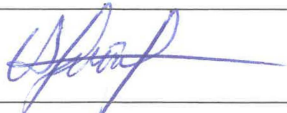


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TS 250.272

TSI CERTIFICATED MONOBLOCK WHEEL TECHNICAL SPECIFICATIONS

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1. SCOPE

This technical specification covers the technical characteristics and requirements, inspections and tests concerning rolled and forged TSI approved solid wheels made of unalloyed steel, of which the types are given in the appended drawing, to be used on trailing stock of TCDD.

2. GENERAL REQUIREMENTS

- 2.1.** All articles of this technical specification shall be explicitly and fully responded one by one. Any item not responded explicitly and fully, will be regarded as not responded and the tenderer as not responsive to the relevant article.
- 2.2.** The Wheelsets' type shall be BA004, BA318 design for Ø920 mm wheel; Special design for Ø760 mm wheel and technical drawings and documents concerning wheelsets offered must be enclosed to the tender documents. Offers shall be submitted in Turkish or English language.
- 2.3.** Tenderers shall submit together with their offer TSI certificate and TSI declaration of conformity for wheels that will be given to the TÜRASAS by tenderer.
- 2.4.** Tenderers shall submit TSI certificate for the special design monoblock wheels that will be given to the TÜRASAS at the latest in product control.

3. TECHNICAL CHARACTERISTICS AND REQUIREMENTS

3.1. Material and Chemical Composition

Solid wheels shall be manufactured of ER7 class unalloyed steel and their chemical composition shall not exceed values given in Table 1. These values are for the product analysis.

ER7	C	Si	Mn	P	S	Cr	Cu	Mb	Ni	V	Cr+Mo+Ni
%	0.52	0.40	0.80	0.020	0.015	0.30	0.30	0.08	0.30	0.06	0.50

Table -1

3.2. Manufacture

3.2.1. Steelmaking Process

Wheels shall be manufactured from steel by open hearth, electric arc or basic oxygen process. Additionally the steel shall be killed in the ladle or in the furnace and then shall be degassed under vacuum.

After degassing process, maximum amount of hydrogen in the liquid steel shall be **2,5 ppm**.

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The liquid steel shall be poured by the continuous casting method or the ingot casting method. In case of ingot casting, ingots shall be poured by means of bottom pouring method.

3.2.2. Wheel Manufacturing Process

Wheels shall be manufactured from ingots or blooms capable of producing two or more wheels after removal of discard by rolling. Cropping shall be sufficient to eliminate defective section of ingot. Any superficial defects shall be completely removed before or during working. Where this is not possible, the defective sections shall be rejected.

The sections of ingots or blooms shall be forged and shaped by hammer or press. They shall be finally shaped by rolling or by drop forging, if necessary. Suitable precautions shall be taken during hot working to ensure that material is not damaged by excessive temperatures or by grain growth due to cessation of work at high temperatures.

All ingots, blooms, sections and wheels shall be marked with suitable identification marks during manufacturing process. But the final marking of the wheels shall be carried out as indicated in Item 3.4.

3.2.3. Heat Treatment

The rolling surfaces of the wheels shall be subjected to heat treatment so as to ensure the mechanical properties specified in this specification.

3.3. Physical and Mechanical Properties

3.3.1. Appearance

The parts of wheels remaining unmachined shall be perfectly trimmed. The wheels shall show no marks other than at the positions stipulated in Item 3.4 of this technical specification. However, it shall be permissible for Brinell Hardness impressions to be left on the surface of the rim. All appearances of all sides of wheels shall be perfect and no cracks, gaps, burrs, material missing, rolling defect and any defect to prevent the use shall be available.

In order to correct the defected part of wheel surfaces, any welding, gas torch heating, electric burns, filling by metallization, electrolytic or chemical deposit etc. Shall not be permitted.

3.3.2. Dimensions

The final machining sizes, tolerances of the wheels and the surface roughness values shall conform to the appended drawings in this technical specification. The tread profile of wheel is

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indicated in the attached technical drawings. The appended drawing. Tolerances not found on the appended drawings shall comply with Table 9 in EN 13262 Standard.

3.3.3. Micrographic Appearance

The inclusion values to be achieved by micrographic examination shall comply with the values given in Table 2.

Micrographic Examination shall be carried out in accordance with the requirements of standard ISO 4967, Method “A”.

The test piece shall be extracted as indicated in Figure 3. The examination field shall be the shaded area with “F” center point, situated 15 mm below the tread surface.

TYPE OF INCLUSION	THICK SERIES (max.)	THIN SERIES (max.)
A (Sulphur)	1,5	2
B (Aluminate)	1,5	2
C (Silicate)	1,5	2
D (Globular Oxide)	1,5	2
B+C+D	3	4

Table-2

3.3.4. Detection of Inner Flaws

Detection of inner flaws and preparation of samples shall be performed with magnetic particle inspection method as per EN 13262 Standard.

The test piece shall be wheels with all operations carried out according to this technical specification and final machining of the tread surface and side faces of the rim completed.

