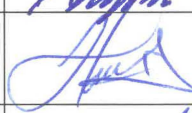
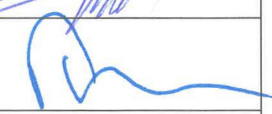
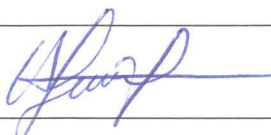


TÜRASAS Regional Directorate of Eskişehir	TECHNICAL SPECIFICATION	Document No	250.273			
		Revision	G	H	J	K
		Page	1/10			

TS 250.273

TSI CERTIFICATED AXLE

TECHNICAL SPECIFICATIONS

Manager of Incoming Control Division	Şükrü Baha BAYDIR	
Manager of Wagon Division	Halis SAĞIR	
Manager of Wagon Factory	Murat GÖRÜR	
Manager of Gear and Wheel Manufacturing Plant	Tezcan BÜYÜKCAN	
Prepared by	Ahmet SÖNMEZ	Ahmet URAL
		
Prepared on	22.08.2013	

TÜRASAS Regional Directorate of Eskişehir	TECHNICAL SPECIFICATION	Document No	250.273			
		Revision	K			
		Page	3/10			

1. SCOPE

This technical specification covers the general requirements, technical characteristics, sampling, inspection, testing and warranty conditions concerning rolled and forged axles (the technical drawings are given in appendix) made of unalloyed steel to be used on trailing stock of TCDD.

1.1. DEFINITIONS

ADMINISTRATION: TÜRASAS,

BIDDER: Refers to the companies that will participate in the tender in order to provide the services within the scope of this specification

CONTRACTOR: The firm that won the tender and will perform the work within the scope of this specification.

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 axles' type shall be BA002 design for Ø920 mm wheel; Special design for Ø760 mm wheel and technical documents concerning axles 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 axles that will be given to the TÜRASAS by tenderer. Tenderers shall submit TSI certificate for the special design axles will be given to the TÜRASAS at the latest in product control.

3. TECHNICAL CHARACTERISTICS AND REQUIREMENTS

3.1. Material, Chemical Composition

The axles shall be manufactured of EA1N class unalloyed steel. Chemical composition of the axles shall not exceed values in table 1. These values are for the product analysis.

EA1N	C	Si	Mn	P	S	Cr	Cu	Mo	Ni	V
%	0.40	0.50	1.20	0.020	0.015	0.30	0.30	0.08	0.30	0.06

Table 1: Chemical composition of AIN class steel (%)

TÜRASAS Regional Directorate of Eskişehir	TECHNICAL SPECIFICATION	Document No	250.273			
		Revision	K			
		Page	4/10			

3.2. Manufacture

3.2.1. Steelmaking process

The axles shall be manufactured from steel produced 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, max. amount of hydrogen in the liquid steel shall be 2,5 ppm.

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

3.2.2. Manufacturing process

The axles must be manufactured from ingots transformed by rolling or forging as stated in the EN 13261

3.2.3. Heat Treatment

The axles shall be subjected to heat treatment in a way so as to ensure the mechanical properties specified herein.

3.3. Physical and Mechanical Properties

3.3.1. Appearance

The parts of axles remaining unmachined shall be perfectly trimmed. The axles shall show no marks other than at the positions stipulated in Item 3.4 of this technical specification.

All appearances of all sides of axles must be perfect and they shall be free of any cracks, gaps, burrs, insufficient material, rolling defect or any defect that will prevent the use.

In order to correct the defected parts of axle surfaces, any welding, gas torch heating, electric burns, filling by metallization, electrolytic or chemical deposit etc. are not permitted.

3.3.2. Dimensions

Final machining dimensions, tolerances and surface finishing qualities shall comply with the drawings given in annex.

Tolerances not specified in the technical drawings given in annex shall comply with Table-9 of EN 13261 Standard.

TÜRASAS Regional Directorate of Eskişehir	TECHNICAL SPECIFICATION	Document No	250.273		
		Revision	K		
		Page	5/10		

3.3.3. Microscopic Appearance

Microscopic structure of the axle shall be suitable for heat treatment applied. Ferritic grain size shall not be coarser than index 5, according to ISO 643.

Microscopic inspection and preparation of test piece shall be made according to ISO 643.

3.3.4. Micrographic Cleanliness

The values to be achieved by micrographic inspection are given in table-2.

