

[TŞ-02.024]

[Rev. D 4045]

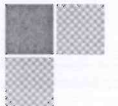
Monoblock Wheel Technical Specification

[Issued Date : 07/05/2004]

[Revision Date : 17/08/2022]

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Revision History

[illegible]

10-2-8

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1. SUBJECT

This technical specification covers the minimum technical and general specifications for monoblock wheels used in passenger coach bogies manufactured by TÜRASAS, manufactured from unalloyed steel by rolling and forging, and whose type is specified in the attached technical drawings.

This technical specification has been prepared in Turkish and English, and in case of any disagreement between the two, the Turkish version is valid.

2. DEFINITIONS

ER7	: It describes the chemical composition of monoblock wheels to be manufactured by rolling and forging from non-alloy steel according to EN 13262.
EN 13262	: Railway applications - Wheelsets and bogies - Wheels - Product requirements
ISO 4967	: Steel - Determination of content of non-metallic inclusions - Micrographic method using standard diagrams
ISO 6933	: Railway rolling stock material; magnetic particle acceptance testing
ISO 5948	: Railway rolling stock material — Ultrasonic acceptance testing
ISO 6892-1	: Metallic materials - Tensile testing - Part 1: Method of test at room temperature
ISO 148-1	: Metallic materials - Charpy pendulum impact test - Part 1: Test method
ISO 6506-1	: Metallic materials - Brinell hardness test - Part 1: Test method
ASTM E399.19	: Standard Test Method for Linear-Elastic Plane-Stress-Fracture Toughness K_{Ic} of Metallic Materials

3. TECHNICAL REQUIREMENTS

3.1. Material, Chemical Composition

The wheels will be manufactured from ER7 class unalloyed steel and their chemical composition will not exceed the values given in Table-1. These values are for product analysis.

Table – 1

ER7	C	Si	Mn	P ^a	S ^{a b}	Cr	Cu	Mo	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

a: A maximum content of % 0,025 may be agreed upon.

b: A minimum sulfur content may be agreed at the time of enquiry and the order according to the steel making process, in order to secure against hydrogen embrittlement.

b: If the bidders are to offer a different rate than the sulfur (S) value in the above table, they shall submit the sulfur (S) rate of the steel they have offered together with their bids at the time of the tender.

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3.2. Manufacturing

3.2.1. Steel Manufacturing

The steel used in the manufacture of wheels will be produced by Siemens Martin, Electric arc or Basic Oxygen method, and will be subjected to vacuum degassing after being turned into quiescent steel in a crucible or furnace.

Liquid steel shall be cast by continuous casting or ingot casting methods. If it is to be poured into ingots, the bottom pouring method will be used.

3.2.2. Hydrogen Content in Steel

As a result of the degassing process, the amount of hydrogen in the molten steel will be a maximum of 2 ppm for Category 1 wheels and a maximum of 2.5 ppm for Category 2 wheels.

Two categories of wheels are defined, Category 1 and Category 2. Category 1 is selected when the operating speed is greater than 200 km/h.

3.2.3. Wheel Manufacturing

The wheels shall be manufactured by rolling from ingots or logs, from which two or more wheels can be produced after the ends are cut. Cutting the ends will be sufficient to remove the faulty parts of the ingots.

Any superficial error will be completely eliminated before or during processing. When this is not possible, faulty sections will be rejected.

The cut ingots or billets will be shaped by pressing. If necessary, final shaping will be done by rolling or ram forging.

All ingots, logs, sections and wheels shall be marked with an appropriate identification mark during manufacture. However, the final marking of the wheels will be made as indicated in the technical drawing no. 00.036.

In the marking, the TUA pseudonym will be used to represent TÜRASAŞ Sakarya Regional Directorate.

3.2.4. Heat Treatment

The rolling surfaces of the wheels will be heat treated to provide the mechanical properties specified in this specification.

4. GENERAL FEATURES

4.1. Appearance

The roughness of the untreated surfaces of the wheel will be thoroughly cleaned. There shall be no other markings on the surfaces of the wheels other than the marking specified in the technical drawing no. 00.036 of this specification. However, markings formed on the wheel rim surfaces as a result of Brinell hardness tests shall be permitted to remain. The appearance of all sides of the wheels will be perfect, they will not contain cracks, gaps, burrs, lack of material, rolling stock or any errors that will prevent use.

