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Manual for common crossing with forged and hardened vee operation and maintenance

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Dolní 100, 797 11 PROSTĚJOV

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Chief Manager for Quality, Environment
and BOZP (Safety and Health Protection)

signature 4. 11. 2013 seal

Content:

1. Generally

This manual contains the information on product design, installation, operation and maintenance.

Prior whichever work commencement, the maintenance and operation personnel have to read this instruction and be acquainted with. The verification of this fact should be ratified in written.

The instruction for operation is intended for professional workers experienced in the installation of the railway superstructure upper part, who took part in the specialized training as turnout fitters.

1.1 Survey of most important symbols

The three categories of safety instructions are stated in this document:

DANGER! — Omission of this instruction can cause the lost of life.

WARNING! — Omission of this instruction may cause the serious injury, or breakdown of the equipment.

NOTICE! — Omission of the instruction may cause the damage of the equipment or injury.

1.2 Address of the manufacturer

Railway trackwork is made by:

DT - Výhybkárna a strojírna, a.s.
Dolní 100
797 11 Prostějov
Czech Republic

e-mail: dt@dtvm.cz
Internet: http://www.dtvm.cz/

1.3 Information page –Your opinion

DT – Výhybkárna a strojírna (hereinafter referred to as DT) will be pleased to receive the **information sent by customers.** Please fill the enclosed form in with your reminders, proposals and experience concerning the product, acquired during its application:

DT - Výhybkárna a strojírna, a.s.
Dolní 100
797 11 Prostějov
Czech Republic

e-mail: dt@dtvm.cz

Internet: http://www.dtvm.cz/

My reminders:

Name: .....

Transporting organization: .....

2 Technical specification, product description

2.1 Basic technical data

The course of the crossing flangeway width and the crossing upper running table shaping are designed and assessed for the wheel running profile applied within the crossing installation territory – submission of the wheel profile by the customer is necessary

The crossing flangeway width shall be in conformance with value stated in the approved drawing documentation

The wheel transition within the crossing is performed at place where the vee thickness is approximately 30 till 35mm.

Axle load

- 25t at most

Maximal speed

- Till 120 k.p.h in the straight direction
- In the diverging branch in dependency with radius

Rails position inside the crossing

- Vertical – rail inclination in the turnout 1:∞ (inclination-free).
- The wing rail and the connection rail end can be in case of requirement set into inclination 1:40 or 1:20 to enable the joining to the adjacent rail.

Turnout placement

- Onto wooden or concrete sleepers or on the bed of concrete.

2.2 Product description

The solid common crossing has a design enabling the intersection of two opposite running edges of turnouts, or track crossings and consists of crossing vee and two wing rails. Marking of intersection, the mathematical point of intersection - MBK, is carried out at the wing rail head side by means of the bell punch.

As long as both running edges are continuously straight, i.e. all four legs are straight ones then crossing is not called the right-hand one, or the left-hand one and we speak about straight crossing. The solid common curved crossing has the one running edge straight one and the latter is a curved one. The crossing is designated as a right-hand one or the left-hand one according to the fact if the diverging branch axis seen from the crossing vee tip on its vee opening deviates to the right, or to the left hand.

The common crossing equipped with forged vee is a fabricated crossing consisting of forged piece of vee joined with connection rails (the legs) by means of resistance flash butt welding. The legs are made of flat-bottom rails, which can be mutually welded together by means of longitudinal weld on the head and on the heel as well. The wing rails are made of flat-bottom rail as well.

The inserts are imposed between the wing rails and the welded vee. The connection is carried out by means of high-tension screws M27 (particularly for section 60E1) or M24 bolts. The torque moment equals to 955 Nm (for M27) and 755 Nm (for M24).

The crossings designed in 49E1 system and in similar systems for instance 50E3 and 50E2 up to radius R=300m are of Grade R260. The crossings of 49E1 system above R=300m and the further systems, for instance 60E1 are made of Grade 51CrV4 (15 260).

The connection rails and the wing rails are commonly made of Grade R260. The position where occurs the wheel transition onto crossing vee and vice versa, the heat treating of running table is carried out.

In case of requirement the perliting of crossing all rails is possible. The retained rail surface hardness is 390 HBW at most. The application of rail with higher Grade, which conforms to vee forged piece quality after heat treatment carried out is possible as well.

Crossing scheme:

Illustration of crossing

Crossing placement:

- The crossing is laid onto plates and attached by means of Vossloh clips, possibly via Pandrol spring clips or via solid clamps.

Field of utilization:

- The common crossings of UIC 60 (60E1) system: standard ratio series, except for Czech Republic and Slovakia according to the requirement.

- The common crossings in system S49 2nd generation (49E1): standard ratio series, except for Czech Republic and Slovakia according to the requirement.