Micrographic inspection shall be performed as per Method A of ISO 4967.

Test piece shall be taken as specified in Figure 2. Inspection zone shall be the 200 mm² shaded area on the plane vertically axial to the (F) arrow that crosses the radius at the largest diameter of the axle.

RESIDUAL TYPE	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

3.3.5. Detection of Inner Flaws

Inner flaw detection and sample preparation shall be made as per EN 13261 standard with the ultrasonic examination method.

The test piece shall consist of the axle after full heat treatment and final machining.

3.3.6. Detection of Surface Cracks

Detection of surface cracks and sample preparation shall be made as per EN 13261 standard with the magnetic particle examination method. No residual magnetism shall be found on the axles after the examination.

The test piece shall consist of the axle in the delivery condition specified in this technical specification, but without any treatment to protect it from oxidation.

Maximum dimensions of defects that are permitted on the surface of axles after the inspection:

On the external surface of the axle:

TÜRASAS Regional Directorate of Eskişehir	TECHNICAL SPECIFICATION	Document No	250.273			
		Revision	K			
		Page	6/10			

- No transversal defect is to be tolerated,
- Longitudinal defects are tolerated, if they are within limits given in Table-3 and outside “Z0” connection areas (see fig.3). A defect shall be considered as a longitudinal defect if its inclination with the axle-centerline is less than 10 degrees.

Zones	Max. Length of each defect (1)	Max. Length of all defects
Z0	0	0
Z1	≤ 6 mm	≤ 6 mm
Z2	≤ 6 mm	≤ 15 mm
Z3	≤10 mm	≤ 30 mm
(1) If the distance between two defects on the same diameter is more than 10 mm, they will be regarded as two different defects.		

Table-3

3.3.7.Mechanical Properties

The mechanical properties of axles shall comply with the values given in Table-4.

Tensile Strength	550-650 N/mm ²
Limit of Elasticity	320 N/mm ² (min)
Impact U-notch)- lengthwise	30 J (min)
Impact (U-notch)-crosswise	25 J (min)
Elongation	% 22 (min)

Table-4

3.3.8.Determination of Tensile Strength

The tensile test shall be carried out in accordance with the requirements of ISO 6892-1. Tensile test pieces, shall be taken from the sample axle as shown in figure 1.

The gauge diameter of the test piece shall be minimum 10 mm and the gauge length shall be 5 times the diameter.

3.3.9.Impact Test (U-notch)

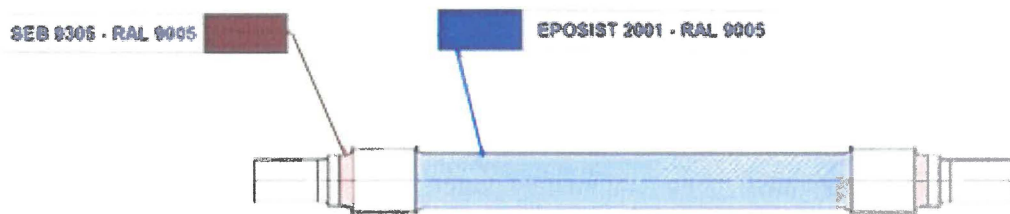
The impact test shall be carried out in accordance with the requirements of ISO 148-1. Three test pieces (a,b,c) shall be taken from the sample at the positions shown in figure 1 (Longitudinal and Transverse). Marking of the test pieces shall be marked in longitudinal surfaces parallel and

TÜRASAS Regional Directorate of Eskişehir	TECHNICAL SPECIFICATION	Document No	250.273		
		Revision	K		
		Page	7/10		

perpendicular to section AA as shown in figure 1. The axis of the bottom of the notch shall be parallel to the radius AA. U-notch sample shall be used at +20 °C.

3.4. Painting and Marking

3.4.1. Axles will be painted as in the example picture shown below. Different paint applications meeting the same technical specification will be evaluated by the ADMINISTRATION.



3.4.2. The unpainted surfaces of the axles will be covered with Tectyl 506 or an equivalent protective oil.

3.4.3. The axles shall be marked according to appended drawing.

3.5. Packaging

3.5.1. Axles will be packaged with VCI packaging material so that they will not be affected by external weather conditions.