Welding, torch heating, electric burning, metal filling, electrolytic or chemical filling, etc. to remove defects on wheel surfaces. No action will be taken at all.

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4.2. Dimensions

The finishing dimensions, tolerances and surface treatment qualities of the wheel shall be in accordance with the drawings attached to this specification. The wheel rolling profile will be in accordance with the attached picture no. 02.029. For tolerances not found on the attached technical drawings, the latest version of the EN 13262 standard will be taken as basis.

4.3. Structural Features

4.3.1. Micrographic View

The residual values to be obtained in the micrographic examination will be in accordance with the values given in Table-2. Micrographic examination will be made according to ISO 4967 standard Method A. The test piece will be taken as specified in Annex-3. The inspection area will be 15 mm below the rolling surface, the shaded area centered at the "F" point.

Table – 2

Ingredient Content	Category 1		Category 2	
	Thick Series (Max.)	Slim Series (Max.)	Thick Series (Max.)	Slim Series (Max.)
A (Sulfur)	1,5	1,5	1,5	2
B (Aluminat)	1	1,5	1,5	2
C (silicate)	1	1,5	1,5	2
D (spherical oxide)	1	1,5	1,5	2
B+C+D	2	3	3	4
DS	1,5		2	

4.3.2. Identifying Internal Cracks

Determination of internal cracks and sample preparation will be done by ultrasonic inspection method in accordance with EN 13262 and ISO 5948 standards.

The test piece will be wheels, all of which have been processed according to this specification, and the final processing of the rolling circle and the lateral surface of the circle has been completed.

4.3.3. Identifying Surface Cracks

Determination of surface cracks and sample preparation will be done by magnetic particle inspection method in accordance with EN 13262 and ISO 6933 standards. As a result of the inspection, there will be no permanent magnetism on the monoblock wheel.

Maximum dimensions of defects that can be seen on the surfaces of monoblock wheels as a result of inspection:

- 2 mm on machined surfaces,
- There will be 6 mm on the untreated surfaces by forging or rolling.

4.3.4. Permanent Stressess

The permanent stresses on the wheels after the heat treatment will be the compressive stress. For the control of the permanent stresses, two points 100 mm apart from each other shall be marked in the middle of the wall thickness of the circle from the opposite side of the wheel flange.

The wheel will be cut radially from the top of the bode to the hole between the two mark points. The distance between the points will then be measured. In the measurement made after cutting, the distance between two points will be reduced by at least 1 mm.

Apart from the above-mentioned method, the determination of permanent stresses can also be made by other methods specified in the EN 13262 standard.

4.3.5. Static Imbalance

The static unbalance value on the wheels shall not exceed 75 g.m according to EN 13262 4.8 article Table 11. Again, according to the same table, the symbol will be taken as E2.

4.4. Mechanical Properties

4.4.1. The mechanical properties of the wheels will be in accordance with the values given in Table-3 for ER7.

Table – 3

Steel Quality	Rim		Body
R_{cH}^a	≥ 520 MPa		-
R_m	820 - 940 MPa		-
R_m reduction ^b	-		≥ 110 MPa
A_5	$\geq \% 14$		$\geq \% 16$
Brinell Hardness Value	Category 1	Category 2	-
	≥ 245 HB	≥ 235 HB	-
+20°C'de U-snick	Average KU		≥ 17 J
	Min. KU		≥ 12 J
-20°C'de V-snick	Average KV		≥ 10 J
	Min. KV		≥ 7 J
a: If the yield point is not evident, the test stress Rp0,2 should be determined.			
b: Reduction in tensile stress compared to the tensile stress of the spoke of the same wheel			

Note: The maximum values of Brinell hardness values will be as indicated in the technical drawings.

4.4.2. Determination of Tensile Strength

The tensile test shall be carried out in accordance with ISO 6892-1. The tensile test piece will be removed from the sample wheel from the 1 and 2 positions shown in Annex-1.

The diameter of the part between the reference points on the test piece will be at least 10 mm and the length between the reference points will be 5 times the diameter.

4.4.3. Determining Notch Impact Resistance

The notch impact test will be carried out in accordance with ISO 148-1. For the notch impact test, three test pieces (a, b, c) will be removed at the positions shown in Annex-1. The marking of the test pieces will be made parallel to the AA section shown in Annex-1, on the forehead surface. The lower axis of the notch will be parallel to the AA axis. U notch sample will be used at +20°C and V notch sample will be used at -20 °C.