3 Safety instructions

- The product assembly, regeneration and adjustment shall be carried out just by the authorized person eighteen years old at least, who was demonstrably acquainted with instructions concerning the operation, maintenance and the safety directions.

- Within whichever setting and installation works carried out, the entrepreneur is obliged to secure the personnel safety and prevent them against collisions with the track and non-track running vehicles and prevent injuries of unauthorized persons by putting them out of the installation area.

- The suitable hoisting device with declared bearing capacity shall be applied for the parts handling. An application of the unsuitable hoisting device should induce your injury and wound the persons staying in the nearest space.

- The attendance of independent person during the product hoisting and assembly, who pursue the monitoring of the suspended weight is necessary. The aim is to prevent its rotation or inception of instable position even by using of means of communication. The unauthorized persons must be put off the workplace area

- An utmost care should be devoted within the product manual handling and within its welding and the weld grinding. The using of protection means is necessary.

- Using of means of protection within the manual maintenance is necessary to prevent the possible injury of the personnel. A reason should be the occurrence of sharp edges and flow lips situated on the crossing running table.

4 Product preparation for utilization

4.1 Parts identification

- **Crossing** – the name plate is attached to the wing rail. This tag bears the exact name of the product, serial number, sign of QAD of the manufacturer, sign of customer quality inspector and the year of manufacture.
- **Crossing vee** – the heat number is stamped onto forged piece face.
- **Connection rails (the legs)** – the web bears the heat number, perlitization if need be.
- **Wing rails** - the web bears the heat number, number of perlitization if need be.

The serial number of the turnout shall be marked with paint. The sleepers with bearing plates attached onto shall be equipped with serial number of the sleeper according to the crossing layout drawing, turnout drawing pertinently.

The small accessories for given turnout shall be stored into transporting crates. These shall be equipped with the crossing (turnout) serial number, situated namely on the cover and on one side as well.

The spare parts delivery marking:

The crossing spare parts shall be marked with serial number and equipped with tag.

4.2 Way of delivery and the product packing

- Delivery of crossing with sleepers – independently assembled crossing and the set of sleepers with plates attached onto.
- Crossing delivered free form sleepers – assembled crossing unit with bearing plates attached onto.
- Spare part crossings – assembled crossing free from plates (including plates in case of the customer requirement).

4.3 Transportation, handling and storing

General principles for product handling and storing:
When product handling, the safety measures must be adhered to – see the Item 3

- The way of the turnout part handling is in dependency with distance, where the part is to be installed and with hoisting equipment applied. As long as the distance of installation is not far from the storing place, the laying equipment itself may be applied, or the suitable vehicles shall be used for transport into the place of destination. The way of activity in connection with the transport and placement must prevent possible turnout parts damage or deterioration of its geometry as well.
- When handled by means of crane, the suspension of assembled turnout part shall be carried out via rails attached to the sleepers. The lifting rope deviation from the vertical must not exceed ± 20° in the longitudinal direction, which is parallel with the turnout part axis (the reason is to prevent the sleepers slipping within the strong thrust) and maximally up to 35° in the lateral direction, vertical to the turnout part axis.
- The turnout parts shall be stored at the solid and leveled ground. The turnout parts must be underlay with crossers laid with spacing approximately four meters. The turnout assembled parts may be laid the one on another in the three layers at most. Besides, it is necessary to exclude the damage of insulation of running rails equipped with LIS (Glued Insulated Joints) if applied within the turnout.

4.4 Installation and instruction for assembly

General principles for handling when install:
When handling the product, the adherence to the safety instructions is necessary – see the Item 3.

- The spreading of the crossing panel sleepers with assembled-on plates in accordance with layout drawing.
- The rubber pads shall be installed onto bearing plates.
- The crossing panel running rails shall be placed and the rails from the main line inner stripe straightened.
- The pre-assembled sleeper positions shall be adjusted pursuant to marking situated onto heel of the crossing panel external running rails.
- Installation of the crossing unit.
- The gauge shall be adjusted within the prescribed tolerance.
- The curved running rail for the check rail shall have its arch deflection checked.
- The check rail shall be assembled including the flangeway and gauge setting in the main and branch line as well between the crossing running edge and the guiding edge of the check rail.

4.5 Limiting allowances / tolerances for product assembly in the shop and during the acceptance

Recommended values of tolerances
If not agreed the other way then the standard EN 13 232 – 6 is in force.

4.6 Safe operation / limiting operational allowances and tolerances

- The permissible limiting allowances and tolerances are governed by the standards and regulations of local railways (the railway entrepreneurs).
- To secure the product operational ability and its proper utilization, the monitoring of its parameters is necessary.
- For given territory the railway users may apply standards with their own requirements and conditions, different from our proposals applied.
- Parameters stated below are therefore just recommended by the manufacturer and the user is not obliged them to follow.

