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EN ISO 9001
EN ISO 3834-2
EN ISO 14001
ISO 45001

259/2013

Manual for the Operation and Maintenance of frogs made of austenitic manganese steel

2 nd Edition

Title: **Manual for the Operation and Maintenance of frogs made of austenitic manganese steel**

Release date: 01.07.2022
Number of pages: 42

Manufacturer of frogs made of austenitic manganese steel and publisher of this manual:

DT – Výhybkárna a strojírna, a.s.

(hereinafter referred to as the “manufacturer”)

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

signature stamp

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LIST OF ABBREVIATIONS USED

BFM	Bari Fonderie Meridionali SpA (Italian supplier of castings)
MBK	Mathematical crossing point
PJD	Fixed guideway
SŽ	Správa železnic, state organization
ZPT	frog monoblock whose running surfaces are not blast-hardened
ZPTZ	frog monoblock whose running surfaces are blast-hardened according to EN 15689
ZMM	frog shortened monoblock whose running surfaces are not blast-hardened
ZMMZ	frog shortened monoblock whose running surfaces are blast-hardened according to EN 15689
Insert	frog with a central part made of casting
ŽSR	Železnice Slovenské republiky

1 General

This manual contains information on the design of frogs made of austenitic manganese steel (type ZPT, hereafter referred to as "ZPT frog" or collectively "frog") and blast-hardened austenitic manganese steel (type ZPTZ, hereafter referred to as "ZPTZ frog" or collectively "frog"), their installation and operation requirements, including maintenance.
The above requirements are also applicable to the ZMM, ZMMZ and Insert types.
The manual is binding for all persons who carry out the activities specified below on the above-mentioned types of frogs, especially during the warranty period. The manufacturer assumes no responsibility for activities and their consequences performed in a different manner 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 List of the most important symbols

This document includes three categories of safety instructions:

DANGER!

Ignoring these instructions can result in loss of life.

WARNING!

Ignoring these instructions can cause serious injury or substantial damage to property.

CAUTION!

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

Contact details for service personnel are available on the website DT – Výhybkárna a strojírna, a.s.: http://www.dtvs.cz/

1.3 Contact form for sales technical support – Your opinion

The company DT – Výhybkárna a strojírna, a.s. is happy to receive **feedback from its customers**, especially your comments, suggestions, and experience gained from operating the product in question. Please send us a copy of this form to:

DT - Výhybkárna a strojírna, a.s.
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or you can use the form available on the website of DT - Výhybkárna a strojírna, a.s.: https://www.dtvs.cz/kontakty

Comments, suggestions, and experience using the product:

Name: …….

Organization: …….

Contact details (phone, e-mail):

2 Technical specification, frog description

2.1 Basic technical data

Material of the frog:
manganese steel with austenitic structure according to CSN EN 15689 or TPD 202-360-23.

Frog design:
monoblock

Type designation:

ZPT

ZPTZ

Note: The ZMM, ZMMZ and Insert type of frogs were inserted into the SŽ network in the years 1996-2008. They are not mentioned further in this manual, but the same rules and recommendations apply to them as to the ZPT and ZPTZ frogs.

Geometry and system of permanent way:
Standard used - see Annex No. 1, others according to customer requirements and production possibilities.
Permanent way system UIC 60.

2.2 Frog description

The frog consists of a casting made of austenitic manganese steel and connecting rails welded by contact welding with annealing through a CrNi intermediate piece. The connecting rails can be made of material grade R260, R260 perlite or higher grade (e.g. R350HT). Description of the ZPT and ZPTZ frog - Figure1, example of frog placement in a switch in the track - see Figure2.
Schematic of the height machining of the crossing point - see Appendix No. 2.

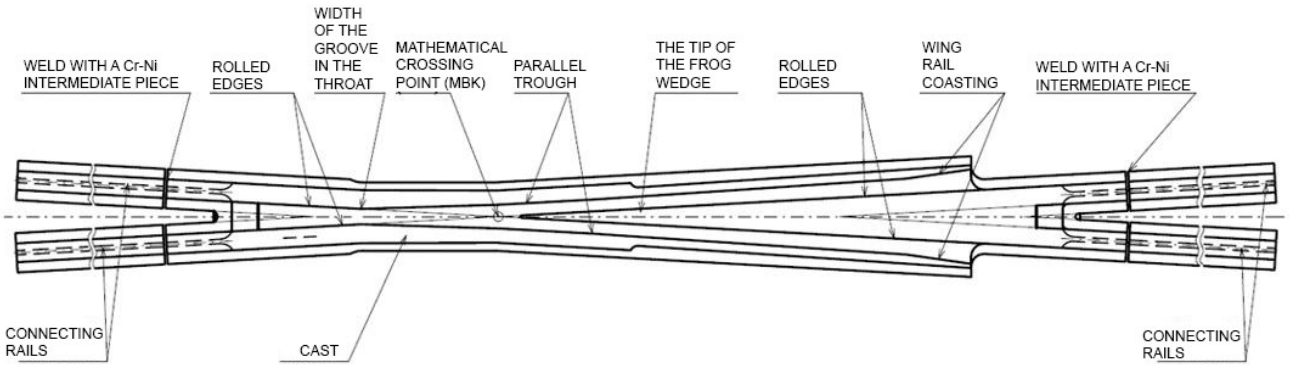


Figure1 - Frog description

Figure2 - Frog in the switch in the track

The dimensions of the ZPT and ZPTZ frogs are identical after welding with the connecting rails, and the used sole plates or concrete sleepers are also identical.
Blast-hardening according to CSN EN 15689 (in the area of running surfaces) is performed in order to increase surface and subsurface hardness, increase wear resistance and thus extend the service life of the frog with simultaneous reduction of maintenance costs.

No jumpers are used for the frog.
The machined surfaces of frogs after their quality verification are coated with a protective coating according to the respective TPD of the frog manufacturer.

The MBK is marked with a mark or stamped with a dimple on the bottom of the groove before the start of the heart tip (see Figure 3).

Figure 3 - Example of MBK marking

The position of the 40 mm crossing point width is marked on the frog by a dimple or bore on the outside of the casting (see Figure 4).

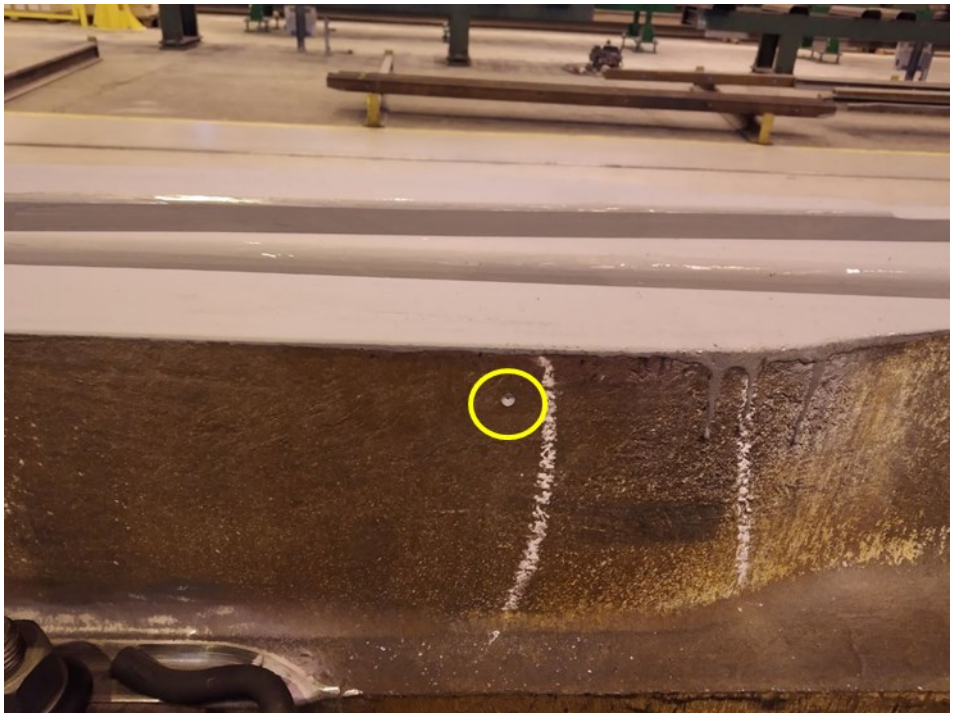


Figure 4 - Marking of the crossing point position in 40 mm width

3 Safety instructions

- Only a person who is familiar with the contents of this manual may carry out work on the frog.
- During all activities carried out on the frog, the works manager is obliged to ensure the safety of the workers.
- Only suitable lifting equipment with the declared lifting capacity must be used for handling the frog, see chapters 4.3 and 6.1 for more information.
- Personal protective equipment must always be used during maintenance of the frog to prevent injury to workers and to ensure their health is protected at work.

4 Preparing the frog for use

4.1 Identification of the frog

- **Frog**

There is a nameplate attached to one of the connection rails at the beginning of the frog, which reads (see Figure 5):

- manufacturer's designation,
- exact designation of the frog - TYPE,
- serial number of the frog - SER. NO.,
- year of manufacture - Y.M.
- mark of the manufacturer's technical inspector - TK DT,
- mark of the quality controller of the user authority - KK SZCZ,
- mark of the quality controller of the user authority - PK ŽSR,

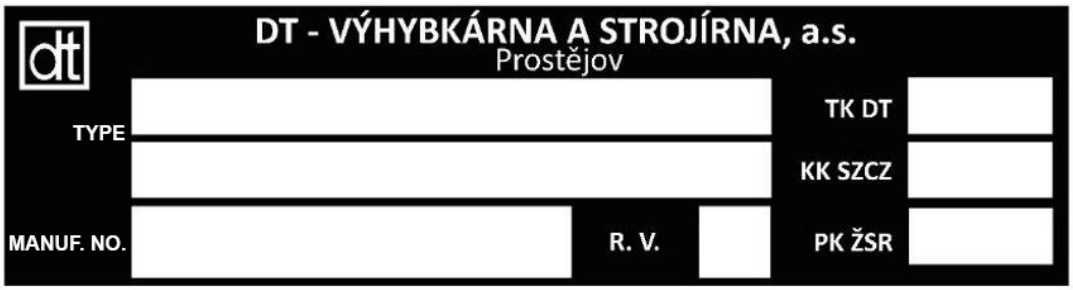


Figure 5 - Frog identification plate

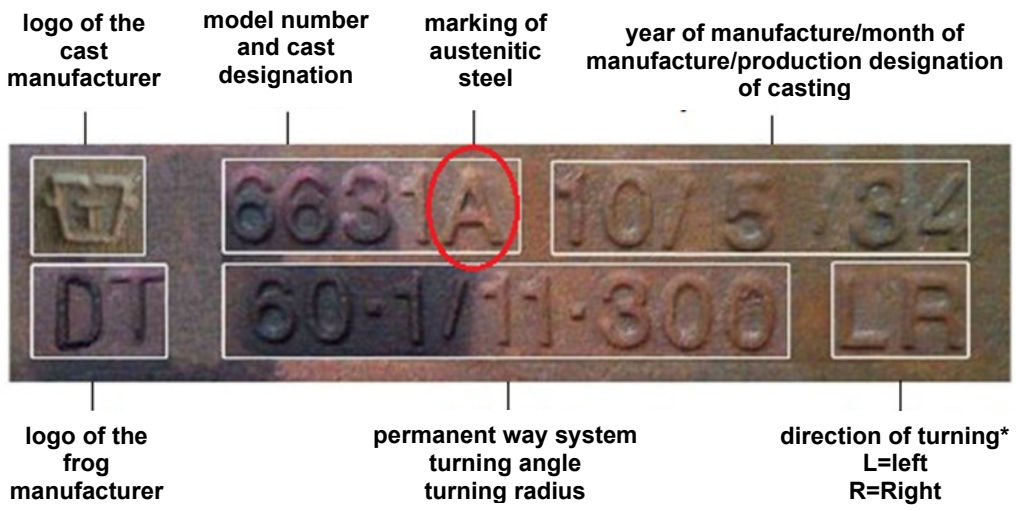
- **Casting of the frog**

Marking with a pre-cast mark on the side of the casting.

