

Technical Specification No. M-04-48 H
For
the Supply of Solid (mono-block) Wheels

August 2017

Issue 6

1. Scope

Solid wheels shall be supplied according to BS EN 13262:2004+A2:2011 Standard for forged or rolled solid (mono-block) wheels which are made from vacuum degassed steel and have a chilled rim.

Note: "Rim-chilled" describes heat treatment of the rim, which aim is to harden the rim and to create compressive residual stresses in the rim.

According to BS EN 13262:2004 Standard, paragraph 1, some characteristics of the wheels are defined according to a category 1 or a category 2. Category 1 is chosen when the train speed is higher than 200 km/h. The maximum speed of operation of the considered wheels is limited to 160 km/h, therefore their characteristic shall fit to the category 2.

The wheels have to satisfy a technical approval procedure for their design according to BS EN 13979-1:2003+A2:2011 Standard.

2. Product definition

The solid wheels should be supplied according to the following Table.

Table 1. Wheels types

No.	Wheel diameter mm	Drawing No.	Material	Profile	Max. residual imbalance g·m	Brake type	Size of ultrasonic defects, mm
1	850	ME413.00.3(B)	ER8	DSB 82-1	75	Disk/Tread	2
2	850	ME416.00.3(A)	ER8		75	Disk/Tread	2
3	850	ME427.00.3	ER8		75	Disk/Tread	2
4	920	ME415.00.3(A)	ER7	EN 13715 S1002	75	Disk	2
5	920	ME428.00.3	ER8		50	Disk	2
6	920	ME437.00.3	ER7		75	Disk	2
7	920	ME399.00.3(B)	ER7	or	125	Tread	3
8	920	ME355.00.3(B)	ER7		125	Tread	3
9	1000	ME380.00.3(B)	ER7	UIC510-2 OR Appendix B1	125	Tread	3
10	1067	ME456.00.1	ER7		75	Disk	2
11	1016	ME418.00.3(A)	ER9		75	Tread	2
12	1016	DG548.00.3C	ER8		75	Tread	2
13	1100	ME434.00.3	ER8		125	Tread	2
14	1117.6	ME459.00.1	ER8		75	Disk	2
15	1250		ER8		75	Disk	2

3. Wheels marking

The solid wheels should be supplied with following marks:

- A. Manufacturer's mark.
- B. Number of cast (six digits).
- C. Steel grade.
- D. Date of manufacture (month and four digits of the year).
- E. Position of residual imbalance and symbol according to Appendix 15 B.
- F. Inspection mark
- G. Wheel serial number after heat treatment.
- H. Position of wheel diameter according to Appendix 15 B.

Height of the cold stamping shall be at least 15mm. Depth of stamping shall be -
0.5÷1 mm.

Location of the wheels marking shall be according to Appendix 15 B.

4. Tests and number of inspected wheels

Types and number of controls to be carried out are shall be in accordance in accordance with BS EN 13262:2004, Annex F, Table F1.

Table 2. Type and number of controls to be carried out

Characteristics to be verified	Number of wheels per batch to control			Subclause reference BS EN 13262:2004
	Qualification	Delivery		
Maximum size of the butch	≤100	≤250	>250	
Chemical composition	1	1	1	3.1
Hydrogen content	a	a	a	b
Tensile characteristics				
in the rim	1	1	2	3.2.1
in the web	1	1	2	3.2.1
Hardness on rim parts	1	1	2	3.2.2
Hardness on rim (homogeneity)	100%	100%	100%	F.4.2
Impact tests	1	1	2	3.2.3
Toughness ^c	1	1	1	3.2.5
Heat treatment homogeneity	10% ^d	-	-	3.3
Inclusion cleanliness	1	1	2	3.4.1
Internal integrity				
rim	100%	100%	100%	3.4.2
hub	100%	-	-	3.4.2
web	20% ^e	-	-	3.4.2
Residual stress trends	1	1	2	ⁱ
State of surface	100%	100%	100%	3.6.1
Surface integrity	100%	100% ^f	100% ^f	3.6.2
Geometry and dimensions	100% ^g	100% ^g	100% ^g	3.7

Static imbalance	100%	100%	100%	3.8
Complementary tests	^h	-	-	E.3.5

- ^a One analysis by cast. Sampling shall ensure that the content measured is representative of the maximum hydrogen content of the cast.
- ^b The hydrogen content is determined according to the methods described in annex A (normative). It has to be <2 ppm for wheels of category 1 and 2.5 ppm for wheels of category 2.
- ^c Only tread braked wheels.
- ^d Only category 1 wheels.
- ^e The rejection of one wheel in a batch will require verification of the whole batch.
- ^f By agreement between customer and the supplier, visual inspection as defined in F.4.4 may replace magnetoscopy inspection.
- ^g Tread diameter, bore diameter, rim profile.
- ^h To be defined according to test laboratory results (see 3.4).
- ⁱ E3.5 for qualification and F4.3 for delivery.