Rail gauge for V≤ 160 k.p.h. – AL limit (monitoring limit)	+3/-2 mm
Rail gauge for V≤ 160 k.p.h. – IL limit (intervention limit-repairs)	+4/-3 mm

To assess the rail gauge value, the gauge values changes must be taken into consideration.

Rail gauge change for V≤ 80 k.p.h.– AL limit	6mm
Rail gauge change for V≤ 80 k.p.h. – IL limit	7mm
Rail gauge change for 80 < V≤ 120 k.p.h. – AL limit	5mm
Rail gauge change for 80 < V≤ 120 k.p.h. – IL limit	6mm

The gauge change applies for length 2m.

5. Product maintenance and repairs recommended by the producer

To maintain the turnouts ability within the operation, the inspections on the regular basis and the measurement in appointed time periods shall be carried out, which must be mentioned in the appropriate railway documents.

As to foreign customers, these activities are governed by the standards and regulations issued by local authorities.

When the activities in close connection with the product maintenance and repairs are carried out, the observance of appropriate safety measures and the safety instructions mentioned in Item 3 is necessary.

5.1 Product maintenance

The track and turnouts maintenance (generally the product) means the correction of imperfections, which can jeopardy the railway operation safety and continuity, or defects, which with its propagation should immediately jeopardy the railway operation, if not removed in time.

At the turnout running surface and at stressed parts the occurrence of imperfections and deformations can be found. Their timely removal makes its operational life longer.

Crossings imperfections can be divided into the three main categories:

A) Imperfections where the repair is not necessary (A.1 till A.3)
- A.1 Folds (flow lips) situated onto running surface up to 1mm
- A.2 Inception of slanted tiny flaws onto running surface
- A.3 Excessive wear in the longitudinal direction

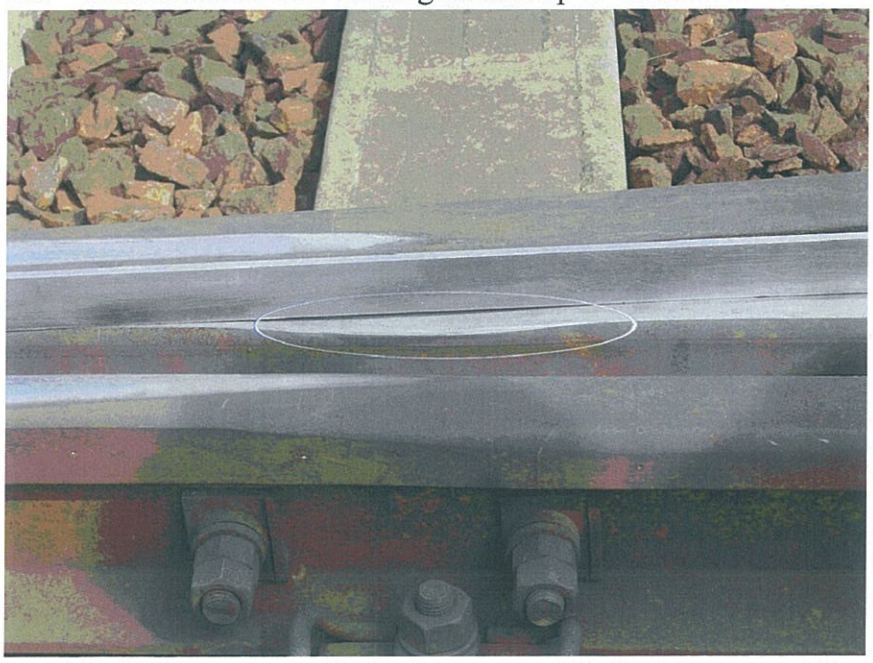
B) Imperfections requiring the repair via grinding (B.1 till B.6)
- B.1 Flow lips situated onto running table above 1 mm and the sharp edges onto wing rails.
- B.2 Tiny slanted flaws on the running surface
- B.3 Repair of the laterally deformed vee tip
- B.4 Longitudinal and lateral dishings (excessive wear in the shape of dish) of the vee point in accordance with the passage speed applied above 1mm up to 4 mm for speed up to 120 k.p.h.
- B.5 Surface spalling of the material within the initial phase into depth 0,7mm

C) Imperfections requiring the repair via surfacing (C.1 till C.4)
- C.1 The longitudinal and lateral dishing of the running surface pursuant to passage speed above values B.4.
- C.2 Surface spalling of the material in advanced phase above values B.5 into depth 20 mm at most, after the imperfection grinding-off.
- C.3 Flaws.