Pre-cast mark of the casting varies according to the casting manufacturer. For an example of a casting from Slévárny Třinec (Czech Republic), see Figure 6,for an example of a casting from BFM - Figure 7. Permanent legible casting marking is placed on the side of the casting in accordance with the relevant drawing documentation and TPD.

Manufacturer of castings Slévárny Třinec

- brand of the casting manufacturer and the manufacturer of the frog,
- model number and casting designation (the letter A indicates austenitic manganese steel),
- last two digits of the year of manufacture, month of manufacture,
- casting serial number.
- precise designation of the frog (system type, type of a switch - tg of the turning angle, turning radius) and direction of turning,



***note: according to the design of the frog, the redundant marker will be ground off**

Figure 6 - Example of casting identification - Slévárny Třinec

Manufacturer of castings BFM

- logo of the casting manufacturer and the manufacturer of the frog,
- month of manufacture, year of manufacture, serial number of casting
- precise designation of the frog (system type, type of a switch - tg of the turning angle, turning radius) and direction of turning,

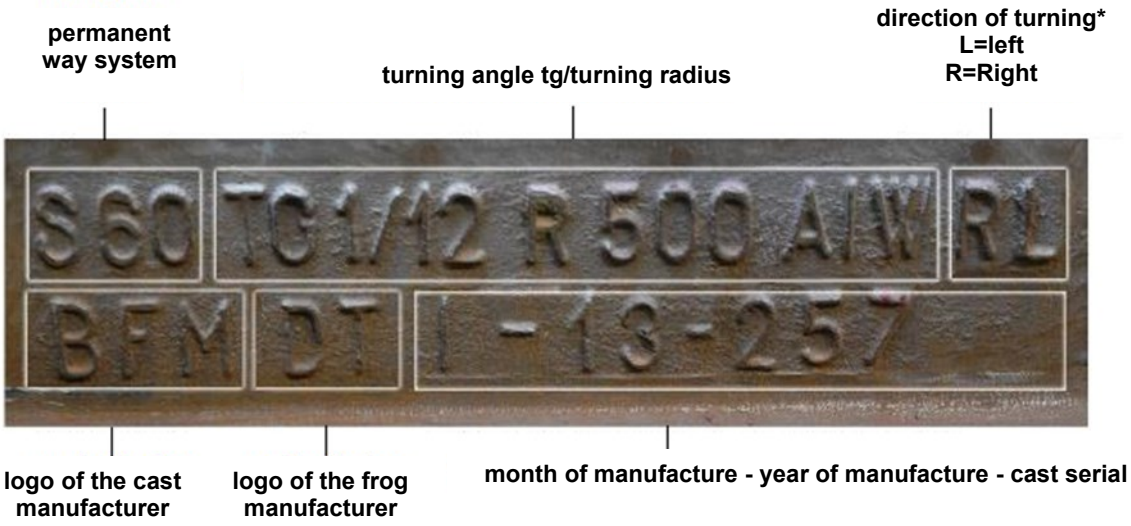


Figure 7 - Example of frog casting identification - BFM

4.2 Method of delivery and packaging of the frog

The frog is supplied either as part of the rail switch or separately as a spare part, in unpacked form on open rail vehicles or trucks. The manufacturer must secure the frog for transport so that it cannot be damaged.

4.3 Transport, handling and storage

The frog sections of the switches are delivered dismantled on flat cars. The entire assembled frog section of the switch can only be transported using a special tilting rail vehicle.

- The work associated with the transport and installation of the frog must be carried out in such a way as to avoid damage and deformation of the frog and thus damage to its geometry or surface, especially the running surfaces. Frogs up to 10 m long can be held in the centre of gravity by a single lashing, provided that the capacity of the lashing is not exceeded. Frogs over 10 m in length must be tied with two lashings.

- When handling with a crane, it is necessary to hang the assembled heart sections of the switches by the rails fixed to the sleepers. The deviation of the suspension ropes from the vertical direction must not be greater than max. ± 20° in the longitudinal direction parallel to the axis of the frog section (to prevent the sleepers from bunching under very strong tension) and max. 35° in the transverse direction perpendicular to the axis of the switch section, see Figure 8.

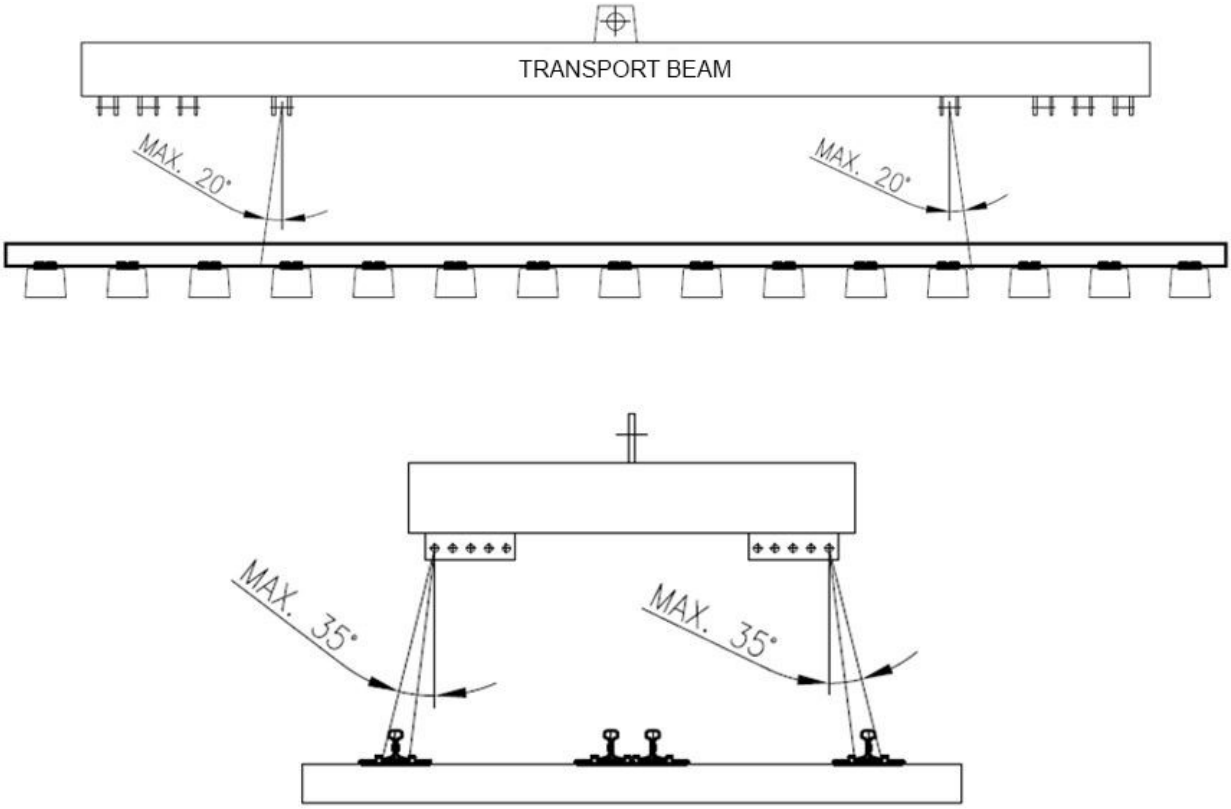


Figure 8 - Hanging the assembled frog sections of the switches

- The individual frogs must be stored on a paved, level surface in a maximum of three layers. The individual frogs must be supported by wooden blocks spaced approximately 4 metres apart.

The assembled frog sections of the switches must be stored on a paved levelled surface. The reinforcement and the shape of the surface must ensure that the sleepers are not subjected to negative bending moment (tensile stress on the upper/ storage surface of the sleeper) from the steel part of the switches during storage. In the event that sufficient flatness of the storage area cannot be ensured, a flattened grid of rails of adequate load-bearing capacity may also be used under the lower surface of the frog section. The rails of the grid must be placed under the sleepers at the points where the running rails are placed. Assembled frog sections of switches with concrete sleepers installed may be placed in a maximum of three layers on top of each other. Assembled frog sections of switches may be placed in a maximum of three layers on top of each other.

4.4 Installation of a frog with a new switch

When handling the frog it is necessary to follow the safety instructions, see chapter 3

4.4.1 Working procedure for mounting the frogs of partially assembled switches on wooden or concrete sleepers

1) Lay out the sleepers of the frog section (switch) with mounted sole plates according to the layout (assembly) drawing of the frog section (switch) assembly.
2) Spread the rubber pads on the sole plates.
3) Install the frog section running rails, align the rails of the outer belt of the main direction.
4) Adjust the position of the pre-assembled sleepers according to the markings on the feet of the outer running rails of the frog.
5) Install the frog.
6) Adjust the track gauge to the required tolerance.
7) Check the arc rise of the bent running rail to the check rail.
8) Install the check rails, including adjusting the grooves and the L and A guide distances in both the main and branch directions.
9) Welding of the frog and centre part can be done only after inserting the whole switch, its proper directional and height adjustment and tightening of fasteners.

