

Proposed actions on the problem of cracks emerging on Sggmrss 90´and Sggrss 80´ wagons

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1. Introduction

A new entry concerning defects in welded joints on wagons of the Sggmrss 90' and Sggrss 80' series was made in the ERA's Safety Alert Information Tool (SAIT) on 9 July 2024.

The entered information is as follows:

On several wagons of the Sggmrss 90' and Sggrss 80' series, manufactured by Nymwag CS a.s. with production dates from December 2021 to August 2023, defects that could potentially lead to cracks were found in the welding of the underframe.

As seen in the attached photos, there were defective welds present in the joint area. The defective welds were repaired during normal operation of the wagons during routine maintenance inspections.

Photos:



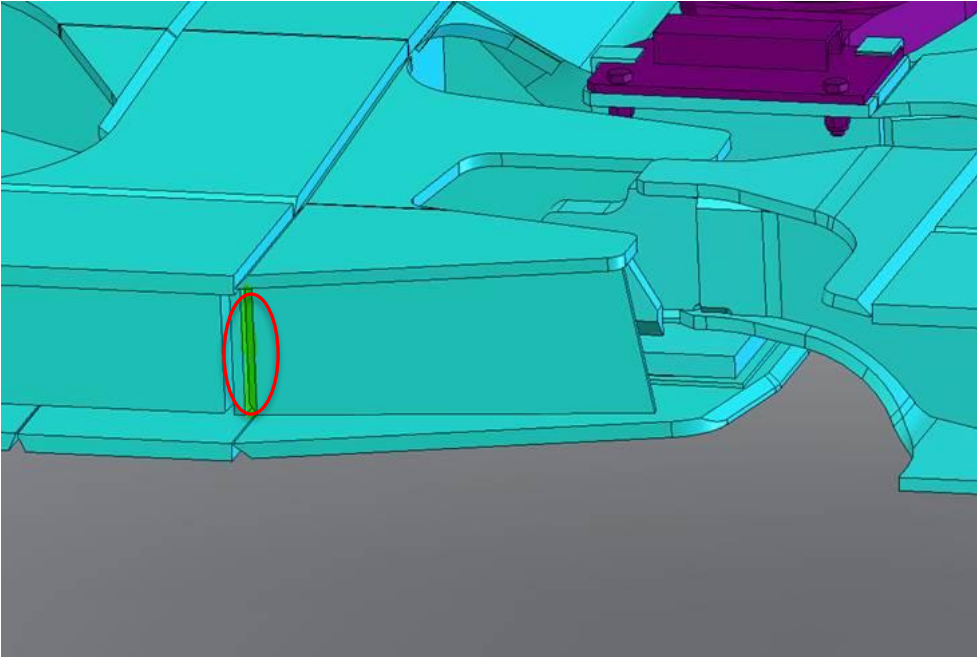
2. Wagon identification and defect description

The wagon of the Sggrss 80' series, 9-591.0 type, registered in the European register under Type ID: 51-076-0002-4-001 from 30.08.2018