4.4.4. Hardness Depth of Rim Parts

Wheel rims will be subjected to surface hardening in accordance with the hardness values given in Table-3 throughout the total wear depth specified in Annex-2. The hardness value of point A will be at least 10 points below the values obtained at the wear limit.

The test piece will be a slice covering the complete radial section of the rim and circle selected from the sample, as shown in Annex-2. One side of the test piece will be prepared in accordance with ISO 6506-1.

The hardness measurement process is on 3 radial lines as shown in Annex-2; 5 mm below the rolling circle, at points B and point A. Points B indicate the expiration limit of the wheel.

4.4.5. Uniformity of Wheel Rim Hardness Distributions in the Lot

The difference between the extreme values recorded from the hardness measurements made on the rolling side surfaces of the same size monoblock wheels from the same charge shall not exceed 30 HB.

Each wheel in the lot shall be subjected to a hardness test from the flat surface of the spokes on the opposite side of the bode. Hardness measurements shall be made on the radius 25 mm below the rolling circle shown in Annex-2.

4.4.6 Toughness Characteristic of Rim

The rim toughness characteristic of the wheels shall be determined as specified in EN 13262 on ER7 class wheels whose rolling surface is in contact with the block brake system.

The brittleness toughness test will be carried out on 6 samples taken from the places specified in Annex-4 scattered around the entire wheel in accordance with ASTM E 399,19 and EN 13262, and the following values will be obtained as a result.

- The average value obtained from 6 test pieces shall be greater than or equal to 80 MPa \sqrt{m} .
- Each value of 6 measurements shall not be less than 70 MPa \sqrt{m} .

4.5. Test and Control

4.5.1. The inspection and acceptance procedures to be carried out by the TÜRASAŞ inspection and acceptance commission of each batch of monoblock wheels, whose manufacture has been completed, will be carried out at the contractor company's factory.

4.5.2. A copy of the quality control documents prepared by the contractor for the monoblock wheels submitted for inspection will be delivered to the TÜRASAŞ control committee. After examining all these documents, physical and laboratory examinations specified in the specification will be carried out on randomly selected samples. If the results obtained from these inspections are found appropriate, the acceptance of the whole lot will be made. If one of the results is not suitable, all of them will be rejected.

4.5.3. The referee laboratory inspections of monoblock wheels will be carried out by quality control laboratories accredited by TÜRKAK (Turkish Accreditation Agency) whose center is located in Turkey.

4.5.4. The Supplier shall inform TÜRASAŞ 30 days in advance for the controls of the monoblock wheels. The contractor firm will also notify TÜRASAŞ of the minimum test times required for the tests to be carried out within the scope of this technical specification.

4.5.5. Sampling

The samples will be randomly selected by the inspection and acceptance commission, from the lot that is the basis for the shipment, in the amount specified in Table-4.

If needed, the sample amount can be increased for non-destructive testing.

Table-4

NUMBER OF PARTS	NUMBER OF SAMPLES
0-500	2
501-1000	3
1001-2000	4
2000'den fazla	5

4.5.5.1. For each charging group of the monoblock wheels manufactured by the Contractor, the inspection and tests written in Table-5 will be made. During these controls, the contractor will reject (destroy) the monoblock wheels that have errors in the inspections in the 3, 4, 6, 7, 9 rows.

If, as a result of other inspections, it is determined that the monoblock wheels do not comply with the features specified in this specification, the entire charge of those monoblock wheels will be rejected (destroyed).

4.5.5.2. The quality control documents containing the test results of the monoblock wheels that are found suitable according to the technical specifications will be given to TÜRASAŞ upon delivery.

4.5.5.3. The calibrated measuring equipment, tools and equipment required to be used by the TÜRASAŞ control team during the quality control of the monoblock wheels will be provided by the manufacturer.

4.5.6. Physical Examinations

After the packaging and marking inspections of the wheels are made by the inspection and acceptance commission, the specification in 4.5.5. On the samples to be selected according to Table-4 in Article 5, the examinations listed in the 3rd row in Table-5 will be carried out. If not eligible, all will be rejected.

