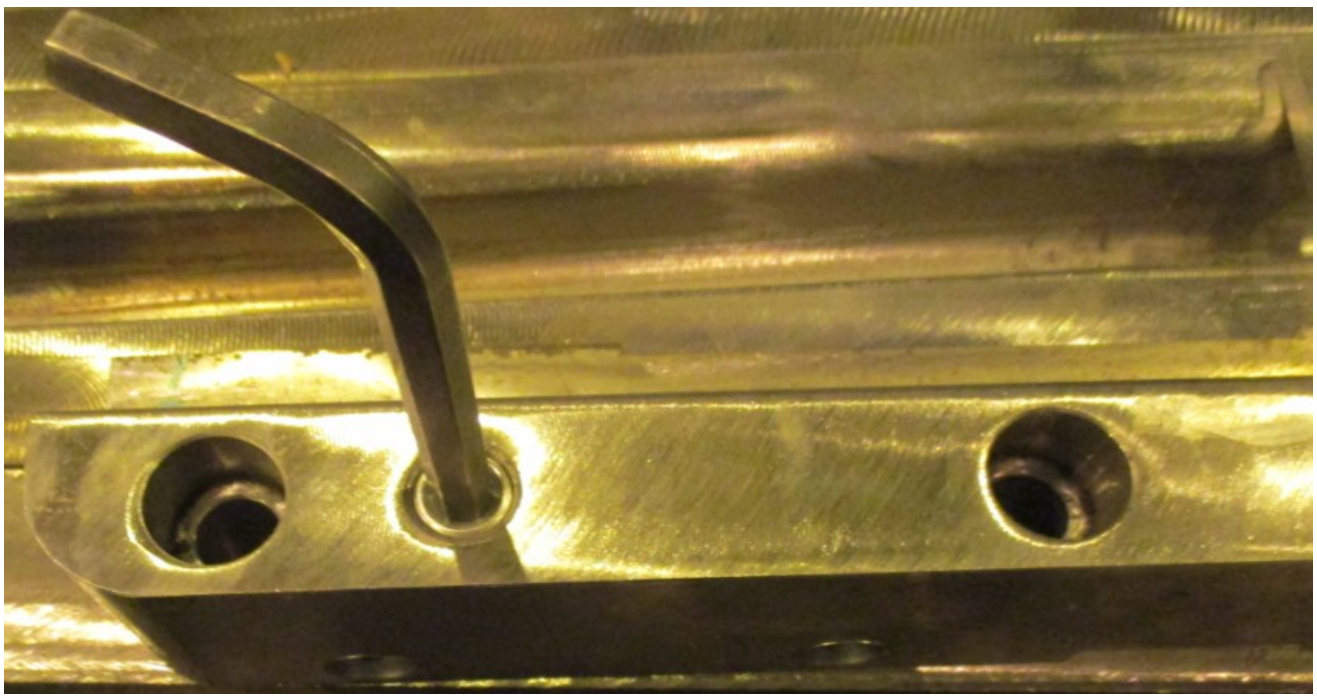


Disassemble the tongue clamp into individual parts, clean, visually inspect, lubricate the individual parts with a thin layer of copper paste- Cu7439 PLUS and reassemble.

The adjusting screws have been pulled out so far



Loosen the adjusting screws with an Allen key



Loosen the adjusting screws so that the upper edge of the screw does not protrude beyond the upper edge of the tongue clamp

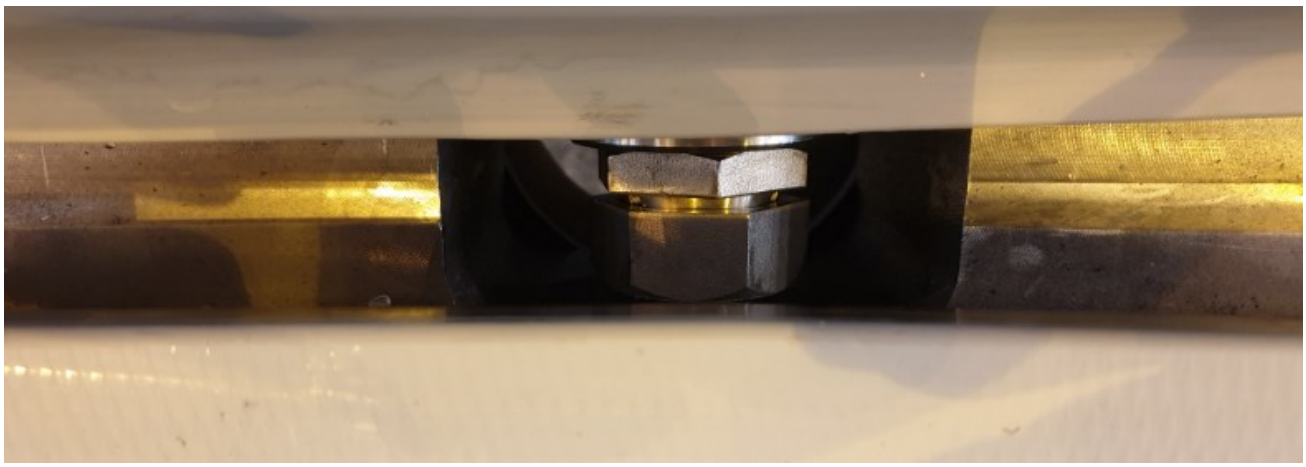
The clamp must slide freely into the hole - do not use hammer!

Lubricate the screws with a thin layer of copper paste- Cu7439 PLUS, install the screws with spring washers and start tightening the middle screw first

Slightly tighten the middle screw

Tighten both end screws alternately so that the clamp fits evenly

Finally, tighten all screws with a torque wrench to the appropriate tightening torque Mu = 170Nm



Connect the tongue with the connected main drawbar - top view

Use open-jawed spanners of the appropriate dimensions

Side view of the hinge cube with the main drawbar attached