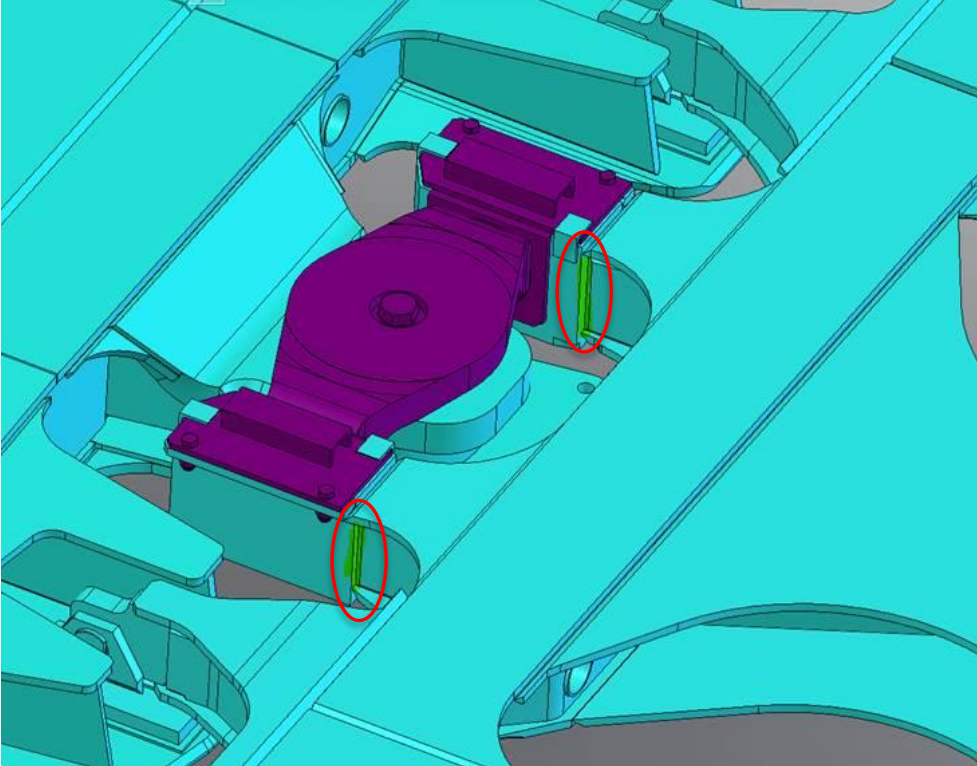
The wagon of the Sggmrss 90' series, 9-590.0 type, registered in the European register under Type ID: 51-047-0003-3-001 from 30.08.2018

Weld cracks were discovered in the area of the articulation on the container articulated wagons of the Sggmrss 90' and Sggrss 80' series.

Area A, vertical weld of the wagon part A side bearer:



Area B, vertical welds of the wagon part B articulation bearing:



3. Strength of the structure

Documentation:

- Stress analysis of the wagon of the Sggrss 80' series, report No. ZP 05/2018-Lo of 2.2.2018
- Load and strength requirements according to EN 12663-2:2010
- Welding of railway vehicles, Structural requirements EN 15085-3+A1:2023

3.1 Service stresses in the areas of indicated defects

The design of the container wagon in the indicated areas of cracks is identical with the design of the container articulated wagons manufactured in various options by Lostr from 2005 (NYMWAG's predecessor). For the Sggrss 80' series wagon, type 9-591.0, a finite element calculation was performed. The evaluation of stresses caused by service loads was carried out in accordance with the DVS 1612 Directive. The highest material utilization factor on the whole structure was 0.93, which is, with a sufficient provision, lower than the permissible value of 1.1. This value was found in the area of the inner headstock of part B.

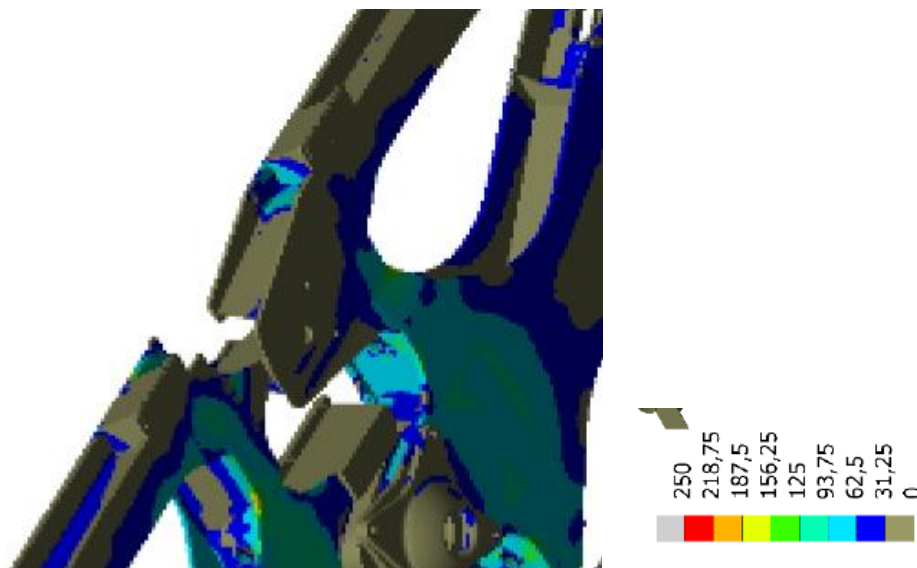
Material of the basic material S355J2+N acc. to EN 10025-2