4.4.2 Work procedure for mounting the frog section of a single switch on a fixed track (Top to down installation system)

1) Lay out the frog section (frog and rails to the check rail assembled with the sole plates and check rails) on the base layer of the concrete slab.
2) Using sufficient jacks, raise the frog section to the required height required for pouring the second concrete layer. Make sure that the height of the frog section is not corrugated, due to its own weight and insufficient support, and that the running rails are not rotated from their horizontal position.
3) Align the centre section with the frog section directionally.
4) Set the gauge to the required tolerances and interlock the frog with the rails to the check rail by suitable means to ensure a constant gauge until the concrete grout is fully cured.
5) Check the arc rise of the bent running rail to the check rail.
6) Fit the holes in the sole plates with insulating sleeves (if supplied).
7) Fit the holes with anchor bolts, washers and nuts. In case the flexible washers under sole plates are supplied together with the frog section, it is necessary to install these washers before pouring the concrete layer and fix them perfectly to the bottom surface of the sole plates.
8) Lightly tighten the nuts of the anchor bolts to fix the position of the anchor bolts.
9) Pour the concrete layer to the required height. If the reinforcing element under the sole plate is installed additionally in the form of a special elastic layer, the upper surface of the concrete top layer must be terminated at a sufficient distance from the lower surface of the sole plate.
10) After the concrete slab has cured sufficiently, pour an additional reinforcing layer under the sole plate.
11) After the grout has cured, tighten the anchor bolts to the specified tightening torque.
12) Welding of the frog section and the rail centre part can be done only after inserting the whole switch, its proper directional and height adjustment and tightening of fasteners.

4.4.3 Work procedure for mounting the frog section of a single switch on a fixed track (Bottom up installation system)

1) Lay out the frog section (frog and rails to the check rail assembled with the sole plates and check rails) on the base layer of the concrete slab. At the same time, insert spring washers under the sole plates.
2) Align the centre section with the frog section directionally.
3) Set the gauge within the required tolerances.
4) Check the arc rise of the bent running rail to the check rail.
5) Drill holes for anchors in the concrete slab through the holes in the sole plates with a core drill.
6) Clean the drilled holes perfectly with compressed air.
7) Apply the adhesive sealant to the hole and insert the fully assembled anchor into the hole.
8) After the adhesive sealant has fully cured, tighten the nut (bolt) of the anchor to the working position with the prescribed tightening torque.
9) Welding of the frog and centre part can be done only after inserting the switch, its proper directional and height adjustment and tightening of anchors.

4.5 Conditions for installing a frog supplied as a separate spare part

In the case of supplying the frog as a spare part, the frog is applicable as a replacement for all types of fixed frogs of the UIC 60 permanent way system. It is standardly produced with an extended constructional length. The welded connection rails are extended by 700 mm, without end drilling. It may be fitted with differential abnormal rib sole plates and supplemented with a bundle of rubber pads of the appropriate number for the other sole plates. The differential sole plates are fitted with clamps and supplied with rubber pads. The number of sole plates and their serial numbers are determined by the geometry of the frog (see Annex No. 3). When inserting the frog as a replacement part, the contractor shall replace all rubber pads along its entire length.

The type and quantity of differential sole plates for each frog shape and type are given in the tables, see Annex No. 3.

The following must be observed when installing the frog supplied as a spare part:

- Ensure the rubber pads are replaced along the entire length of the frog.
- Provide manual tamping of the frog with the impact tamping machine (unless the frog is on the PJD).

4.6 Safe operation/limit operating deviations and tolerances

The permissible limit deviations and tolerances of the operating parameters are governed by the standards and regulations of the infrastructure managers.

5 Maintenance and repairs of the frog

To ensure the long-term service life of the frog, regular inspections and measurements must be carried out to prevent the occurrence of defects caused by operation or to detect them in time. This chapter lists all the known types of faults and defects that can occur with this type of a frog, including references to technological procedures for their elimination.

The defect codes listed are internal codes of the switch manufacturer. The relevant regulations of the infrastructure manager shall apply to the identification of defects and the determination of appropriate measures.

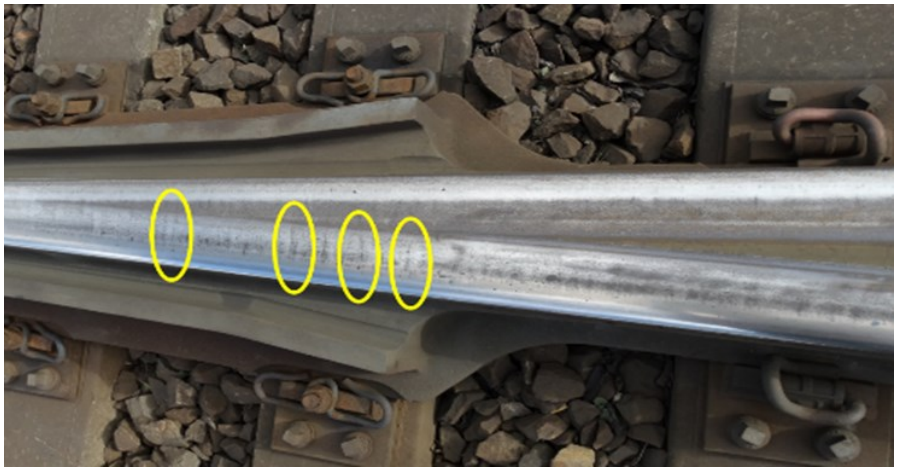
Table of codes for frog defects detected visually

Mark 0	Mark 1	Types of defects	Mark 2	Degree of defect development	Mark 3	Location of M defects	Mark 4	Method of repair	Defect code
S	0	without defects	0	without defects	0	without defects	P	regular inspection	0O0P
	1	laps	0	up to 1.5 mm	1	running surface - crossing point + wing	P	regular inspection	101P 102P 103P
					2	other running surface			
			1	over 1.5 mm and sharp edges	3	connecting, wing rails	B	grinding	111B 1128 1138
					4	casting, wedge			
	2	cracks (also H-CH defect)	1	cracks	1	running surface - crossing point + wing	B	grinding	2118 2128 2138 2148
					2	other running surface			
					3	connecting, wing rails			
					4	casting, wedge			
	3	bumped crossing points	1	bumping	1	running surface - crossing point + wing	B	grinding	3118
	4	wear (in transverse - PŘS, longitudinal - PS changes)	0	PS up to 0.5 mm	1	running surface - crossing point + wing	P	regular inspection	401P
			1	PS 0.51 - 1 mm, PRS up to 4'3 mm up to over 1 40 kmph			B	grinding	4118
			2	PS over 1 mm, PRS over 4/3 mm up to over 140 kmph			N	welding	421N
	5	crumbling (tearing of material, slipping of wheels)	1	small crumbling	1	running surface - crossing point + wing	B	grinding	5110 5120 5130 5140
					2	other running surface			
			2	more crumbling	3	connecting, wing rails	N	welding	S21N 522N 523N S24N
					4	casting, wedge			
	6	longitudinal cracks	2	repairable	1	running surface - crossing point + wing	N	welding	621N 622N E23N 624b
					2	other running surface			
			3	non-repairable	3	connecting, wing rails	V	replacement	631V S32V 633V 634V
					4	casting, wedge			
	7	transverse cracks (fractures)	2	repairable	1	running surface - crossing point + wing	N	welding	72IN 722N 723N 724N
					2	other running surface			
			3	non-repairable	3	connecting, wing rails	V	replacement	731V 732V 733V 734V
					4	casting, wedge			
	J	other defects (screws, inserts, etc. 1	2	repairable	3	connecting, wing rails	O	repair of the part	J23O J24O
			3	non-repairable	4	casting, wedge	V	replacement of the part	J33V J34V

5.1 Breakdown of defects by type of maintenance and repair

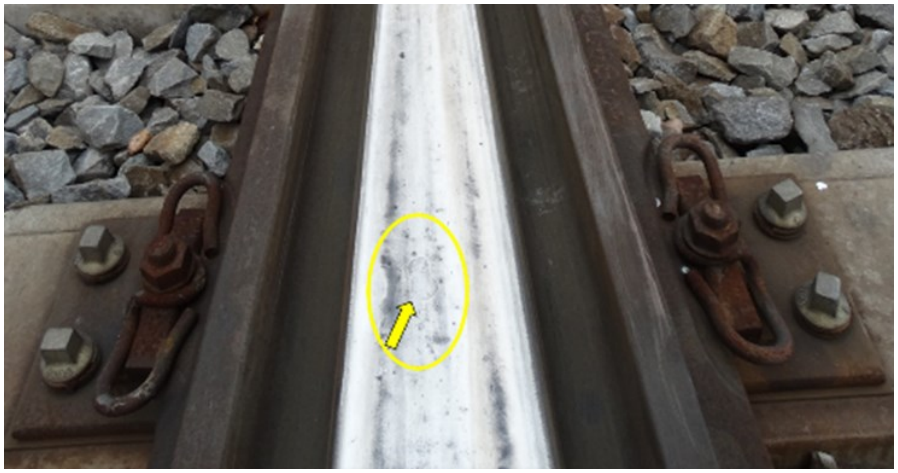
5.1.1 Acceptable size and extent of defects not requiring maintenance intervention

Transverse impressions from the application of blast hardening technology on the running surfaces (applies only to ZPTZ frogs)
Defect code 000P



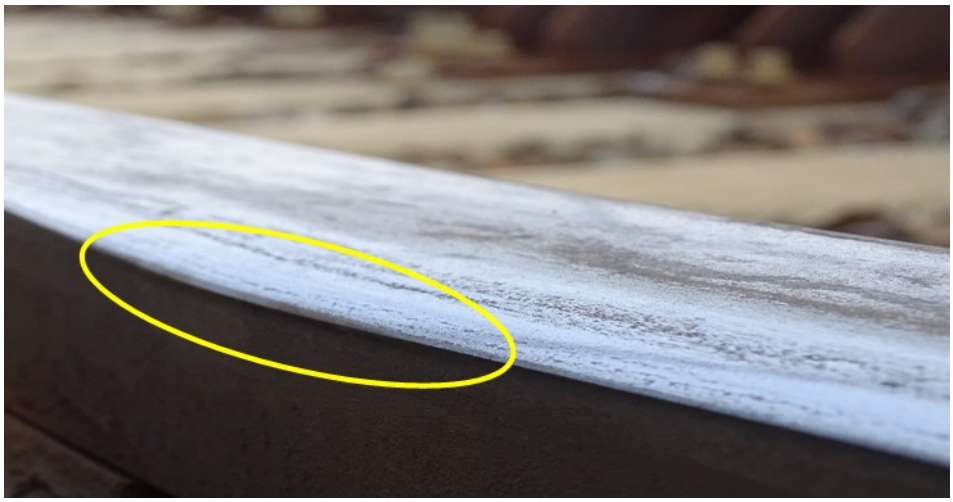
Surface stains on running surfaces
Defect code 000P

Outline of the pattern after the casting has been repaired by welding at the casting or frog manufacturer
Defect code 000P