4.5.7. Laboratory Examinations

4.5.5 of the specification after the physical inspection of the wheels. On the samples to be selected according to Table-4 in Article 5, examinations in the 1st, 4th, 5th, 6th, 7th, 8th, 9th, 10th, 11th, 12th, 13th, 14th and 15th rows will be performed as seen in Table-5.

The supplier will replace the monoblock wheels that will be destroyed during the inspections, and will replace them free of charge. The company has to prepare more monoblock wheels as the number of samples in excess of the order number of monoblock wheels.

The latest editions of the standards specified in EN 13262 and Table-5 are taken as a basis for matters that are not technically specified or understood in this specification. As a result of the tests and controls in the table, if the results are found to be appropriate, the whole lot will be accepted, and if any of the results are not found appropriate, the whole lot will be rejected.

Table- 5

No	INSPECTION AND EXPERIMENTS	Number of Wheels to Check in Each Lot		Test amount applied to the wheel	Inspection and test methods	Specificati on item no
		≤ 250	> 250			
1	Chemical analysis	1	1	1	EN 13262 ISO/TR9769	3.1
2	Hydrogen Amount (H ppm)	1	1	1	EN 13262	3.2.2
3	Appearance Examination	All	All	1	EN 13262	4.1
4	Dimension Inspection	All	All	1	EN 13262	4.2
5	Micrographic Inspection	1	2	1	EN 13262 ISO 4967	4.3.1
6	Ultrasonic Inspection	All	All	1	EN 13262 ISO 5948	4.3.2
7	Magnetic Particle Inspection	All	All	1	EN 13262 ISO 6933	4.3.3
8	Tendency of Persistent Stresses	1	2	1	EN 13262	4.3.4
9	Static Unbalance	All	All	1	EN 13262	4.3.5
10	Tensile Test (on the rim and body)	1	2	1	EN 13262 ISO 6892-1	4.4.2
11	Notch Impact Test	1	2	3	EN 13262 ISO 148-1	4.4.3
12	Hardness in Rim Parts	1	2	1	ISO 6506-1	4.4.4
13	Uniformity of Wheel Rim Hardness Distributions in the Lot	All	All	1	ISO 6506-1	4.4.5

4.6. Guarantee

The warranty period of monoblock wheels will be 5 years. The warranty period starts from the delivery of the products to TÜRASAŞ Sakarya Regional Directorate.

4.7. Packaging

Monoblock wheels will be marked in accordance with the attached monoblock wheel identification marks picture no. 00.036.

In marking, the TUA pseudonym will be used to represent TÜRASAŞ Sakarya Regional Directorate.

The location of permanent unbalance shall be marked on the flank side of the wheel with the pseudonym E2.

1065.02.672 Monoblock Wheel Corrosion protection and packaging will be made in such a way that it will be protected against corrosion and will not be affected by atmospheric conditions, as in the packaging picture.

Polyethylene packaging material or equivalent product can be used as packaging material.

As an equivalent; Anti-Corrosive Packaging System, VCI (Volatile Corrosion Inhibitor) It is possible to use VCI products in various forms, but the most common use is PE film (flat and gusseted bags, films in rolls, etc.) and VCI impregnated kraft paper.

Protection begins with the usual packaging of the metal material with these products. When the packaging process is completed, VCI chemicals evaporate and cover the environment.