Permitted value of stress for extraordinary loads close to the weld is 323 MPa (thickness up to 16mm).

Area A:

According to the calculation report, the weld was analysed neither for fatigue (coordinates $x=10060\text{mm}$, $y=1023\text{mm}$, $z=1092\text{mm}$) nor for exceptional loads.

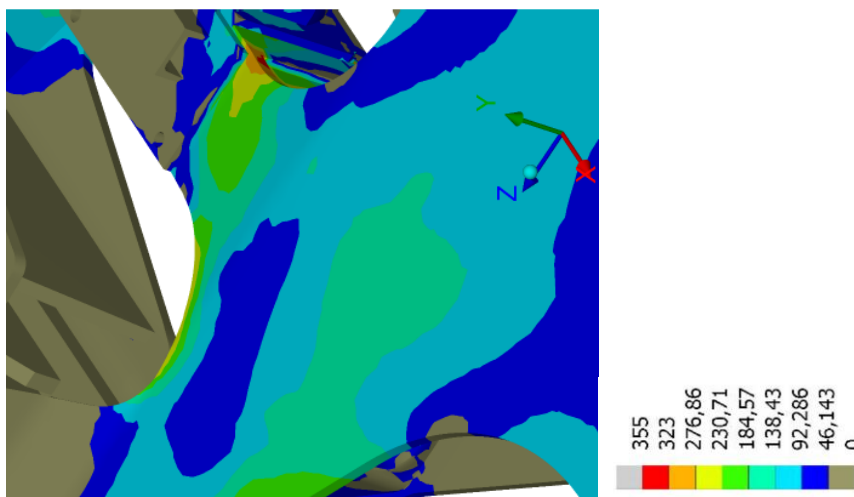
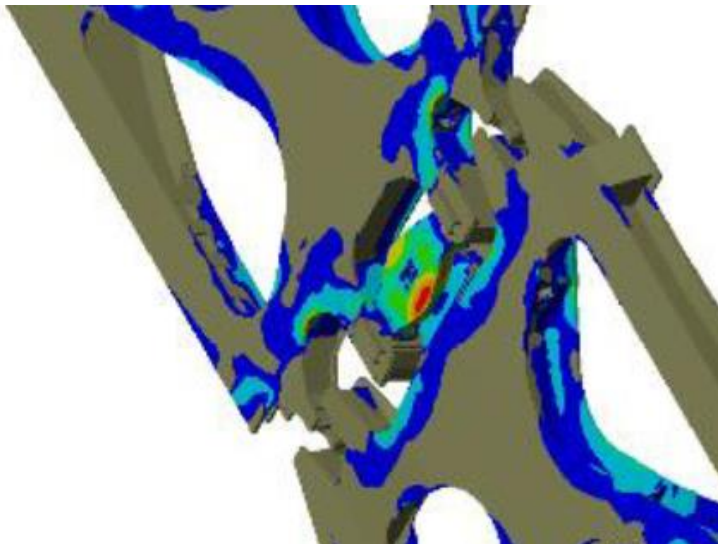
According to Figure 148 of the report, the maximum equivalent stress in the wider area around the weld according to von-Mises is up to 125 MPa under fatigue loading condition U-03 (vertical load 1.3g + transverse load 0.2g).