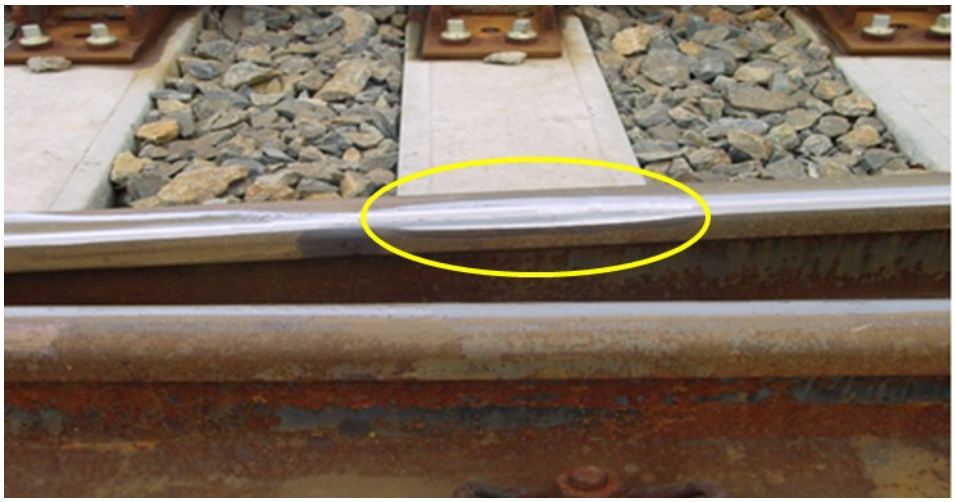


Laps on running surfaces in the crossing point-wing area up to and including 1.5 mm
Defect code 101P

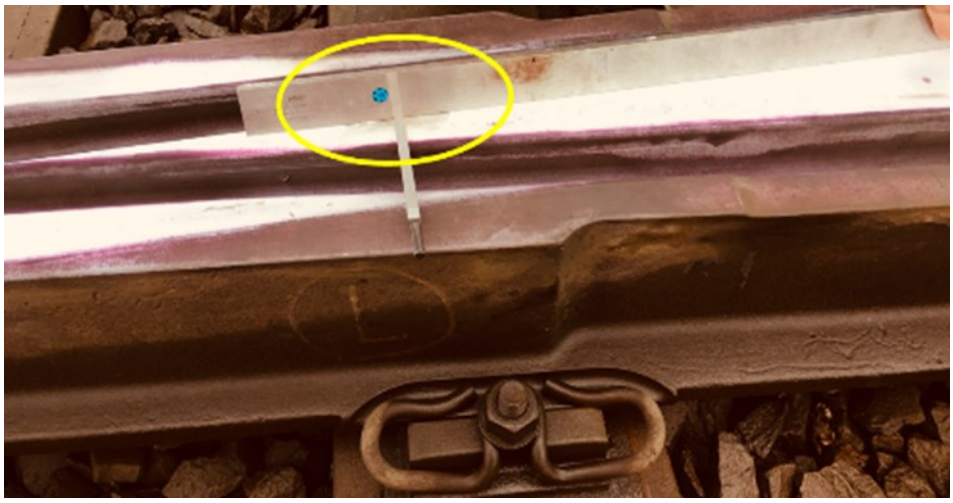
Laps on other running surfaces of the casting up to and including 1.5 mm
Defect code 102P



Laps on connecting rails up to and including 1.5 mm
Defect code 103P

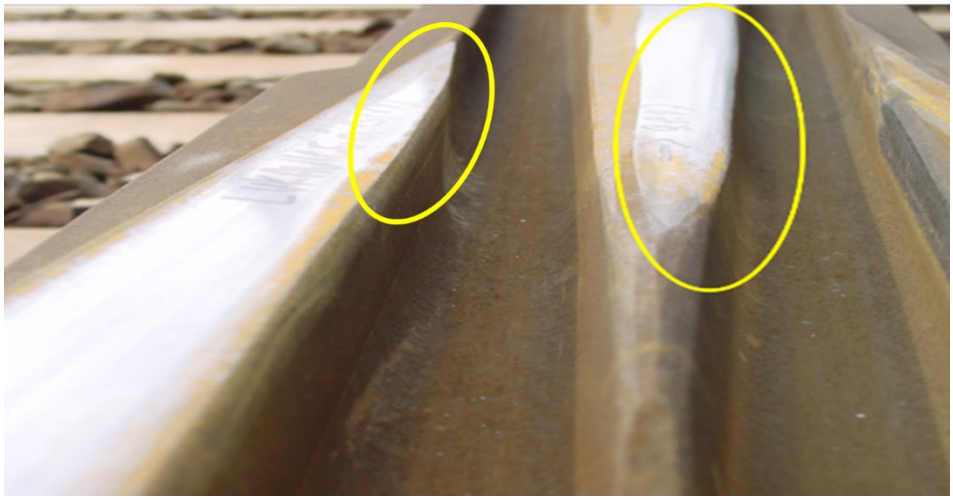


Crossing point wear measured in the longitudinal direction in the crossing point-wing area up to and including 0.5 mm
Defect code 401P

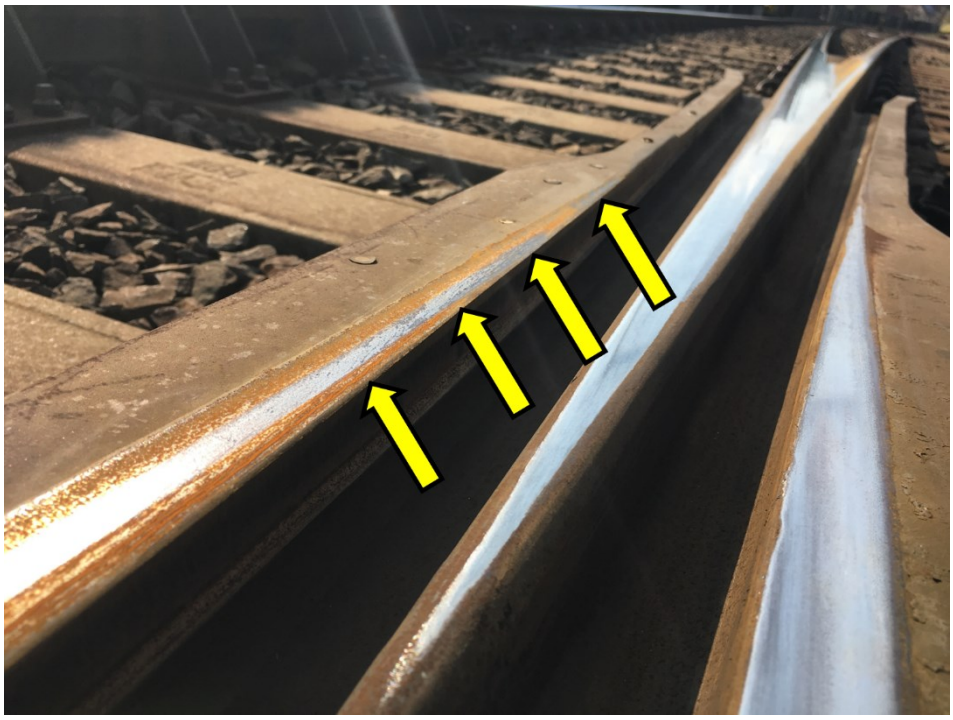


5.1.2 Defects requiring repair by grinding

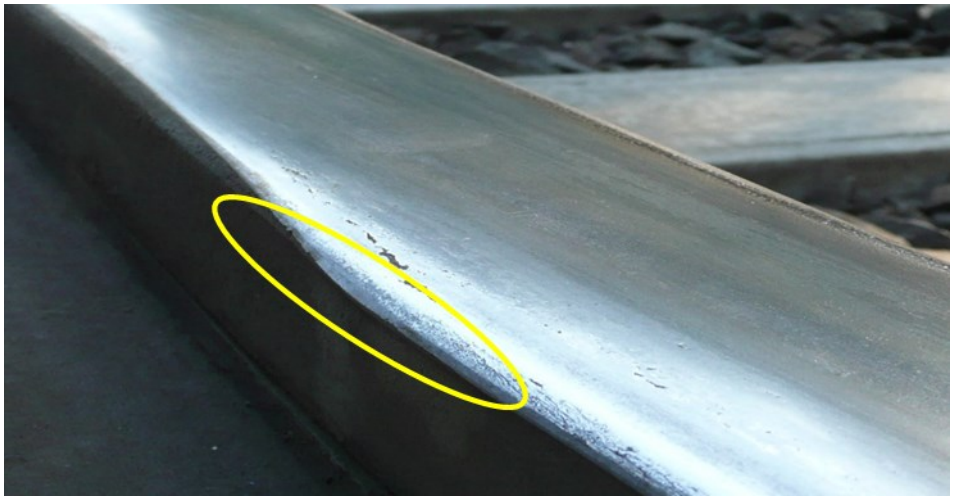
Laps on running surfaces in the crossing point-wing area over 1.5 mm
Defect code 111B



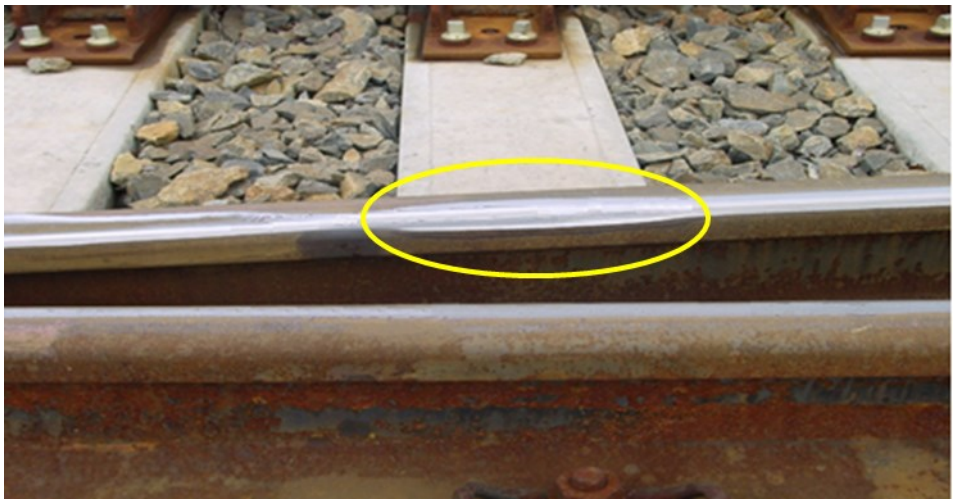
Sharp edges on the wing rails in the crossing point-wing area
Defect code 114B