3.3.5. Surface Crack Detection

Detection of flaws and preparation of samples shall be performed with magnetic particle inspection method as per EN 13262 Standard. No residual magnetism shall be found on the wheels after the examination.

The maximum trace length of permissible surface crack defects on monoblock wheels after the examination shall be:

- 2 mm on machined surfaces
- 6 mm on not machined surfaces either forged or rolled.

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3.3.6. Residual Stresses

After heat treatment the residual stresses occurring in the treated portion of the wheel shall be compressive stresses.

For checking the residual stresses two datum points with a distance of 100 mm shall be marked at the center of wall thickness of the rim on the opposite side of the flange.

The wheel shall be cut radially from the top of the flange to the bore between the two datum marks.

The distance between the marks shall then be measured, it shall have reduced by at least 1 mm.

Alternatively, detection of residual stresses can also be made as specified in EN 13262 Standard.

Bidders shall specify the control method they will apply in their offer.

3.3.7. Residual Static Imbalance

The residual imbalance moment of the finished wheel shall not exceed 75 gm for passenger cars and 125 gm for freight cars. Residual Static Imbalance will be measured on the diameter that assembly axle and wheel for test.

3.3.8. Mechanical Properties

3.3.8.1. Mechanical Properties; The mechanical properties of the wheels shall comply with the values given in Table-3.

Tensile strength on the wheel rim (Rm)		820-940 N/mm ²			
Amount of strength reduction between tensile strength on the rim and on the web of the same wheel (Rm)		110 N/mm ² (min.)			
Elongation – on the rim		% 14 (min)			
Elongation – on the web		% 16 (min)			
Yield resistance at wheel rim (ReH)		520 N/mm ² (min.)			
Hardness		235-280 HB			
Notch impact at wheel rim	U-notch at +20°C	Mean value ≥ 17 J	(min) 12 J		
	V-notch at -20°C	Mean value ≥ 10 J	(min) 7 J		

Table-3

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3.3.8.2. Thermomechanical Properties; The thermomechanical properties of the wheels shall conform to all requirements of EN 13979 Standart. Tenderers shall submit declaration of conformity with all the requirements of Standart EN 13979 for the products will be delivered to TÜRASAS with their offers. Also the tenderers shall submit to TÜRASAS all test and control reports within the scope of EN 13979 at the latest with the first delivery of the product.

3.3.9. Tensile Strength Determination

Tensile test shall be carried out in accordance with the requirements of ISO 6892-1. Tensile test pieces shall be taken from the sample wheel at positions 1 and 2 as shown in Figure 1. The gauge length diameter shall be minimum 10 mm and the gauge length shall be 5 times the diameter between two reference points on the test piece.

3.3.10. Impact Resistance Determination

The impact test shall be carried out in accordance with the requirements of ISO 148-1. Three test pieces (a,b,c) shall be taken from the sample at the positions shown in Figure 1. The marking of the test pieces shall be such as to allow identification of the longitudinal face parallel to Section AA as shown in Figure 1. The bottom axis of notch shall be parallel to the AA axis. U-notch sample shall be used at +20°C and V-notch sample shall be used at -20 °C.

3.3.11. Hardness Depth of Rim Sections

The rim of the wheels shall be hardened up to the total wear depth indicated in Figure-2 in accordance with the hardness values given in the Table-3. At point A, hardness values shall be at least 10 points less than the wear limit values.

The test piece shall consist of a slice comprising a complete radial section of rim and web selected from the sample segment (Figure 2). One face of test piece shall be prepared in accordance with ISO 6506-1.

Hardness impressions shall be situated on the three radial lines indicated in Figure 2 at a distance of 5 mm from the nominal running surface of the tread and at points A and B. Points B correspond to the outline of the last reprofiling.

3.3.12. Rim Fracture Toughness Characteristics

The rim fracture toughness characteristics of the wheels shall be determined on ER7 class and tread braked wheels in accordance with the conditions indicated in EN 13262 Standard.

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The fracture toughness test shall be performed according to ASTM E 399.90 and EN 13262, on six test pieces evenly distributed around the rim as indicated in Figure 4 and the values to be obtained shall be as follows:

- The average value calculated from six KQ measurements shall be greater than or equal to 80 N/mm² √m.
- The individual value for each of the six measurements shall be greater than or equal to 70 N/mm² √m.

3.3.13. Uniformity of Wheel Rim hardness within a Batch

The difference between the peak hardness values recorded on the wheel rims of the same batch and dimensions shall not exceed 30 HB.

Each wheel in the batch shall be subjected to a Brinell Hardness test on the plane surface of the rim on the opposite side of the flange. The position selected for indentation shall be on a circumference with a radius 25 mm less than that of a running circle shown in figure 2. The test position shall be prepared by slightly grinding to remove any decarburization.

3.4. Painting and Marking

Unpainted surfaces of monoblock wheels shall be covered with a protective oil, the surfaces will be painted as given annex-5.

Monoblock wheels shall be marked according to the annex-6 drawing.

3.5. Packing

Wheels shall be packaged with VCI packaging material so that they will not be affected by external weather conditions. The wheels shall be packed prior to shipment with a suitable method so as to protect against corrosion and mechanical impacts.