Area B:

According to the report, the weld was not analysed for fatigue (coordinates x=10600mm, y=1015mm) or exceptional loads.

According to Figures 103 and 81 of the report, the maximum equivalent stress in the wider area around the weld according to von-Mises is up to 185 MPa under the exceptional loading conditions V-12 (combination of 1500 kN stress and vertical load on the loaded wagon) and V-10 (combination of 1200 kN pressure on bumpers and vertical load on the loaded wagon).



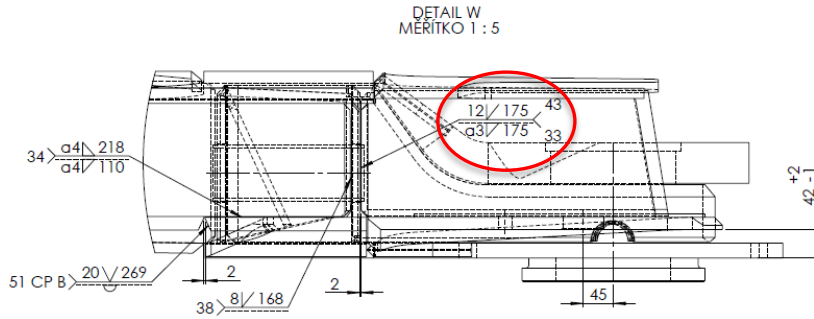
3.2 Prescribed welds in the defect areas

Documentation:

- Drawing, Wagon A underframe No. S009-01-010000 of 1 Nov. 2023
- Drawing, Central part B cross bearer No. 206221040.1.2.22 of 11 Sept. 2017

Area A:

According to drawing No. S009-01-010000

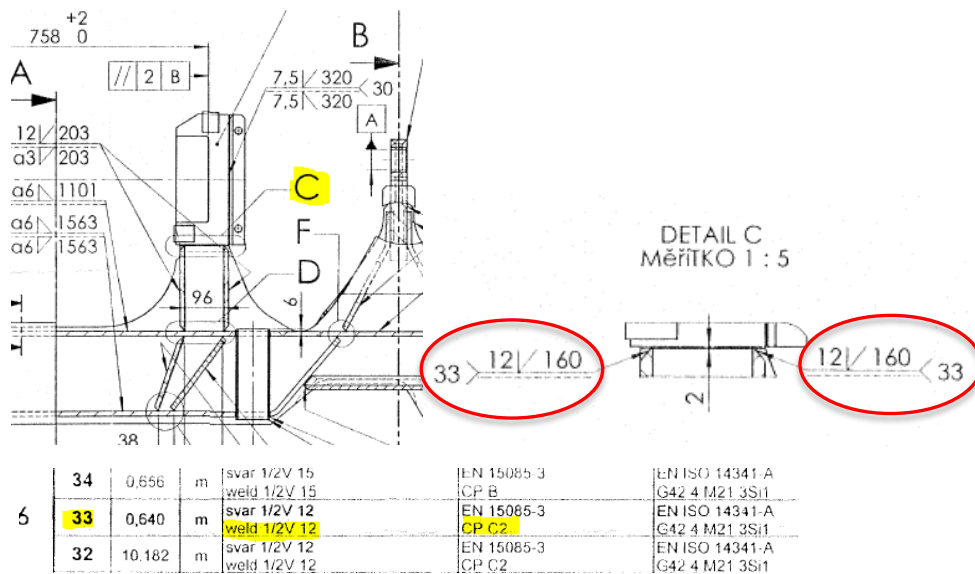


		weld 1/2V 10	CP B	G 42 4 M 21 3Si1
43	0,350m	svar 1/2V 12 weld 1/2V 12	EN 15085-3 CP C2	EN ISO 14341-A G 42 4 M21 3Si1
42	3,320m	svar 1/2V 10 weld 1/2V 10	EN 15085-3 CP B	EN ISO 14341-A G 42 4 M21 3Si1
41	11,578m	svar 1/2V 10 weld 1/2V 10	EN 15085-3 CP C2	EN ISO 14341-A G 42 4 M21 3Si1
40				
39	3,748m	svar 1/2V 9 weld 1/2V 9	EN 15085-3 CP C2	EN ISO 14341-A G 42 4 M21 3Si1
38	8,414m	svar 1/2V 8 weld 1/2V 8	EN 15085-3 CP C2	EN ISO 14341-A G 42 4 M21 3Si1
37	2,028m	svar 1/2V 6 weld 1/2V 6	EN 15085-3 CP C2	EN ISO 14341-A G 42 4 M21 3Si1
36	4,688m	svar koutový a5 filed weld a5	EN 15085-3 CP C2	EN ISO 14341-A G 42 4 M21 3Si1
35	2,820m	svar koutový a4 filed weld a4	EN 15085-3 CP B	EN ISO 14341-A G 42 4 M21 3Si1
34	37,976m	svar koutový a4 filed weld a4	EN 15085-3 CP C2	EN ISO 14341-A G 42 4 M21 3Si1
33	17,442m	svar koutový a3 filed weld a3	EN 15085-3 CP C2	EN ISO 14341-A G 42 4 M21 3Si1
		svar koutový a3	EN 15085-3	EN ISO 14341-A

According to EN 15085-3 this is a 10d type weld.

Area B:

According to drawing No. 206221040.1.2.22



34	0,656	m	svar 1/2V 15 weld 1/2V 15	EN 15085-3 CP B	EN ISO 14341-A G 42 4 M21 3Si1	
6	33	0,640	m	svar 1/2V 12 weld 1/2V 12	EN 15085-3 CP C2	EN ISO 14341-A G 42 4 M21 3Si1
32	10,182	m	svar 1/2V 12 weld 1/2V 12	EN 15085-3 CP C2	EN ISO 14341-A G 42 4 M21 3Si1	

According to EN 15085-3 this is a 10a type weld.

3.3 Summary

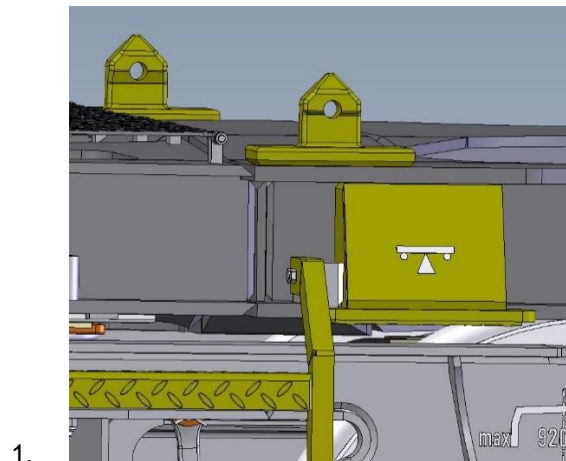
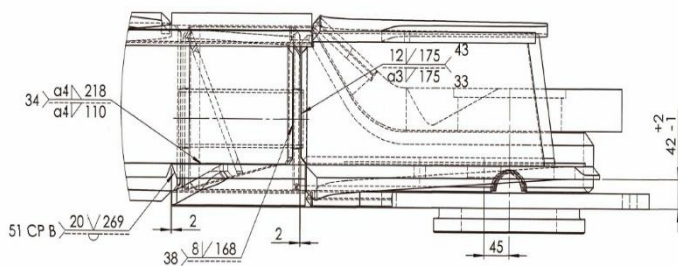
The structural design and the proposed weld design comply with the requirements of EN 12663-2 and EN 15085-3. The design of the part connections is proven by many years of operation of thousands of articulated container wagons.

Cracks in welds are not permitted. A crack in the welds mentioned will not cause direct destruction of the structure. We recommend to put the wagons with cracks out of service and repair the welds.