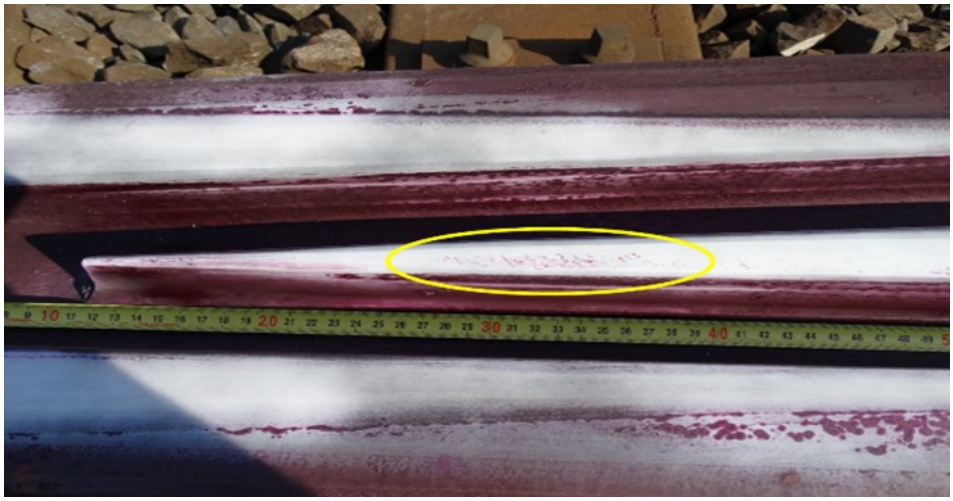
Laps on other running surfaces of the casting over 1.5 mm
Defect code 112B



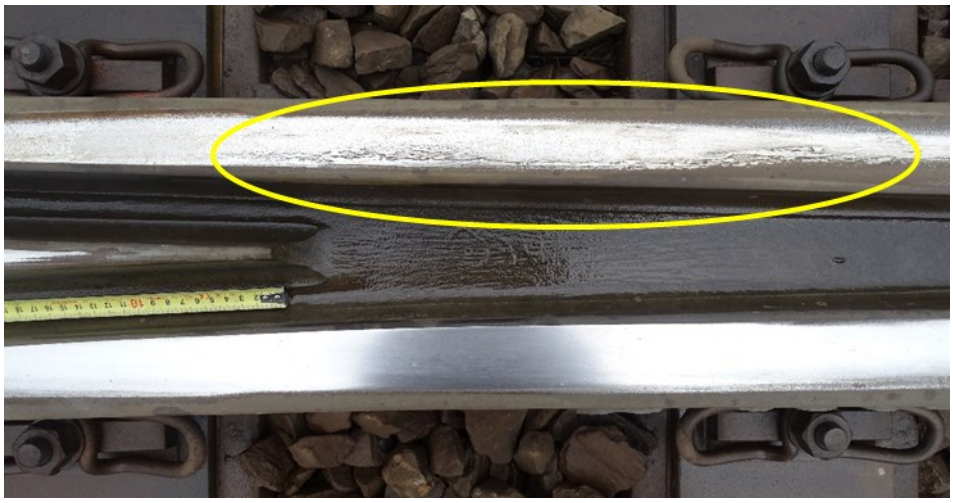
Laps on connecting rails over 1.5 mm
Defect code 113B



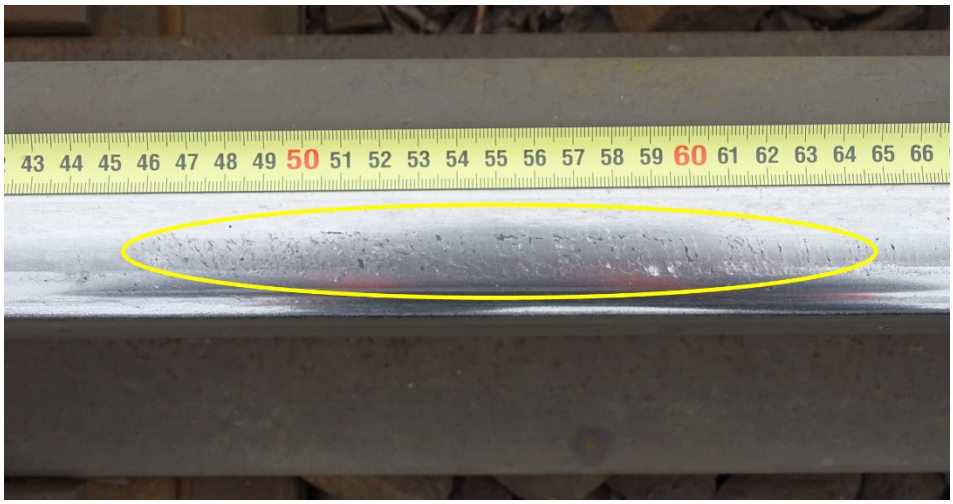
Cracks (including head check defects) on running surfaces in the crossing point-wing area
Defect code 211B



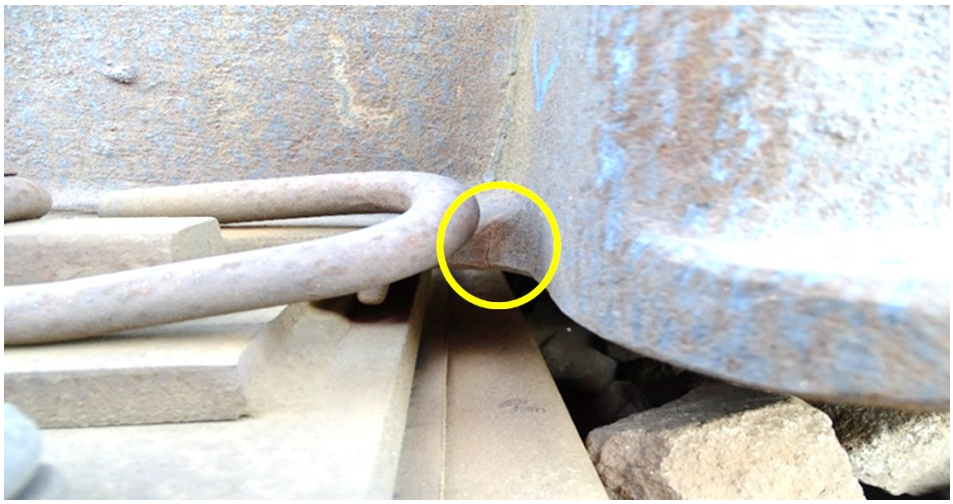
Cracks (including H-CH defects) on other running surfaces of the casting
Defect code 212B



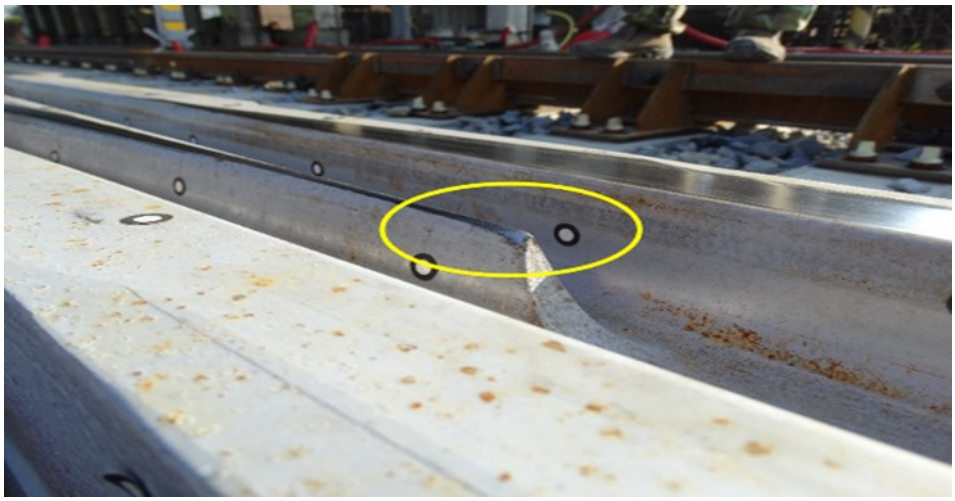
Cracks (including H-CH defects) on connecting rails
Defect code 213B



Cracks on the casting
Defect code 214B

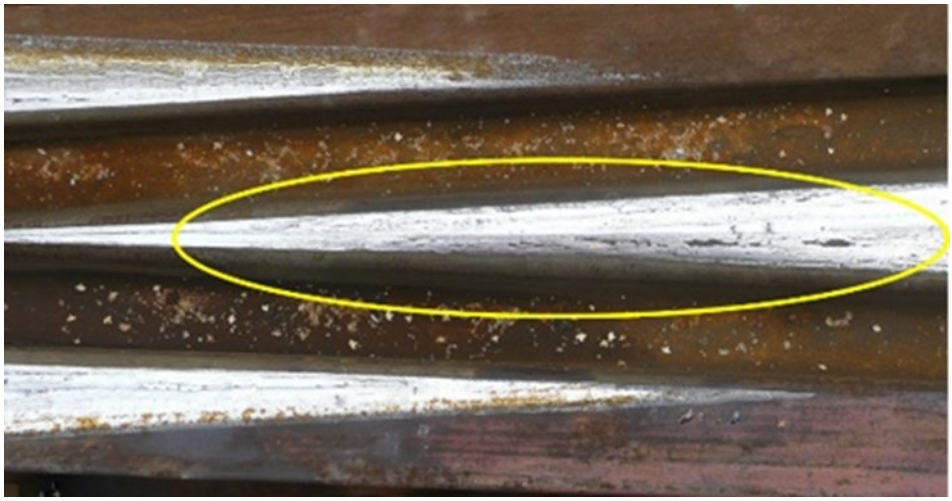


Bumped crossing points on running surfaces in the crossing point-wing area
Defect code 311B

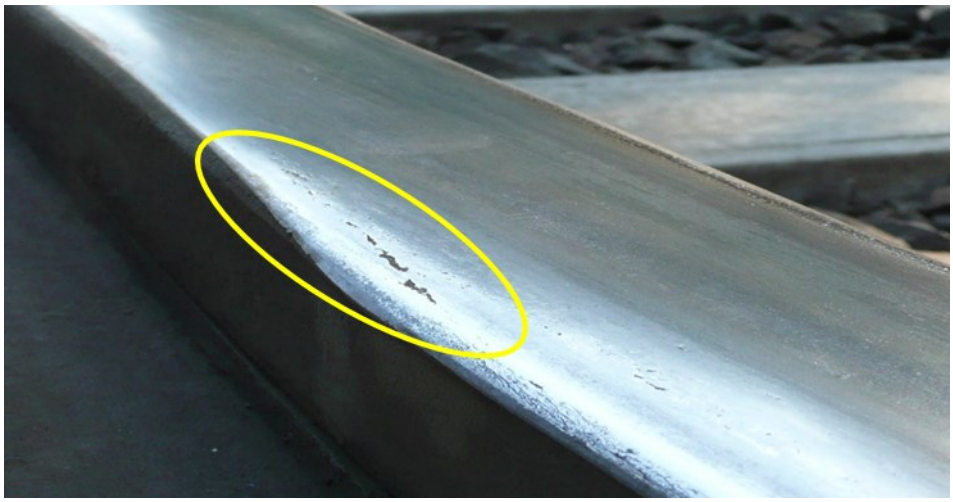


Crossing point wear measured in the longitudinal direction over 0.5 mm up to and including 1 mm and simultaneously crossing point wear measured in the transverse direction over a crossing point width of 40 mm for speeds up to and including 140 kmph up to and including 4 mm and for speeds over 140 kmph up to and including 3 mm
Defect code 411B