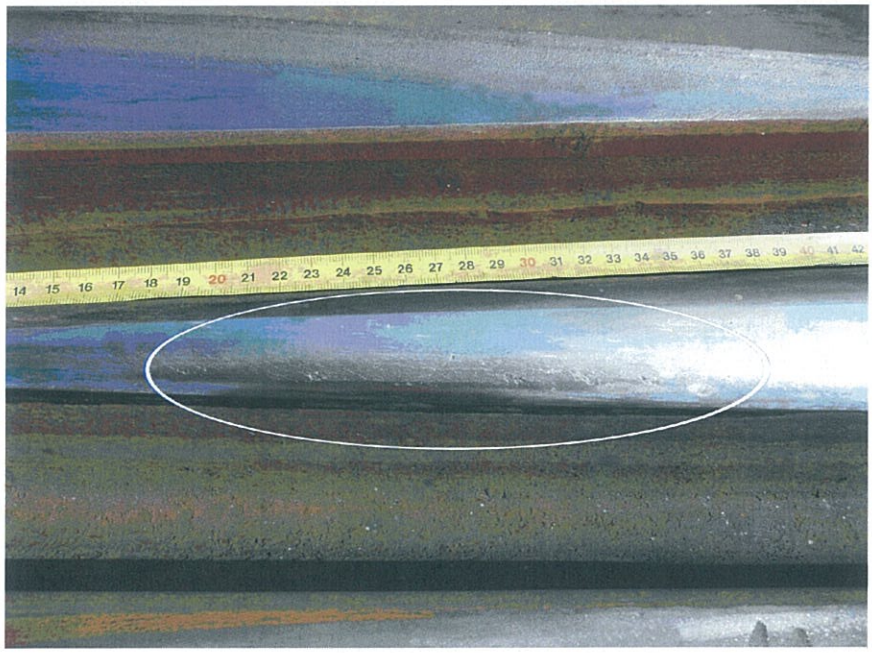
D) Imperfections requiring the crossing unit replacement (D.1 till D.4)
- D.1 Irreparable spalling of material above value C.2.
- D.2 Irreparable flaws.

A) Imperfections where repair is not necessary

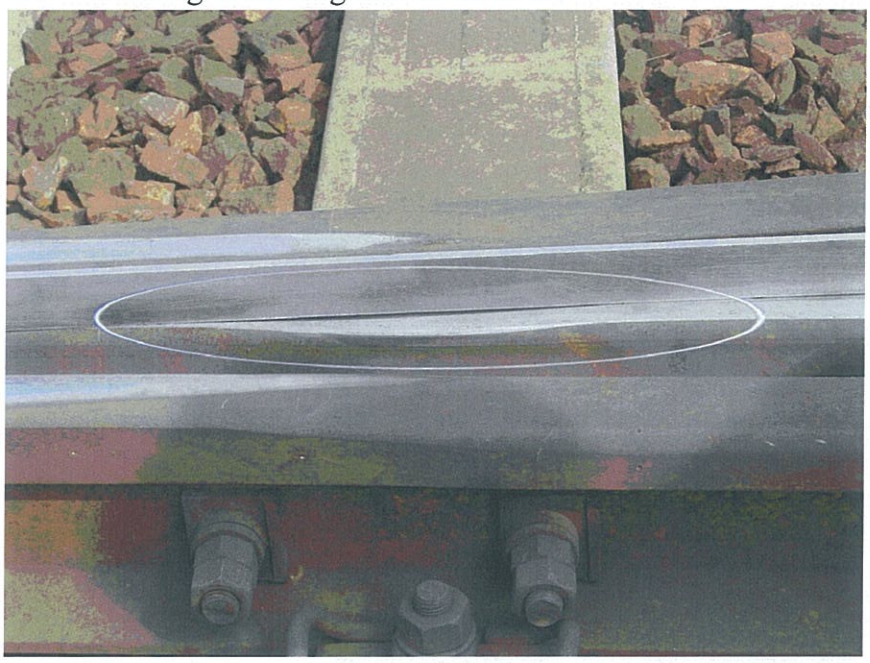
A.1 Folds situated onto running surface up to 1mm