5. FEATURES REQUESTED IN THE SUPPLIER**5.1. Similar Job Description**

Canceled

5.2. Manufacturer Qualification Certificate and Capacity Certificates of the Bidder

5.2.1. Canceled

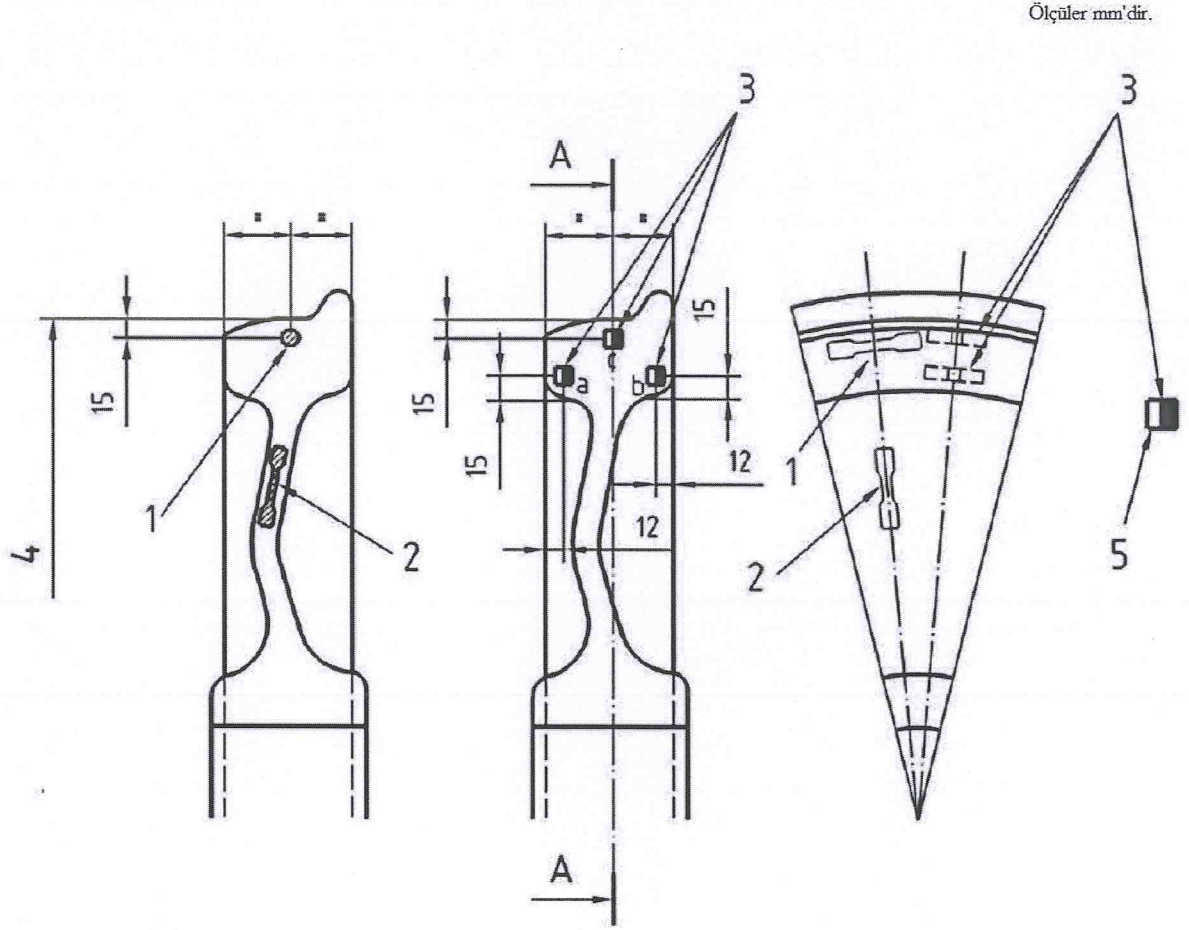
5.2.2. Canceled

5.2.3. Current or valid ISO 9001 or IRIS Quality Management System Certificate for the manufacture of monoblock wheels, axles and wheelsets produced by rolling and forging from all types of non-alloy steel belonging to railway vehicles.

6. ANNEXES

Annex-1	: Position of tensile and notch impact test pieces	
Annex-2	: Location of hardness measurements	
Annex-3	: Micrographic inspection area	
Annex-4	: Circle toughness characteristic test pieces location	
Annex-5	: Sample photos for packaging	
Annex-6	: Picture of monoblock wheel identification marks	00.036
Annex-7	: Wheel rolling profile	02.029
Annex-8	: Schlieren Bogie Monoblock wheel	02.015.05 R_06
Annex-9	: Y-32 Bogie Monoblock wheel	02.139.03
Annex-10	: Stopper	02.139.04
Annex-11	: Monoblock wheel protection and packaging	1065.02.672