Crumbling (tearing of material, slipping of wheels, etc.) of material in the initial phase on the running surfaces in the crossing point-wing area
Defect code 511B



Crumbling (tearing out of material, slipping of wheels, etc.) of material in the initial phase on other running surfaces of the casting
Defect code 512B

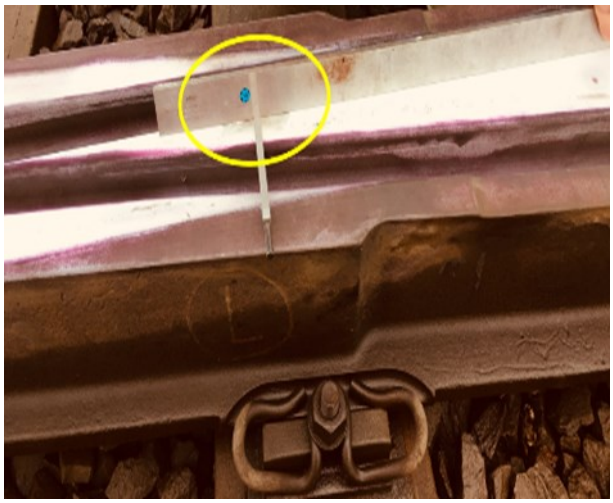


Crumbling (tearing out of material, slipping of wheels, etc.) of material in the initial phase on connecting rails
Defect code 513B

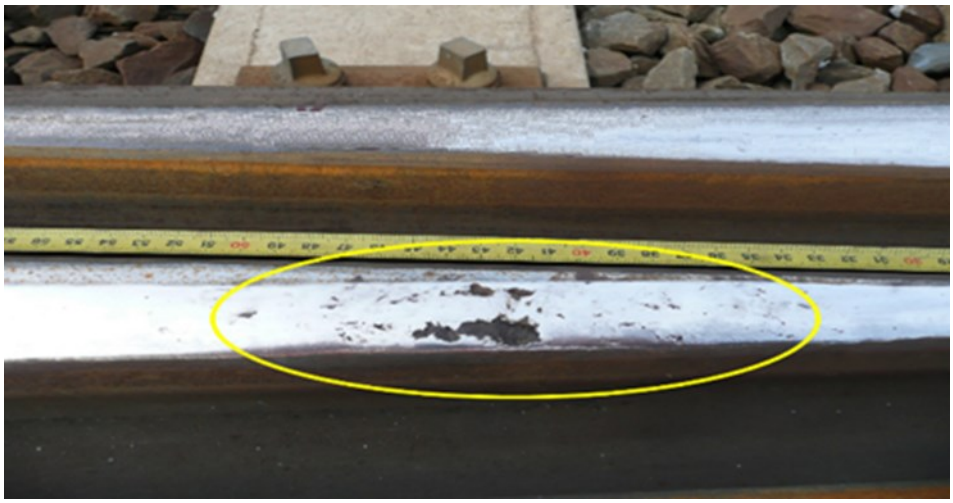
Crumbling (tearing out of material, etc.) of material in the initial phase on the casting
Defect code 514B

5.1.3 Defects requiring repair by welding

Crossing point wear measured in the longitudinal direction over 1 mm and simultaneously crossing point wear measured in the transverse direction over a crossing point width of 40 mm for speeds up to and including 140 kmph over 4 mm and for speeds over 140 kmph over 3 mm
Defect code 421N



More rumbling (tearing of material, slipping of wheels, etc.) of material non-repairable by grinding on the running surfaces in the crossing point-wing area
Defect code 521N



More crumbling (tearing out of material, slipping of wheels, etc.) of material non-repairable by grinding on other running surfaces of the casting
Defect code 522N

More crumbling (tearing out of material, slipping of wheels, etc.) of material non-repairable by grinding on connecting rails
Defect code 523N

More crumbling (tearing of material, etc.) of material - non-repairable by grinding on the casting
Defect code 524N

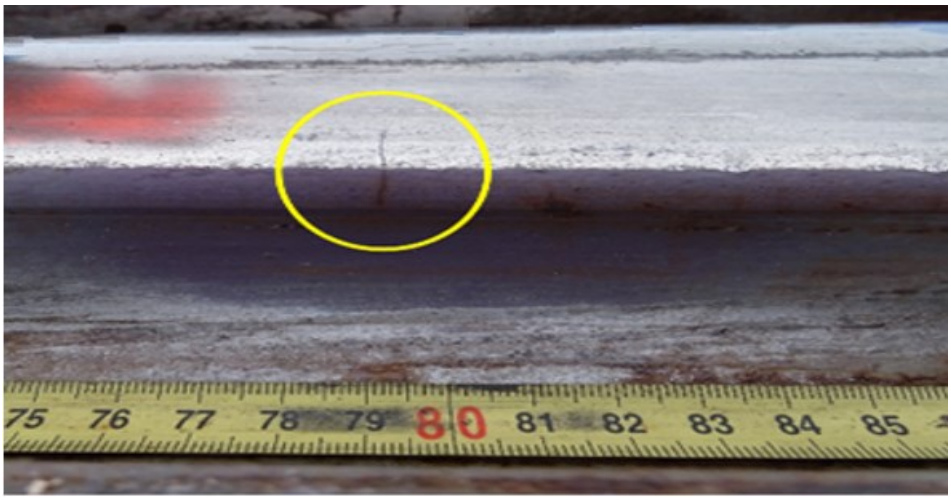
Longitudinal cracks on running surfaces in the crossing point-wing area
Defect code 621N

Longitudinal cracks on other running surfaces of the casting
Defect code 622N

Longitudinal cracks on connecting rails
Defect code 623N

Longitudinal cracks on the casting
Defect code 624N

Transverse cracks on running surfaces in the crossing point-wing area
Defect code 721N



Transverse cracks on other running surfaces of the casting
Defect code 722N

Transverse cracks on connecting rails
Defect code 723N
(No photo)

Transverse cracks on the casting
Defect code 724N

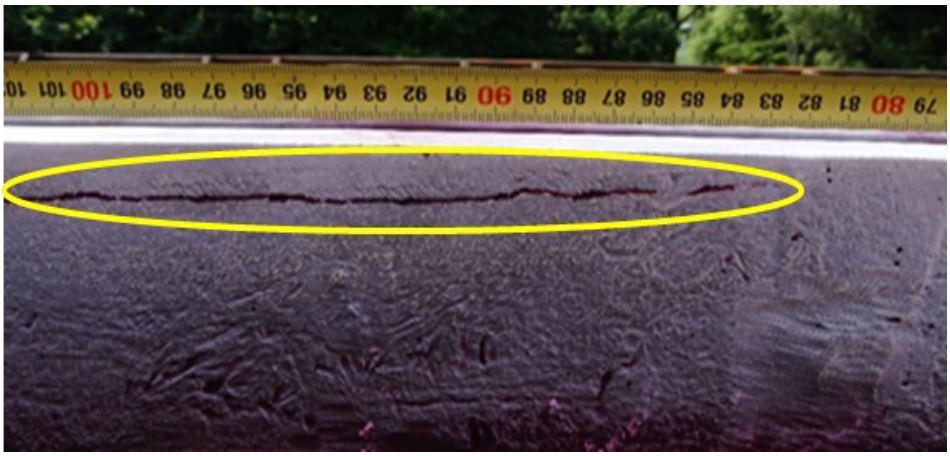
5.1.4 Defects requiring frog replacement

Longitudinal cracks on running surfaces in the crossing point-wing area
Defect code 631V

Longitudinal cracks on other running surfaces of the casting
Defect code 632V

Longitudinal cracks on connecting rails
Defect code 633V

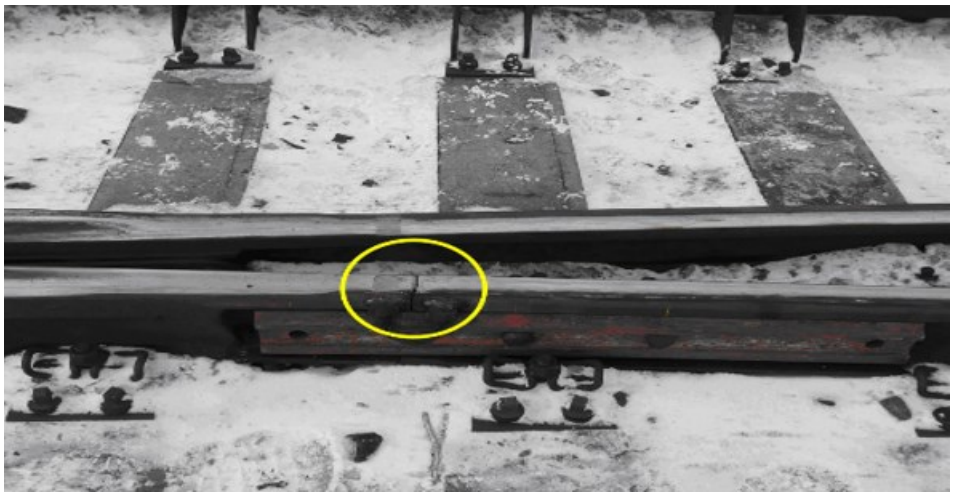
Longitudinal cracks on the casting
Defect code 634V



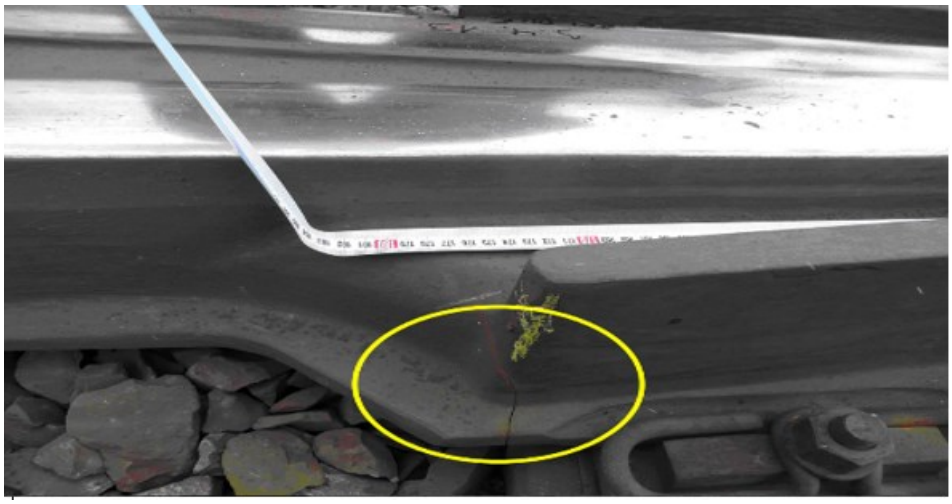
Transverse cracks on running surfaces in the crossing point-wing area
Defect code 731V

Transverse cracks on other running surfaces of the casting
Defect code 732V

Transverse cracks in the connecting rails, or in the weld with a Cr-Ni intermediate piece
Defect code 733V



Transverse cracks on the casting
Defect code 734V



5.1.5 Other defects requiring repair or replacement of frog parts

(all fasteners and other materials related to the frog)

Repairable at ZMM, ZMMZ, Insert - e.g. tightening of the mounted connection, replacement or modification of the insert, replacement or tightening of the bolt. Replacement of a damaged fastening system element, etc.)
Defect code J23O
Defect code J24O
Defect code J33V
Defect code J34V

6 Repair of the frog

The chapter 5 of this manual can be used to assess the defect detected and select the appropriate corrective action.