A.2 Inceptive inclined flaws on the running surface

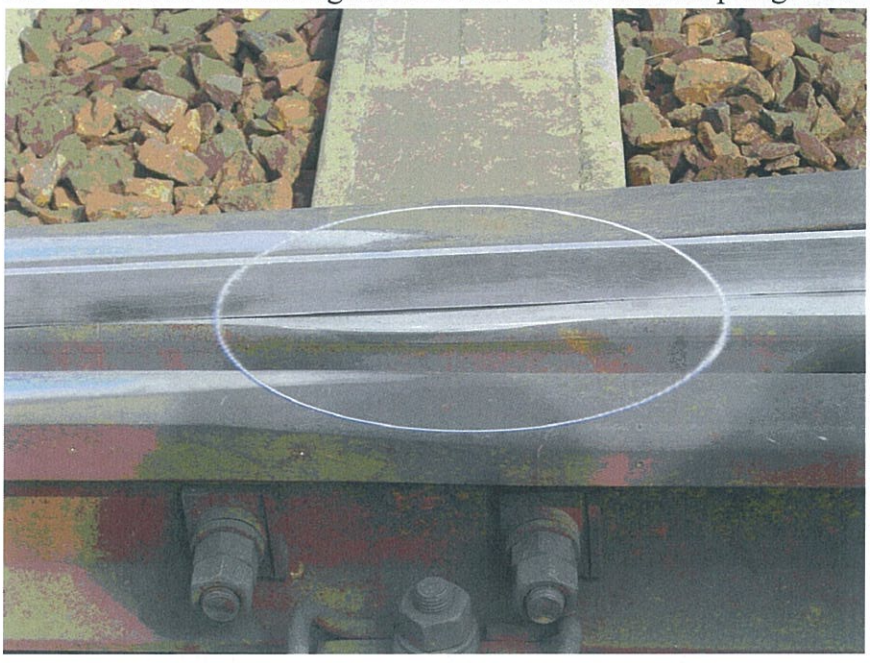


A.3 Dishing in the longitudinal direction

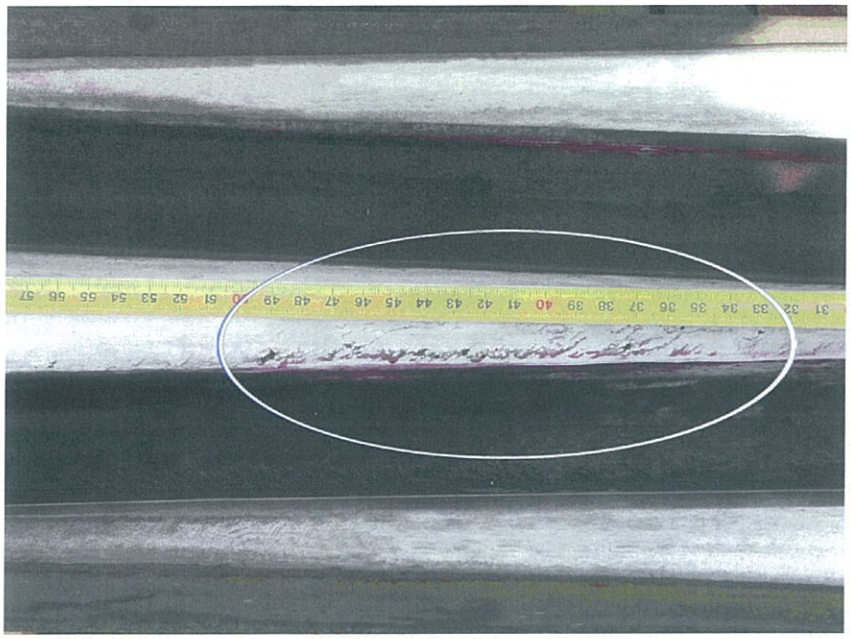


B) Imperfections requiring repair by means of grinding

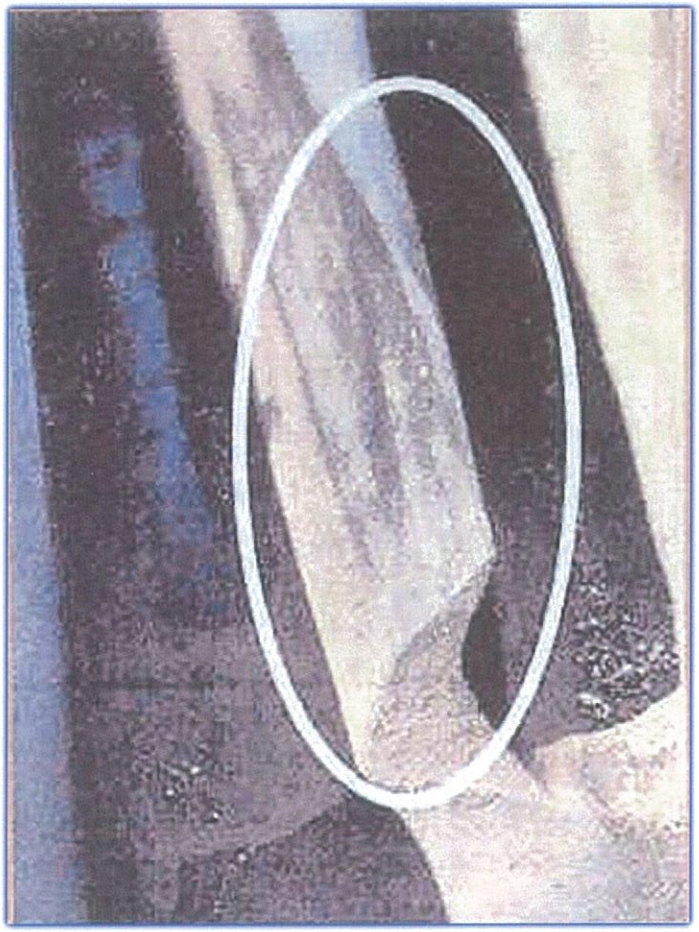
B.1 Folds on the running surface above 1mm and sharp edges on the wing rails.