5. Additional information for supplier and inspection

- A. Profile must be according to EN 13715 S1002, h=28, e=32.5, reverse slope 15% or UIC 510-2 OR Appendix B1 (4th edition May 2004), except items 1 to 3 (wheels of Ø850) which should be supplied with profile DSB 82-1 according to Appendix 16 to this Spec, - drawing DSB 2A 17409.
- B. Chemical composition analysis is required according to BS EN 13262:2004, paragraph 3.1. and Table 1.
- C. Tensile tests are required according to BS EN 13262:2004, paragraph 3.2.1 and Table 2.
- D. Hardness characteristics in the rim are required according to BS EN 13262:2004, paragraph 3.2.2. The minimum hardness values of steel grades ER7 shall be 235 HB; for steel ER8 shall be 245 HB and for steel ER9 it shall be 255 HB.
- E. Impact test characteristics are required according to BS EN 13262:2004, paragraph 3.2.3. The minimum and average values for U-

notch pieces (tested at room temperature) and V-notch pieces (tested at -20°C) are given in Table 4 of the Standard.

F. The fatigue characteristics shall be verified for wheels qualification (new wheels design or manufacturer):

- when the maximum radial stresses calculated with the method defined by EN 13979-1 "Wheels – Technical approval" are between 50% and 100% of the fatigue limit;
- if the roughness values of the surfaces are greater than those indicated in BS EN 13262:2004, Table 8.
- If the production process is appreciably different from that used for wheels qualified for European network.

G. Toughness characteristic of the rim according to BS EN 13262:2004, paragraph 3.2.5, is required only for tread brake wheels (except items 4, 5, 6, 10 and 14; drawings ME415.00.3(A), ME428.00.3, ME437.00.3, ME456.00.1 and ME459.00.1).

For wheels of steel grade ER7 the average value obtained from 6 test pieces shall be greater or equal than $80 \text{ N/mm} \cdot \sqrt{\text{m}}$, and no single value shall be less than $70 \text{ N/mm} \cdot \sqrt{\text{m}}$.

For wheels of steel grade ER8 the average value obtained from 6 test pieces shall be greater or equal than $70 \text{ N/mm} \cdot \sqrt{\text{m}}$, and no single value shall be less than $60 \text{ N/mm} \cdot \sqrt{\text{m}}$.

For wheels of steel grade ER9 the average value obtained from 6 test pieces shall be greater or equal than $60 \text{ N/mm} \cdot \sqrt{\text{m}}$, and no single value shall be less than $50 \text{ N/mm} \cdot \sqrt{\text{m}}$.

H. Heat treatment homogeneity must ensure that the difference between 3 measured hardness values for all steel grades shall be not greater than 30 HB.

I. Material cleanliness examination is required according to BS EN 13262:2004, paragraph 3.4. The level inclusions size shall be according to Table 6 of the Standard.

J. Residual stresses verification according to EN 13262:2004, paragraph 3.5 and Annex C or D, is required for wheels qualification (new wheels

design or manufacturer). For wheels delivery the residual stresses trend is verified according to EN 13262:2004, Annex F, paragraph F4.3.

- K. Internal integrity by ultrasonic examination is required according to BS EN 13262:2004, paragraph 3.4.2. The standard defect diameters for rim web and hub shall be as required in 3.4.2.2.1, 3.4.2.2.2, 3.4.2.2.3.
- L. The surface roughness (Ra) of areas of "finished" or "ready for assembly" wheels shall be as required in BS EN 13262:2004, paragraph 3.6.1.1.
- M. Surface integrity is determined by magnetic particles method. The maximum trace length of the permissible surface breaking defects according to BS EN 13262:2004, paragraph 6.2, shall be 2 mm on machined faces and 6 mm on black faces.
- N. The limiting values of residual imbalance shall be 50 g·m, 75 g·m or 125 g·m depending on the wheel type as indicated above in Table 1.
- O. The surfaces are to be protected from corrosion according to UIC leaflets 842-3 and 842-5 on all machined surfaces with exception of the surfaces of top of the flange and unfinished surface of the hub hole.

6. Product qualification and quality control

The manufacture must be certified for a quality management System in accordance with the ISO 9001 and IRIS standards for manufacture of wheels of rolling stock.

7. Packing

The wheels should be carefully protected by suitable packing in order to avoid any damage, especially of the machined parts, during handling or transit and they shall be preserved properly for long-term storage.

The wheels shall be supplied on wooden pallets and positioned with the inner surface down. Wooden pallet and the bottom wheel shall be separated by wooden plank of 60 mm thickness as well as each wheel on the pallet.

The number of wheels per pallet shall be limited to a total pallet weight of 2000 kg.

Wheels shall be tied to the pallets by steel bands.

The wheels on each pallet shall be with the same outer diameter.

Permissible tolerance of the wheels outer diameter on the pallet shall be up to 0.3 mm.

The exact outer diameter of each wheel shall be painted on the web part near the rim.