The cases shall be in a manner that they can be loaded/unloaded on to any vehicle and can be piled by a forklift / a crane.

4. INSPECTIONS AND TESTS

The manufacturer shall perform the inspections and tests stipulated in Table-4 for each batch of wheels. During these inspections the manufacturer shall reject the wheel itself, which was found defective according to the results of the inspections stipulated in the lines 3, 4, 6,7 and 9 Whereas in respect to the other tests in Table 4, the whole batch of the relative wheel, which was detected as

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non conforming to the requirements of this specification, shall be rejected. The Quality Control Certificates including the test results of the wheels that comply with this technical specification shall be submitted to TÜRASAS at the time of delivery.

For each batch of the manufactured wheels, the inspection and acceptance procedures to be realised by TÜRASAS inspection and acceptance commission shall be carried out at the manufacturer's premises. The manufacturer shall inform TÜRASAS 30 days beforehand for these inspections. The physical and laboratory inspections indicated in this technical specification shall be performed after checking the factory quality control documents of the wheels subjected to inspections. The whole batch of wheels will be accepted if the results of these inspections comply with this technical specification. On the contrary, the whole batch the wheels will be rejected in case any result does not comply with the requirements.

The calibrated gauges for TÜRASAS representatives during quality control shall be provided by the manufacturer.

4.1. Physical Inspections

The inspections in line 3 in Table 4 shall be performed on the samples to be selected as per Item 4.3 of this specification after packing controls of the Wheels have been performed by the inspection and acceptance Commission.

4.2. Laboratory Inspections

Laboratory inspections of the wheels shall be performed in the manufacturer's plants.

An accredited independent organization will perform the Arbitratory Laboratory Inspections of the wheels.

After physical inspections of the wheels, the inspections stipulated in lines 1, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13 and 14 shall be carried out on the samples to be selected according to Item 4.3 of this technical specification.

The contractor shall replace the wheels that will be destructed during inspections with new ones free of charge.

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ITEM NR	INSPECTIONS AND TESTS	Number of wheels to be tested in each batch		Number of tests applied to the wheel	Inspection and Test Methods	Specification Item Nr.
		Number of wheels in one batch ≤250 > 250				
1	Chemical Analysis	1	1	1	EN 13262 ISO/TR 9769	3.1
2	Steelmaking Process and Hydrogen Amount (H ppm)	1	1	1	EN 13262 annex-A	3.2.1
3	Appearance Inspection (Appearance,Marking)	All	All	1	EN 13262	3.3.1 3.4
4	Dimensional Check Axial /Radial Sagging	All	All	1	EN 13262	3.3.2
5	Micrographic Inspection	1	2	1	EN 13262 ISO 4967	3.3.3
6	Ultrasonic Inspection	All	All	1	EN 13262 ISO 5948	3.3.4
7	Magnetic Particle Inspection	All	All	1	EN 13262 ISO 6933	3.3.5
8	Residual Stresses	1	2	1	EN 13262	3.3.6
9	Residual Static Unbalance	All	All	1	EN 13262	3.3.7
10	Tensile Test (on rim)	1	2	1	EN 13262 ISO 6892-1	3.3.9
11	Tensile Test (on web)	1	2	1	EN 13262 ISO 6892-1	3.3.9
12	Impact Test (U-notch)	1	2	3	EN 13262 ISO 148-1	3.3.10
13	Hardness Depth of Rim Sections	1	2	1	ISO 6506-1	3.3.11
14	Rim Fracture Toughness	1	1	6	EN 13262 ASTM E 399.90	3.3.12
15	Uniformity of Wheel Rim Hardness within a Batch	All	All	1	ISO 6506-1	3.3.13

Table-4

4.3. Sampling

The samples shall be selected at random from the party delivered by the inspection and acceptance commission in the quantities as indicated in Table-5 delivered. The sample quantity for non-destructive tests can be increased if needed.

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Number of Wheels in one Party	Number of Samples
0-500	2
501-1000	3
1001-2000	4
More than 2000	5

Table-5

5. WARRANTY

The solid wheels shall be guaranteed for a period of 5 years.

6. DELIVERY

The monoblock wheel sets shall be delivered in one party. The delivery location will be either TÜRASAS Eskişehir Regional Directorate or TÜRASAS Sivas Regional Directorate, depending on the demand.

7. OTHER REQUIREMENTS

7.1. The last version of EN 13262 standart shall be valid for conflicting issues or for issues not specified clearly in this specification.

7.2. In case of absence of the provision in this technical specification, the tender document, TÜRASAS Tender Regulation and provision of legislation related to these, issued by TÜRASAS, shall be valid.

ANNEXES:

1. Position of tensile and impact test pieces (Figure-1)
2. Position of Brinell Hardness measurements (Figure-2)
3. Micrographic Inspection Zone (Figure-3).
Position of rim fracture toughness characteristics test pieces (Figure-4)
4. Technical drawings
- 5- Wheel Painting
- 6- Wheel Marking