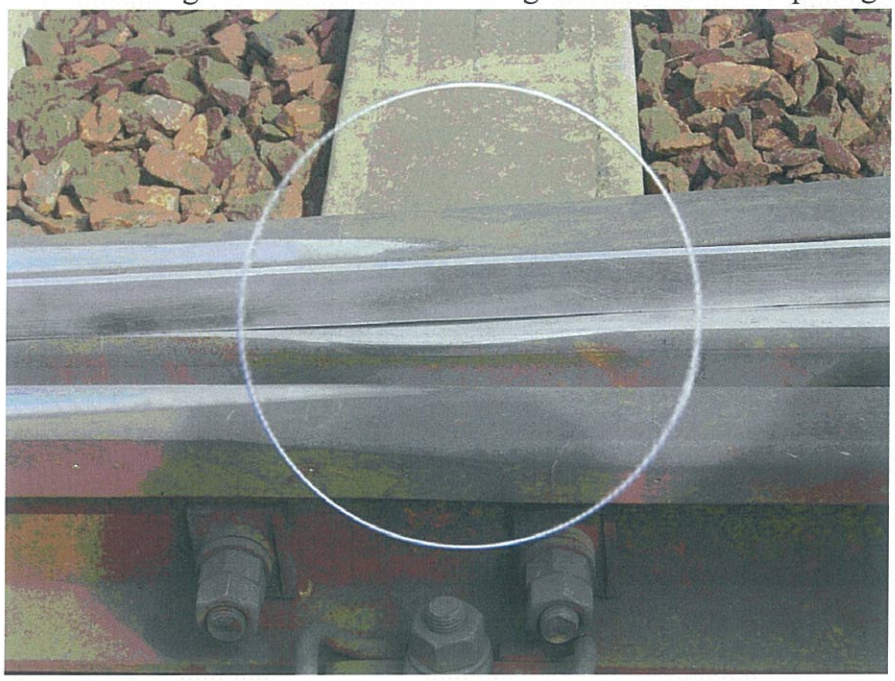
B.2 Tiny inclined flaws on the running surface.



B.3 Repair of the laterally deformed vee tip.



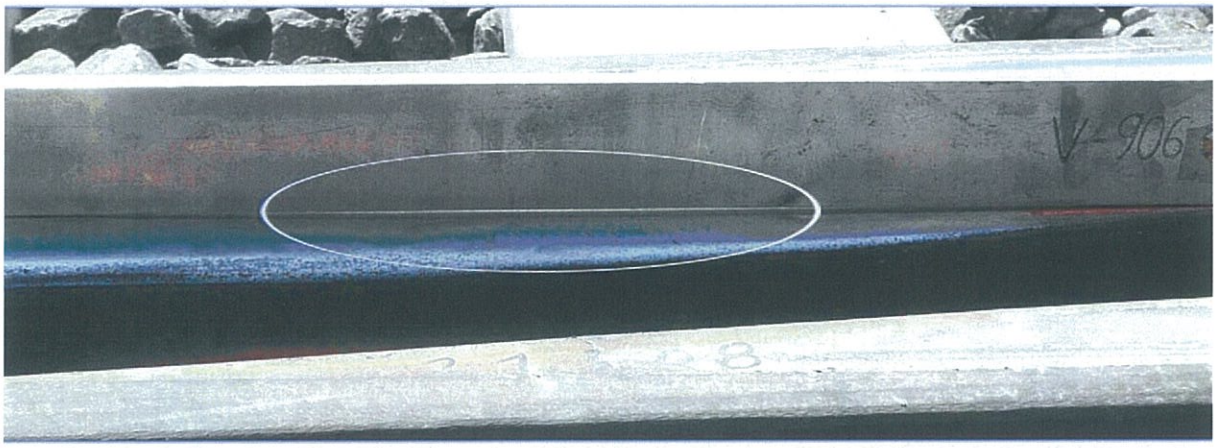
B.4 Vee longitudinal and lateral dishing in connection with passage speed.