Annex-1: Position of tensile and notch impact test pieces

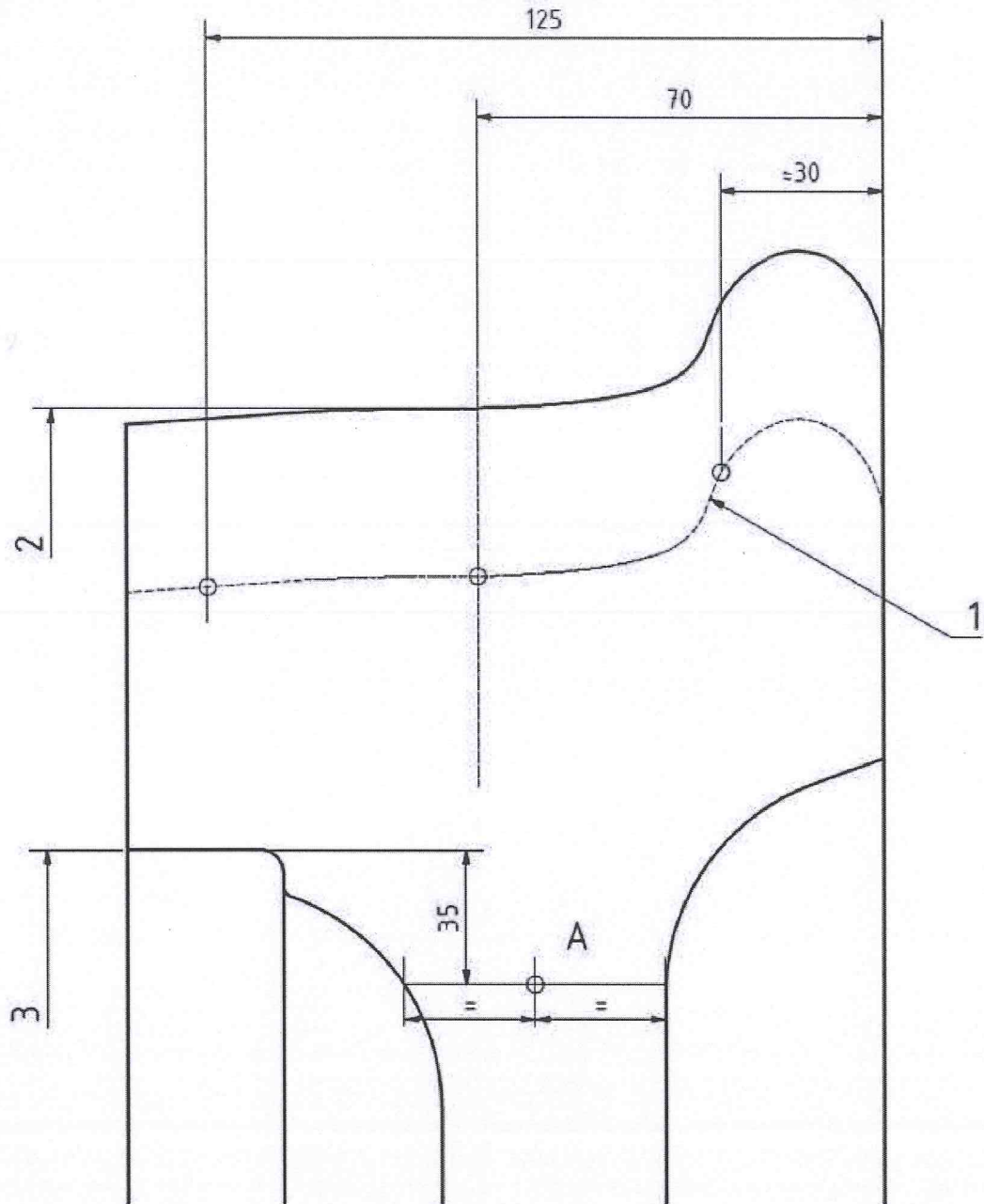


Açıklama

- 1: Çekme Test Parçası (ispitte)
- 2: Çekme Test Parçası (gövde)
- 3: Darbe Deney Parçası
- 4: Anma Çapı
- 5: Çentik