3.5.2. Axles shall be protected with a proper method against corrosion and mechanical impacts before shipment.

3.5.3. 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. INSPECTION & TESTS

4.1.1 The manufacturer shall perform the inspections and tests specified in Table-5 on each batch of axles manufactured. Axles found defective during the tests given in lines 3, 4, 7, and 8 will be rejected. The related batch of axles will be rejected, if any of the axles of this batch are detected as non-conforming during the other tests.

TÜRASAS Regional Directorate of Eskişehir	TECHNICAL SPECIFICATION	Document No	250.273			
		Revision	K			
		Page	8/10			

- 4.1.2** The quality control certificates including the test results of axles, which conform to the requirements of this specification, shall be submitted to TÜRASAS at delivery stage.
- 4.1.3** Inspections and acceptance procedures for each batch of axles manufactured will be performed by TÜRASAS Inspection and Acceptance Commission at the manufacturer's plants. The contractor shall inform TÜRASAS 30 days beforehand for these inspections.
- 4.1.4** Physical and laboratory tests indicated in this specification will be performed after inspecting the factory quality control certificates of the axles subjected to inspections. The whole party will be accepted, if the results of these inspections are favorable. However, the whole party will be rejected if any of the results does not comply with the specifications.
- 4.1.5** The necessary calibrated measuring tools and equipments, which will be used by TÜRASAS representatives during these checks, shall be provided by the manufacturer.

4.2.Physical Inspections

Following the packaging inspections of the axles the Inspection and Acceptance Commission will carry out the inspections stipulated in line 3 of Table-5 on the samples selected as per Item 4.4 of this specification.

4.3.Laboratory Inspections

Following the physical inspections of the axles, the examinations stipulated in lines 1, 4, 5, 6, 7, 8, 9, 10 and 11 of Table 5 will be carried out on the samples selected according to Item 4.4 of this specification.

The contractor shall replace the axles destructed during the inspections free of charge.

TÜRASAS Regional Directorate of Eskişehir	TECHNICAL SPECIFICATION	Document No	250.273			
		Revision	K			
		Page	9/10			

ITEM NR.	INSPECTIONS AND TESTS	Number of axles to tested in each batch		Number of tests applied to the axle	Inspection and Test Methods	Specification Item Nr.
		Number of axles in one batch ≤100	> 100			
1	Chemical Analysis	1	1	1	EN 13261 ISO/TR 9769	3.1
2	Hydrogen Amount (H ppm)	1	1	1	EN 13261 Ek-J	3.2.1
3	Appearance Inspection (Appearance,Marking)	All	All	1	EN 13261	3.3.1
4	Dimensional Check	All	All	1	EN 13261	3.3.2
5	Microscopic Inspection	1	2	1	EN 13261 ISO 643	3.3.3
6	Micrographic Inspection	1	2	1	EN 13261 ISO 4967	3.3.4
7	Ultrasonic Inspection	All	All	1	EN 13261 ISO 5948	3.3.5
8	Magnetic Particle Inspection	All	All	1	EN 13261 ISO 6933	3.3.6
9	Tensile Test	1	2	3	EN 13261 ISO 6892-1	3.3.9
10	Impact Test (U-notch) longitudinal	1	2	9	EN 13261 ISO 148-1	3.3.11
11	Impact Test (U-notch) -transverse	1	2	9	EN 13261 ISO 148-1	3.3.11

Table-5

4.2. Sampling

The number of samples for technical inspection shall be as stated on Table-6 and selected randomly by the Inspection and Acceptance Commission from the party to be delivered.

If necessary, the amount of samples may be increased for non-destructive testing.

Amount of Party	Number of Test Sample
0-500	2
501-1000	3
1001-2000	4
More than 2000	5

Table -6

TÜRASAS Regional Directorate of Eskişehir	TECHNICAL SPECIFICATION	Document No	250.273			
		Revision	K			
		Page	10/10			

5. WARRANTY

The axles shall be guaranteed for 5 years.

6. DELIVERY

The axles shall be delivered in one party.

7. OTHER REQUIREMENTS

7.1. The last revisions of EN 13261, as well as of other standards references herein will be valid are valid for technical points which are not stated or not clear in this specification.

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

ANNEXES:

1. Position of tensile and impact test pieces (Figure 1).
2. Micrographic examination field (Figure 2).
3. Magnetic particle examination field(Figure 3).
4. Related technical drawings