Based on regular inspections and measurements of the frog and their evaluation, it is necessary to carry out the following repair work:

6.1 Grinding and its geometry

The basic grinding should be done within 3 months after the frog commissioning. Further grinding is recommended to be carried out at intervals depending on the operating load of the frog.

The grinding procedure of the running parts of cast frog is governed by the technological regulation TP No. 18 in the valid version, issued by the manufacturer.

6.2 Repairs by welding in the area of the frog casting

The procedure of repairs by welding is governed by the technological regulation TP No. 94 in the valid version, issued by the manufacturer.

6.3 Welding repairs in the weld area of the frog casting with connecting rails via a Cr-Ni intermediate piece

The procedure of repairs by welding in the weld area of the frog casting with connecting rails through the Cr-Ni intermediate piece is governed by the technological regulation TP No. 126 as amended, issued by the manufacturer.

6.4 Intervals of checks and inspections of operated frogs

The intervals and minimum scopes of inspections are mandatorily determined by the regulations of the infrastructure manager.
Unless otherwise specified in these regulations, the manufacturer recommends the following:

Measurement of track gauge values, guideway distances L and A and the elevation of the rail tracks	1 x every 3 months
Inspection of the frog section	1 x every 3 months
Non-destructive check of the frog	if the occurrence of a defect is suspected

7 Occupational safety and health, ecology

7.1 Risk assessment related to occupational safety and health

The manufacturer declares that in connection with the handling, assembly, operation, maintenance, and disassembly of the frog in accordance with this manual, there are no specific safety hazards associated with the aforementioned activities that need to be addressed in this manual. These are common activities carried out during the construction, assembly, and maintenance work on the permanent way. In the course of carrying out activities, the implementing companies and their employees must comply with the occupational health and safety regulations associated with this type of activity in accordance with the applicable legislation (e.g. use of personal protective equipment, storage, working with lifting equipment).

7.2 Assessing risks associated with impacts on the working and living environment

Frogs according to this manual do not have a negative effect on the environment if properly operated, the best available technologies have been used in their design and development, and environmental requirements have been fully respected; no waste is generated during their operation, The manufacturer is certified in compliance with CSN EN ISO 14001.

Packing materials (wooden boxes, wooden pallets, wooden interlinings, binding wire, binding straps, and other suitable fixing materials) are used in the transport and handling of frogs according to this manual pursuant to the applicable legislation of the Czech Republic on the placement of packaging on the market. The manufacturer participates in the Ekokom system, and charges for and keeps records of its packaging. All these packages and devices are disposable; labelled according to the standard

CSN 77 0052–2 specifications, and after use, the waste must be properly sorted and handed over to authorized persons for disposal in accordance with the applicable legislation. The materials used for packaging are fully recyclable. The soundness of the delivered material for packaging has been demonstrated by the manufacturer.

Other and hazardous waste pursuant to the applicable legislation may be generated during the assembly and maintenance of frogs in accordance with this manual, in particular:

120101	Ferrous metal filings and turnings
150103	Wooden packaging
150110*	Packaging containing residues of hazardous substances
150202*	Absorbents
170405	Iron and steel

Note:(*) hazardous waste marking

This waste must be sorted and handed over to authorized persons for disposal pursuant to the applicable legislation.

Other waste and hazardous waste arise when disposing of end-of-life frogs according to this manual, in particular:

120101	Ferrous metal filings and turnings
170405	Iron and steel

This waste must be sorted and handed over to authorized persons for disposal in accordance with the applicable legislation.

The above obligations must be met by the respective companies in accordance with the concluded contract.

8 Overview of applicable used and related standards

CSN EN 13232-1	Railway applications - Track - Switches and crossings - Part 1: Definitions.
CSN EN 13232-2	Railway applications - Track - Switches and crossings - Part 2: Requirements for geometric design.
CSN EN 13232-3	Railway applications - Track - Switches and crossings - Part 3: Requirements for wheel/rail interaction.
CSN EN 13232-6	Railway applications - Track - Switches and crossings - Part 6: Fixed common and obtuse crossings
CSN EN 13232-9	Railway applications - Track - Switches and crossings - Part 9: Layouts.
CSN EN 13481	Railway applications - Track - Performance requirements for fastening systems.
CSN EN 13674-1	Railway applications - Track - Rail - Part 1: Vignole railway rails 46 kg/m and above
CSN EN 13715+A1	Railway applications - Wheelsets and bogies - Wheels - Tread profile.
CSN EN 15689	Railway applications - Railways - Switches and crossings - Cast austenitic manganese steel frogs
TPD 202-360-23	Technical delivery conditions for castings of solid frogs made of austenitic manganese steel
TPD 60/02	Railway switch structures
UIC 510-2	Trailing stock- Wheels and wheelsets - Conditions concerning the use of wheels of various diameters
UIC 864-2	Technical specification for the supply of steel bolts for the permanent way.
UIC 864-3	Technical specification for the supply of spring steel washers for use in permanent way.
UIC 864-6	Technical specification for the supply of base-plates or sections for base-plates made of rolled steel.

National standards and regulations:

CSN 73 6360-1	Geometrical characteristics of railway tracks - Part 1: Layout.
CSN 73 6360-2	Geometrical characteristics of railway tracks - Part 2: Construction and acceptance, service and maintenance.
Regulation SŽDC S3	Permanent Way

Manufacturer's internal regulations:

TP No. 18	Technological regulation for grinding of running parts of switches
TP No. 94	Technological regulation for the repair of in-service frogs made of Mn 13 material by manual electric arc welding
TP No. 126	Technological regulation for resistance welding of Mn frogs over CrNi intermediate piece

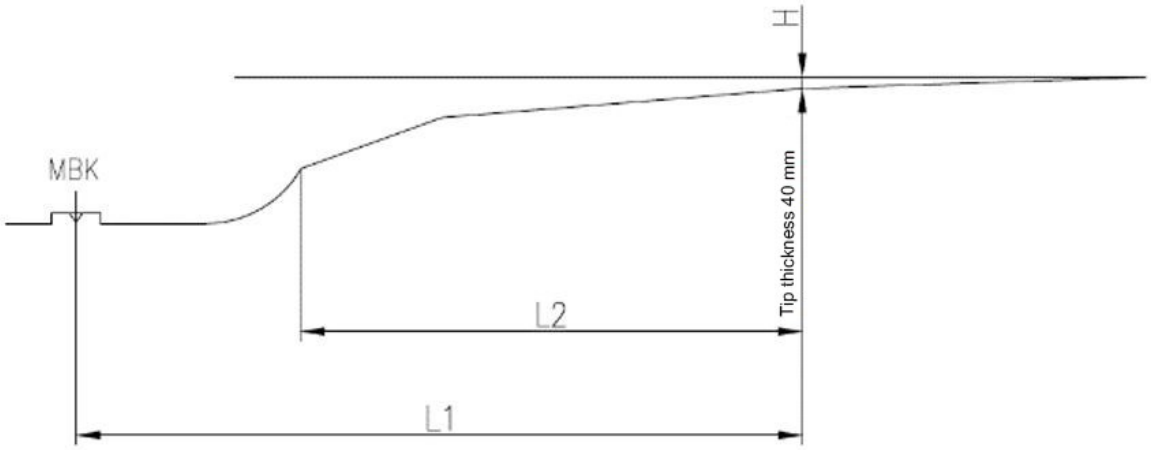
All the above standards, regulations and documents are considered as amended.

Annex No. 1 - Overview of ZPT, ZPTZ frogs used by SŽ and ŽSR

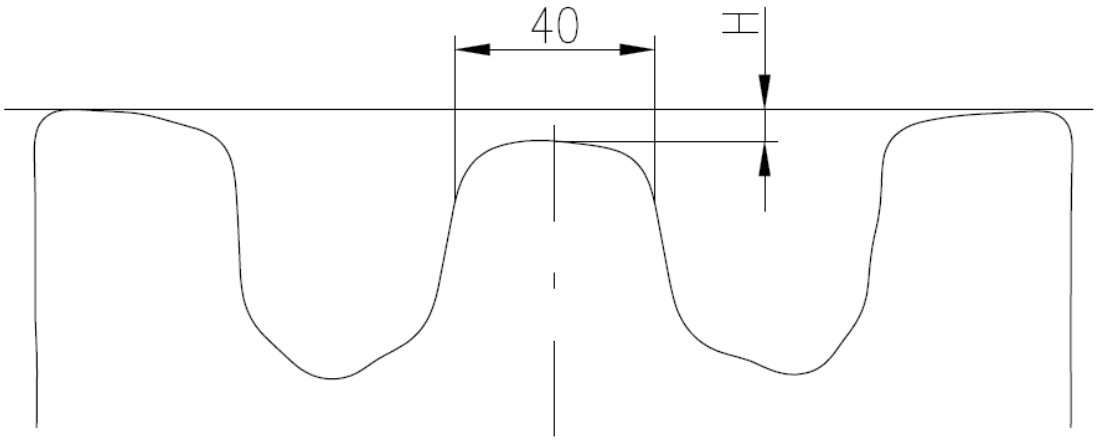
ZPT, ZPTZ				
Geometry of the frog	Frog to the new switch		Spare part-without sole plates	
	Dimensions of the frog length/width/height [mm]	Weight [t]	Dimensions of the frog length/width/height [mm]	Weight [t]
60-1:7.5 (1:6.6)-190	8233/766/175	1.498	9633/859/175	1.666
60-1:9-190	6751/563/175	1.210	8151/636/175	1.378
60-1:9-300	8026/598/175	1.405	9426/656/175	1.573
60-1:11-300	7222/496/175	1.304	8622/557/175	1.472
60-1:12-500	9179/527/175	1.741	10579/574/175	1.909
60-1:14-760	12008/576/175	2.126	13408/616/175	2.294
60-1:18,5-1200	12608/469/175	2.138	14008/499/175	2.306