Annex-2: Location of hardness measurements

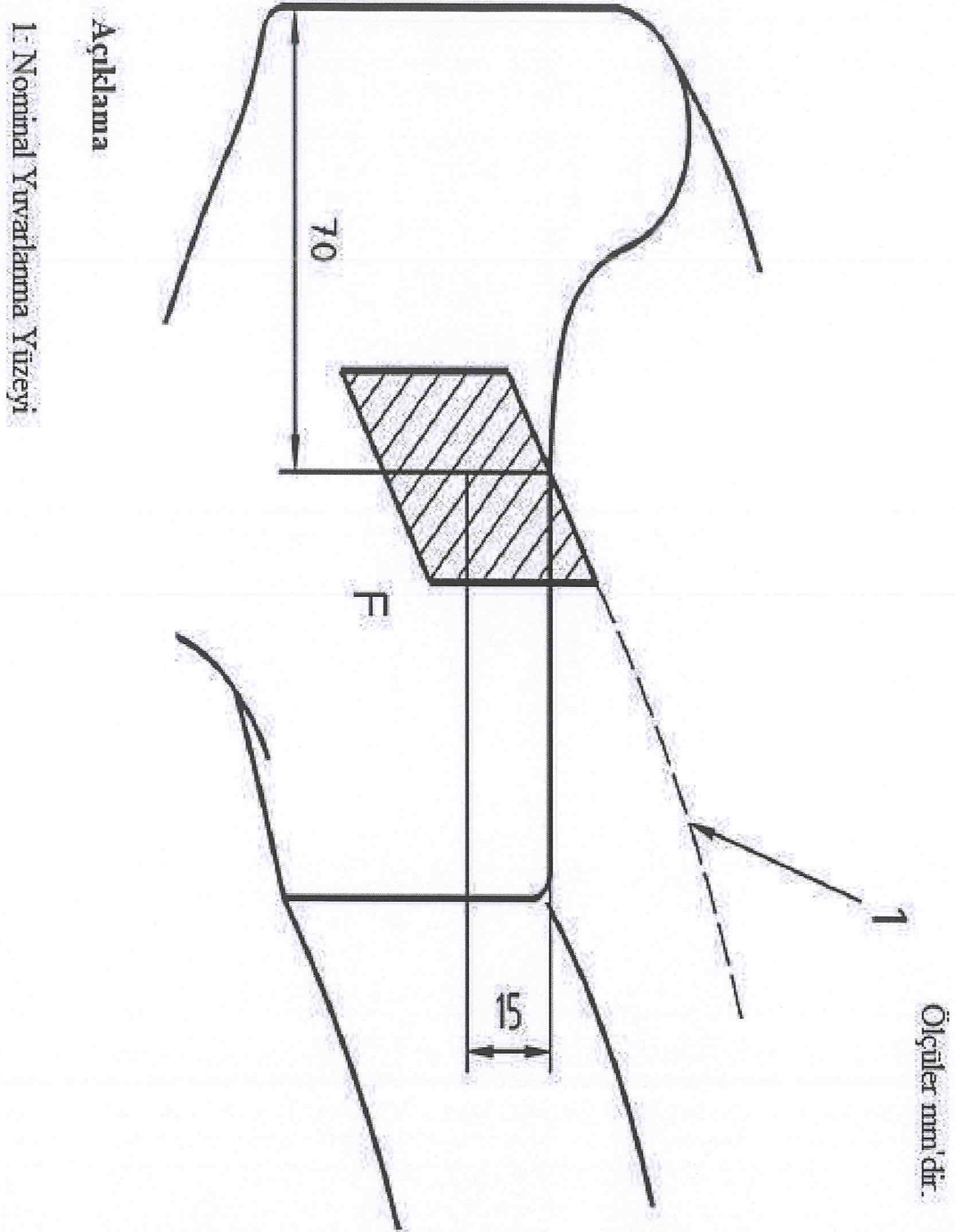
Ölçüler mm'dir.