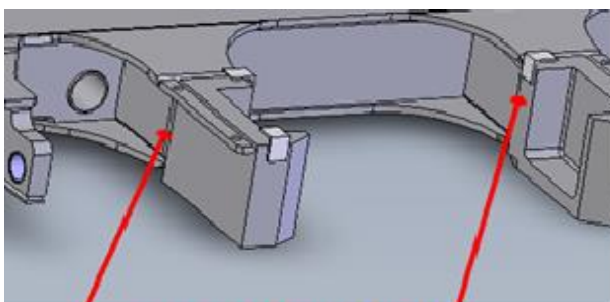
Based on the analysis carried out by the manufacturer, it can be concluded that the cause of the cracks is non-compliance with the production technology in some wagons.

4. Inspection of the wagons

Defects have been detected on the container wagon of the Sggmrss 90 and Sggrss 80' series, on the wagon underframe A, in welds 12HV (pos.43) and 8HV (pos.38). The welds are according to the drawing in CP C2 according to EN 15085-3 (grade C according to ČSN EN ISO 5817).

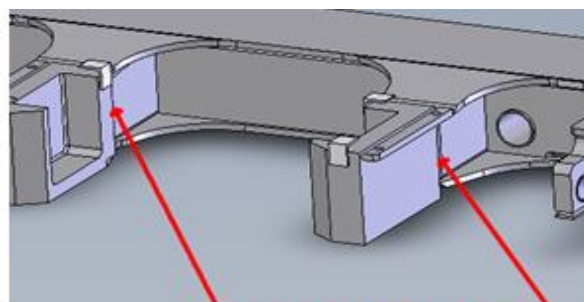


The container wagon of the Sggmrss 90' and Sggrss 80' series, part B underframe at the weld pos.33 (12HV) - indications of a suspected longitudinal crack-type defect were detected by visual inspection (defect 101 according to ČSN EN ISO 6520-1).



svar poz.33 (BW 12HV)

WELD – pos. 33



svar poz.33 (BW 12HV)

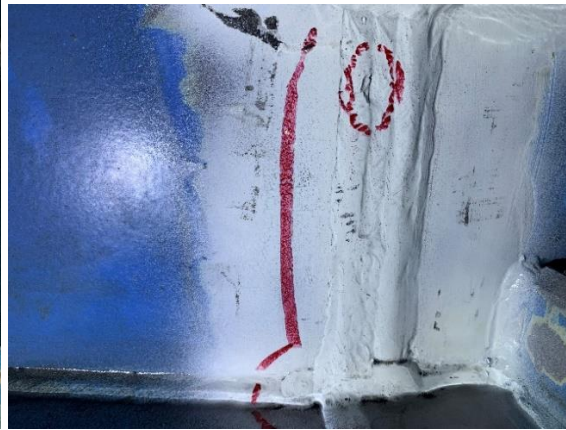
WELD – pos. 33

NDT testing of the problem section was carried out using the MT testing on the claimed wagons. The test revealed various defects in terms of the classification of the type of defect within the meaning of the ČSN EN ISO 6520 standard. If defects occur, a corrective action is taken (see Annex 1, Annex 2).

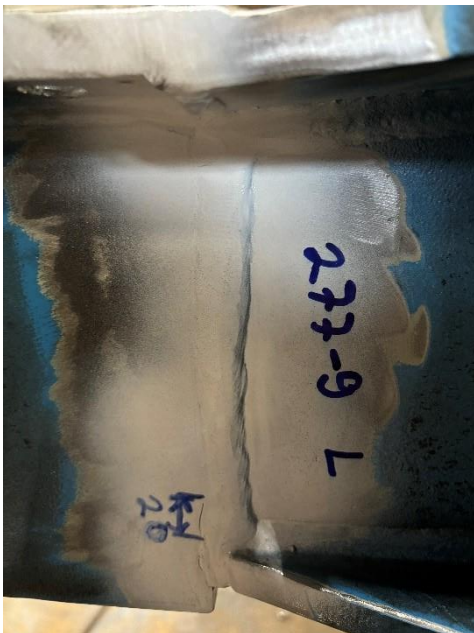
Examples of possible defects:



Example No.1



Example No. 2



Example No.3



Example No.4

5. Actions proposed for customers

We recommend visual testing of the welds (VT method) of all wagons in service. If the incidence is greater than 5% in one job order, repeat the checks max. once a year before a thorough inspection. Defects may occur only on wagons manufactured in a certain period; the inspections will specify the occurrence of defects. Weld cleaning and VT + MT testing need to be done during the inspection.

It is recommended to take the wagons with weld defects out of service and repair them according to the procedure (see Annex 1, Annex 2). Wagons after repair and proper inspection do not need to undergo further extraordinary testing..

6. Corrective actions

The production and inspection process will be intensified for the next produced wagons. Welding control and supervision will be increased beyond the requirements of the drawing documentation; the production procedures will be modified and inspection records will be kept.

Furthermore, we have tightened NDT testing for our future production; these welds have been classified as CP B2 in the meaning of EN 15085-3 and thus the existing VT testing is extended by MT testing.

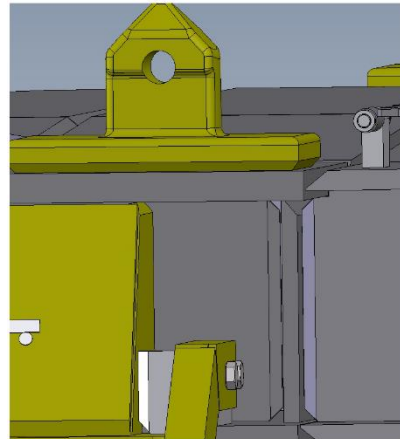
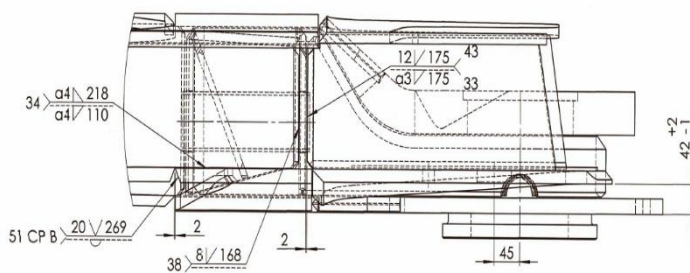
Annex 1

Repair procedure No. 07/2024

Job order: Sggmrss 90 and Sggrss 80' container wagon

Repair procedure for: Repair of defects in wagon welds

Assembly: Underframe A, drawing No. S005-01-01000, defects in welds 12HV (pos. 43) and 8HV (pos. 38)



Remove paint at the welds to be inspected with a wire wheel and brush, mark and document any defects (report + photo).

Long defect of the crack type, cold joint or if the defect removal continued through the entire thickness of the material

1) Use an electric hand grinder and a technical hand cutter to remove the original weld in the place of the defect. Check by using MT testing. If the defect persists, continue in the same manner for a greater length until the defect is completely removed. Prepare the weld surfaces, cut the root gap with a cutting grindstone (should be 2-3 mm if possible).

2) Weld a new weld according to WPS NWN-026

- Welding method 135
- Additional material:
 - For method 135: EN ISO 14341-A: G3Si1 D 1.2mm (OK12.50 ESAB)
 - Welder's certificate acc. to EN ISO 9606-1
 - The number and placement of layers should be selected according to the size of the resulting cavity
 - Clean the formed weld and its surroundings

3) Carry out VT and MT testing after the welding job (quality of the welds according to EN ISO 5817: C). Document that the tests have been made.

4) Renew the paint.