B.5 Surface spalling of the material in the initial phase.

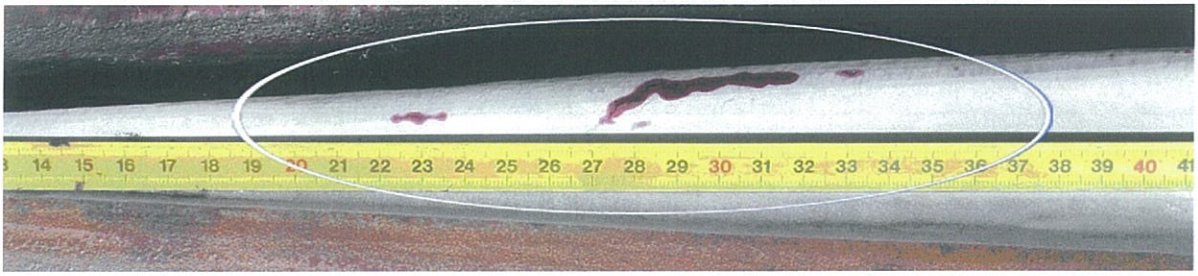
C) Imperfections requiring repair via surfacing

C.1 Longitudinal and lateral dishing of running surface due to the passage speed.



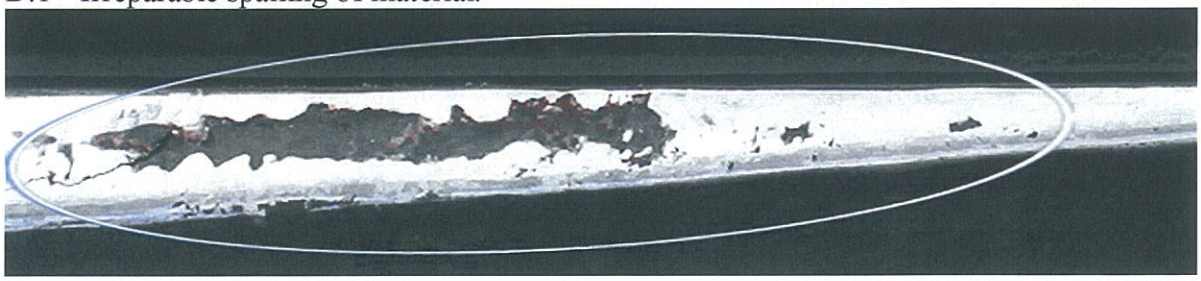
C.2 Surface spalling in the advanced phase.

C.3 Flaws.

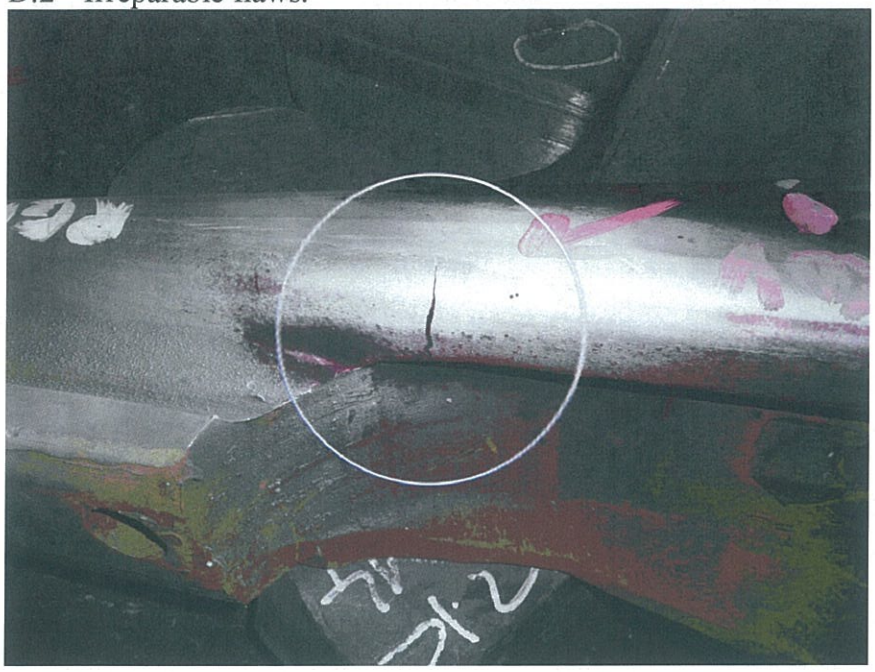


D) Imperfections requiring the crossing replacement

D.1 Irreparable spalling of material.



D.2 Irreparable flaws.