Appendix No. 2 - Height machining of the crossing point

SCHEMATIC LONGITUDINAL SECTION OF A CROSSING POINT



SCHEMATIC CROSS-SECTION THROUGH THE CASTING IN A CROSSING POINT WIDTH OF 40 MM



TABLES OF VALUES FOR THE RELATIVE HEIGHT POSITION OF THE CROSSING POINT AND WING RAILS

ZPT frogs - BFM - manufacture from 2007 to 2015:

Shape of the frog	H / L1 / L2 [mm] crossing point thickness 40 mm
60-1:9-300	3.2 / 405 / 304
60-1:11-300	3.0 / 440 / 330
60-1:12-500-l	3.2 / 525 / 365
60-1:14-760	3.2 / 647 / 450
60-1:18,5-1200	3.2 / 812 / 565

ZPT frogs - Třinec - manufacture from 2006 to 2014:

Shape of the frog	H / L1 / L2 [mm] crossing point thickness 40 mm
60-1:7,5-190-l	3.0 / 324 / 245
60-1:9-190	3.0 / 361.5 / 271
60-1:9-300	3.0 / 405 / 303
60-1:11-300	3.0 / 440 / 330
60-1:12-500-l	3.0 / 525 / 393
60-1:14-760	3.0 / 647 / 484

ZPT / ZPTZ frogs - Třinec - manufacture since 2015:

Shape of the frog	H / L1 / L2 [mm] crossing point thickness 40 mm
60-1:7,5-190-l	2.8 / 324 / 245
60-1:9-190	2.8 / 361.5 / 271
60-1:9-300	2.8 / 405 / 303
60-1:11-300	2.8 / 440 / 330
60-1:12-500-l	2.8 / 525 / 393
60-1:14-760	2.8 / 647 / 484
60-1:18,5-1200	4.9 / 812 / 608

Annex No. 3 - Tables for determining the type and quantity of differential sole plates

SOLE PLATE FOR THE FROG OF THE SWITCH J60-I:7,5-190 (ACCORDING TO THE TYPE OF FROG)

Sleeper number	11-051	11-052	11-053	11-054	11-055	11-056	11-057	11-058	11-059
Type of frog design									
Forged hardened crossing point SK	Y5217	Y5218	Y5219	Y5220	Y5221	Y5222	Y5223	Y5224	Y5225
Monoblock ZPT, ZPTZ					Y7316	Y7317	Y7318		

Sole plates to replace differential sole plates

Also valid for the ZPT, ZPTZ frogs of switches 160-1:6,6-190

SOLE PLATE FOR THE FROG OF THE SWITCH J60-I:9-190 (ACCORDING TO THE TYPE OF FROG)

Sleeper number	11-035	11-036	11-037	11-038	11-039	11-040	11-041	11-042	11-043	11-044
Type of frog design	Sole plate number									
Monoblock ZPT - until 2002	**Y3921**	**Y3922**	**Y3923**	**Y3924**	**Y3925**	**Y3926**	**Y3927**	**Y3928**	**Y3929**	Y3930
Forged hardened crossing point SK				**¥3931**	**¥3932**	**Y3933**	**Y3934**			
Assembled from rails ZP, ZPN										
Shortened monoblock ZMB, ZMB 1				**Y5112**	**Y5113**	**Y5114**	**Y5115**			
Monoblock ZPT, ZPTZ				**Y6607**	**Y6608**	**Y6609**	**Y6610**			
Shortened monoblock ZMB 3				**Y5112**	**Y9557**	**Y5114**	**Y5115**			

Sole plates to replace differential sole plates

SOLE PLATE FOR THE FROG OF THE SWITCH J60 1:9 300 (ACCORDING TO THE TYPE OF FROG)

Sleeper number	13-044	13-045	13-046	13-047	13-048	13-049	13-050	13-051	13-052	13-053	13-054
Type of frog design	Sole plate number										
Monoblock ZPT - until 2002	**Y3680**	**Y3681**	**Y3682**	**Y3683**	**Y3987**	**Y3988**	**Y3989**	**Y3990**	**Y3688**	**Y3689**	**Y3690**
Vario VR					**Y3684**	**Y3685**	**Y3686**	**Y3687**			
Forged hardened crossing point SK											
Assembled from rails ZP, ZPN											
Shortened monoblock ZMB, ZMB 1					**Y5040**	**Y5041**	**Y5042**	**Y5043**			
Monoblock ZPT, ZPTZ					**Y6597**	**Y6598**	**Y6599**	**Y6600**			
Shortened monoblock ZMB 3					**Y5040**	**Y9128**	**Y5042**	**Y5043**			

Sole plates to replace differential sole plates

SOLE PLATE FOR THE FROG OF THE SWITCH J60-I:II-300 (ACCORDING TO THE TYPE OF FROG)

Sleeper number	13-062	13-063	13-064	13-065	13-066	13-067	13-068	13-069	13-070	13-071	13-072	13-073
Type of frog design	Sole plate number											
Monoblock ZPT - until 2002	**Y3691**	**Y3692**	**Y3693**		**Y3917**	**Y3918**	**Y3919**	**Y3920**		**Y3700**	**Y3701**	**Y3702**
Vario VR					**Y3695**	**Y3696**	**Y3697**					
Forged hardened crossing point SK												
Assembled from rails ZP, ZPN												
Shortened monoblock ZMB. ZMB 1					**Y4853**	**Y4854**	**Y4855**	**Y3698**	**Y3699**			
Monoblock ZPT. ZPTZ				**Y3694**	**Y6588**	**Y6589**	**Y6590**	**Y6591**	**Y6592**			
Monoblock ZPT - Outreau Manoir				**Y6471**	**Y6472**	**Y6473**	**Y6474**	**Y6475**	**Y6476**	**Y6477**		
Shortened monoblock ZMB 3				**Y3694**	**Y4853**	**Y4854**	**Y9129**	**Y3698**	**Y3699**	**Y3700**		

Sole plates to extend by differential sole plates

SOLE PLATE FOR THE FROG OF THE SWITCH J60-1:12-500 (ACCORDING TO THE TYPE OF FROG)

Sleeper number	15-057	15-058	15-059	15-060		15-061	15-062	15-063	15-064	15-065	15-066	15-067	15-068	15-069	15-070
Type of frog design		Sole plate number													
Insert VA	Y3715	Y3716	Y3717	Y3718		Y3837	Y3838	Y3839	Y3840	Y3841	Y3842	¥3725	Y3726	Y3727	Y3728
Shortened monoblock ZMB. ZMM						Y3719	Y4232	Y4233	Y4234						
Vano VR							Y3720	Y3721	Y3814	Y3815	Y3816				
Forged hardened crossing point SK									Y4523	Y4524	Y3816				
Assembled from rails ZP, ZPN									Y3722	Y3723	Y3724				
Shortened monoblock ZMB 1							Y6370	Y6371	Y4234	Y3841	Y3842				
Monoblock ZPT, ZPTZ							Y6175	¥6611	¥6612	Y6613	¥6614		Y6869		
Monoblock ZPT1						Y8095	Y8096	Y8097	Y8098	Y8099	Y8100	Y8101(SK) Y8303 (Ke)			
Shortened monoblock ZMB 3						Y3719	Y6370	Y6371	Y6699	Y3841	Y3842	Y3725	Y3726		

Sole plates to replace differential sole plates

SOLE PLATE FOR THE FROG OF THE SWITCH J60-1:14-760 (ACCORDING TO THE TYPE OF FROG)

Sleeper number	17-070	17-071	17-072	17-073	17-074	17-075	17-076	17-077	17-078	17-079	17-080	17-081	17-082	17-083	17-084	17-085	17-086	17-087
Type of frog design	Sole plate number																	
Insert VA	Y3782	Y3783	Y3784	Y3785	Y3786	Y3843	Y3844	Y3845	Y3846	Y3847	Y3848	Y3822	Y3794	Y3795	Y3796	Y3797	Y3798	Y3799
Varto VR						Y3787	Y3788	Y3789	Y3790	Y3820	Y3821							
Forged hardened crossing point SK																		
Assembled from rails ZP. ZPN										Y3791	Y3792	Y3793						
Shortened monoblock ZMB. ZMB 1. ZMM							Y4266	Y4267	Y4268	Y4269	Y3848							
Monoblock ZPT, ZPTZ							Y6958	Y6959	Y6960	Y6961	Y6962	Y3822						
Shortened monoblock ZMB 3							Y4266	Y4267	Y4268	Y9160	Y3848							

Sole plates to replace by differential sole plates

SOLE PLATE FOR THE FROG OF THE SWITCH J60-I:14-760 (ACCORDING TO THE TYPE OF FROG)

Sleeper number	17-070	17-071	17-072	17-073	17-074	17-075	17-076	17-077	17-078	17-079	17-080	17-081	17-082	17-083	17-084	17-085	17-096	17-097
Type of frog design	Sole plate number																	
Insert VA	Y3782	Y3783	Y3784	Y3785	Y3786	Y3843	Y3844	Y3845	Y3846	Y3847	Y3848	Y3822	Y3794	Y3795	Y3796	Y3797	Y3800	Y3801
Vario VR						Y3787	Y3788	Y3789	Y3790	Y3820	Y3821							
Forged hardened crossing point SK																		
Assembled from rails ZP.ZPN										Y3791	Y3792	Y3793						
Shortened monoblock ZMB. ZMB 1. ZMM							Y4266	Y4267	Y4268	Y4269	Y3848	Y3822						
Monoblock ZPT. ZPTZ							Y6958	Y6959	Y6960	Y6961	Y6962							
Shortened monoblock ZMB 3							Y4266	Y4267	Y4268	Y9160	Y3848							

Sole plates to replace differential sole plates

SOLE PLATE FOR THE FROG OF THE SWITCH J60 1:18.5 1200 (ACCORDING TO THE TYPE OF FROG)

Sleeper number	12-089	12-090	12-091	12-092	12-093	12-094	12-095	12-096	12-097	12-098	12-099	12-100	12-101	12-102	12-103	12-104	12-105	12-106	12-107	12-108	12-109
Type of frog design	Sole plate number																				
Insert VA	Y3740	Y3741	Y3742	Y3743	Y3744	Y3745	¥3746	Y3747	¥3748	¥3749	¥3750	Y3751	Y3752	Y3753	Y3754	Y3755	Y3756	Y3757	Y3758	Y3759	Y3760
Forged hardened crossing point SK							Y3774					Y3817									
Assembled from rails ZP. ZPN												Y3779	Y3780	Y3781							
Shortened monoblock ZMM. ZMB. ZMB 1								Y4329	Y4330	Y4331	Y4332	Y4333	Y3752	Y3753							
Monoblock ZPT. ZPTZ								Y6964	Y6965	Y6966	Y6967	Y6968	Y6969								
Shortened monoblock ZMB 3								Y4329	Y4330	Y4331	Y4332	Y9499	Y3752								

Sole plates to replace differential sole plates