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Ing. Jiří MATUNA *Welding Supervisor*

Annex 2

Repair procedure No. 015/2024 SD

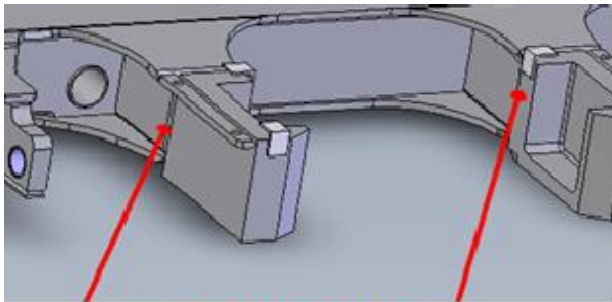
Job order: Sggmrss 90', Sggrs(s) 80' container wagon

Repair procedure for: Weld repair of the articulation bearing attachment

Assembly: Wagon B underframe, drawing No.S005-01-02000, S003-01-020000

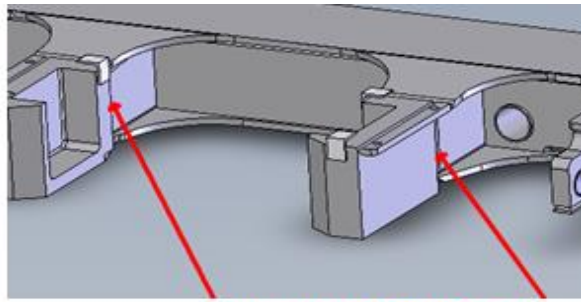
Central cross bearer 206221040.1.2.22, 206221046.1.2.22

Description of the problem: Indications of a suspected longitudinal crack were discovered by a visual inspection on this assembly, weld with pos. 33 (12HV) (defect 101 according to ČSN EN ISO 6520-1).



svar poz.33 (BW 12HV)

WELD pos. 33



svar poz.33 (BW 12HV)

WELD pos. 33

Repair procedure:

Disassemble the articulation assembly. Clean it of any dust and lubricant residue. Use a wire brush to remove paint from the welds to be inspected. Perform an MT testing of the problem area. Mark and document any defects (report + photo).

Repair of detected defects:

General principles:

- All welding jobs must be carried out by a person appropriately certified according to EN ISO 9606-1. The paint must be removed at least 10 mm in the vicinity from the edge of the future weld.
 - Preheating to 150°C (also applies to stitch-weld) must be used whenever welding on the articulation bearing is made, and an interpass temperature of max. 170°C must be strictly observed to limit any deformation. Temperatures should be checked with a thermometer.
 - If more than one spot on the assembly is being repaired, alternate welding locations to eliminate deformation.
- 1) Weld an auxiliary brace (reinforcement) to the face of the bearings to fix the position of the bearings during repair, which will be removed after the repair is complete.
Welding method No. 135, additional material: EN ISO 14341-A: G3Si1, D 1.2 mm (OK12.50 ESAB). Additional welds FW a3 according to WPS NWK099.
 - 2) Use an electric hand grinder and a technical hand cutter to remove the problem part of the weld with the defect. Check for complete removal of the defect using MT testing. If the defect persists, continue in the same manner to a greater depth until the defect is completely removed or the entire original weld is removed. Prepare the weld surfaces for a weld with angles for ½ V groves between approx. 50° to 60° to facilitate welding; when removing the whole weld, cut the root gap with a cutting grindstone (should be 2-3 mm if possible).
 - 3) Weld the new weld according to WPS NWN-028

Welding method 135, additional material: EN ISO 14341-A: G3Si1, D 1.2 mm (OK12.50 ESAB) Decide on the number of layers and the positions of individual caterpillar welds depending on the size of the resulting cavity. Clean the new weld and its surrounding.

- 4) Carry out VT and MT testing after the welding job (quality of welds according to EN ISO 5817: C). Document that the tests have been made (report + photo)
- 5) Grind off the auxiliary brace (reinforcement), grind off any remains of the auxiliary welds. Renew the paint.

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