5.2 Product repairs

On basis orf regularly performed product inspections and their assessment to carry out these repair activities is necessary:

Crossing flangeway width adjustment:

- The crossing flangeway and their flares width should be maintained the way to prevent undesirable impacts when the wheel set is guided into required direction.
- The common crossing prescribed flangeway width and the recommended layout and operational allowances must be taken into consideration in connection with local railways directives.

Crossing height and section adjustment:

- The crossings are made in conformance with the technical conditions of the manufacturer.
- The crossing vee tip topping is carried out from the start up to the place, where the lateral load is fully transferred.
- The removal of unfavorable spots originated due to the wheel contact with crossing operated part can be performed by the grinding.
- The running surface grinding must not exceed the mutual height interaction of the vee and the wing rail.
- When the larger imperfections are repaired, the part of the surface rammed by operation must be ground-off and the missing material welded-on up to the optimal shape via application of approved technology. The final adjustment is thereafter carried out by means of grinding and checks via template in the same time.
- The wing rail maximal permissible wear is 6 mm. In case the wear is larger, the repair by means of surfacing is possible.

5.3 Crossings installed in the track recommended intervals of checking and inspections:

The inspection intervals are obligatory governed by the infrastructure authority regulations, which must be adhered to.

The intervals stated below are by the product manufacturer intentioned for the final user just like recommended.

The gauge and the height position of the rail stripes measurement	once a three months
Crossing panel inspection	once a three months
Crossings non-destructive inspection	once a six months

6. Safety and the health protection, ecology

6.1. Assessment of risks in connection with influence towards the working and life environment

1. Our products are environmentally friendly.
2. No hazardous waste arises from the manufacture, assembly and maintenance.
3. If the wooden sleepers are the part of the turnout delivery, we always apply the environmentally friendly means of impregnation.
4. No special risks arise for personnel within the manufacture, assembly and maintenance. Those are commonly applied activities within the building and installation of the railway superstructure. During the activity carried out (turnouts installation and maintenance) the observance of safety measures concerning this kind of activity is necessary.

6.2 Production and ecology

The manufacturing technology of turnouts, turnout trackwork, tramway turnouts and their operating boxes is predominantly based on the dry chip working. For operations, where the application of this method is impossible the chips working is used with application of the biology degraded cooling fluids.

The processes, which harmfully influence the environment, just like grinding, welding, heating and coating are applied as well. The effect of these processes is regularly monitored and limited by means of exhausting, filtering and the precipitation unit application.

The company follows the requirements of the Czech Legislative concerning the air pollution. We do not belong to the big air polluters.

In the technology process of manufacture we apply the chemical substances and preparations, which jeopardy neither water nor the working environment.

Within the working spaces of the company we produce approximately 1000 tons of the waste annually. Of this volume circa ninety percent is recycled.

DT - Výhybkárna a strojírna, a. s. is incorporated into the System of associated discharge EKO – KOM and it is the holder of the ISO 14 001 certificate.

6.3 Other

The DT - Výhybkárna a strojírna, a. s. is a member of the Integrated Register of Waste since 2009. This register also provides the data for EU database how the company influences the environment.

We apply a subsidy of gamekeeping within the company area.

7 Survey of applied and related standards in valid version

EN 13232-1 Railway applications - Track – Switches and Crossings - Part 1: Definition

EN 13232-2 Railway applications - Track – Switches and Crossings – Part 2: Design and tolerances.

EN 13232-3 Railway applications - Track – Switches and Crossings - Part 3: Wheel/Rail interaction.

EN 13232-6 Railway applications –Track - Switches and Crossings - Part 6: Fixed and obtuse crossings.

EN 13232-9 Railway applications - Track – Switches and Crossings - Part 9: Design, documentation and acceptance.

EN 13481 Railway application - Track – Requirements on fastening systems.

EN 13674-1 Railway application - Track - Rails - Part 1: Vignole railway rails weight 46 kg/m and more.

EN 13674-3 Railway application - Track - Rails - Part 3: Check rails.

EN 13715 Railway applications – Wheel sets and undercarriage - Wheels – Wheel profiles.

UIC 510-2 Wagons – Conditions for wheels with different diameters in undercarriage of various design.

UIC 864-2 Technical conditions for delivery of railway superstructure screws.

UIC 864-3 Technical conditions for delivery of steel spring washers for railway superstructure.

UIC 864-6 Technical conditions for supply of plates made of rolled steel.

National standards and regulations:

ČSN 73 6360-1 Construction and geometry layout of the railway tracks and their position in area - Part 1: Projection

ČSN 73 6360-2 Construction and geometry layout of the railway tracks and their position in area - Part 2: Assembly and acceptance, operation and maintenance.

Regulation SŽDC S3 – Railway superstructure.