Açıklama

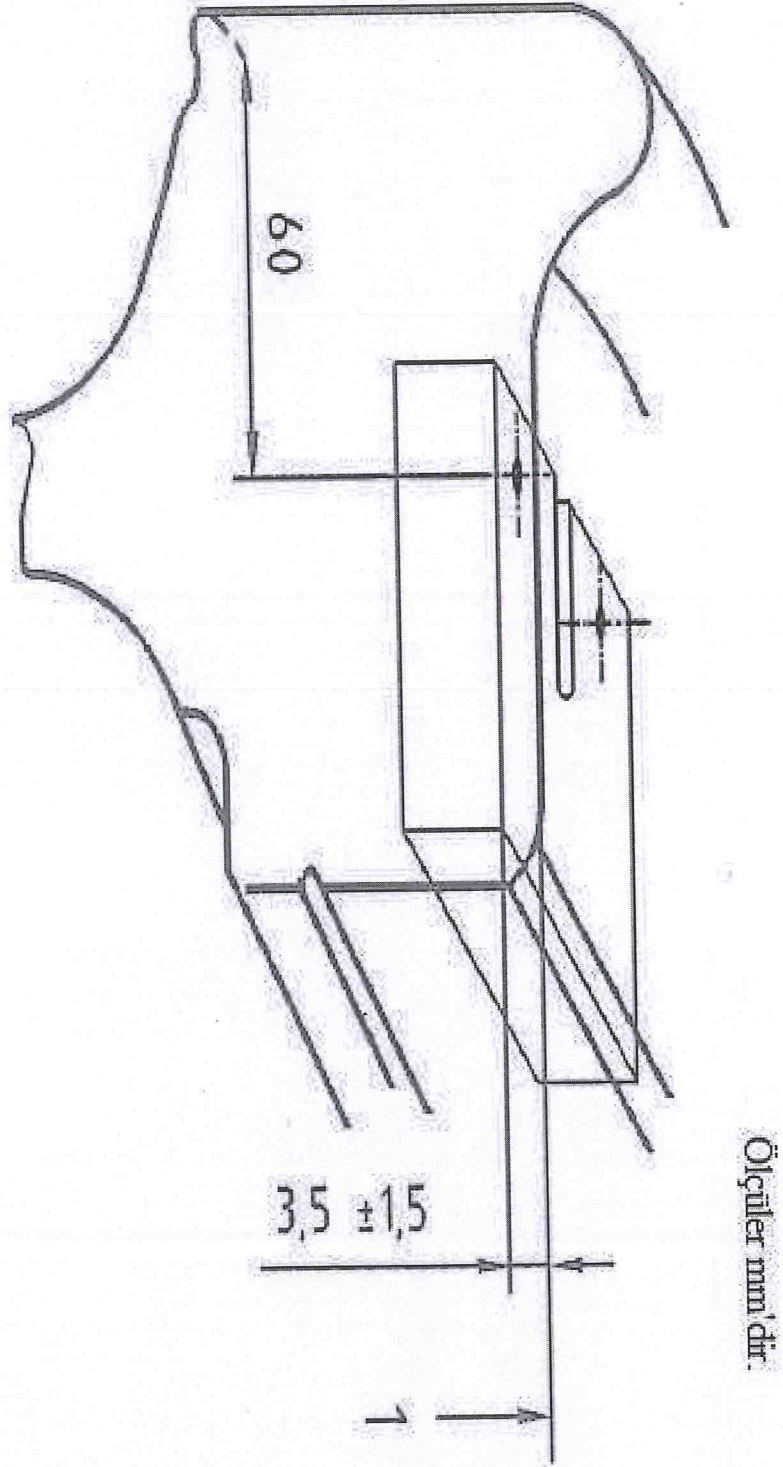
- 1: Aşınma aralığı sınırı veya ulaşılabilen son yeniden profil oluşturma çapı
2: Nominal çap
3: İç çap (dış yüzeyde)

Annex-3: Micrographic inspection area

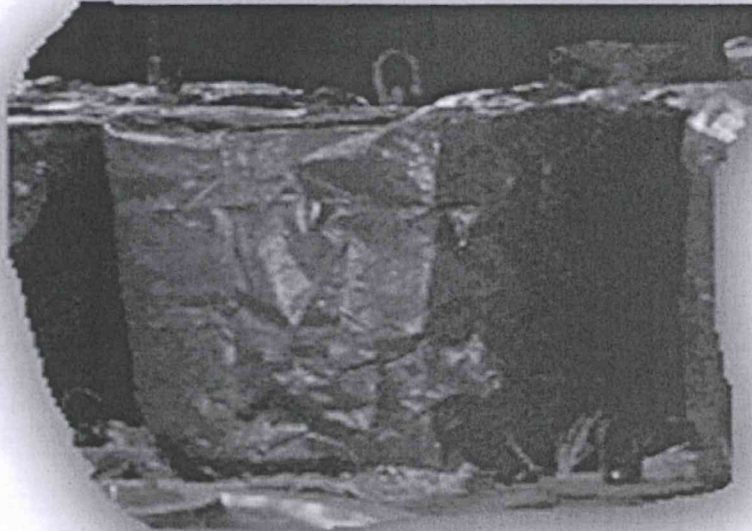
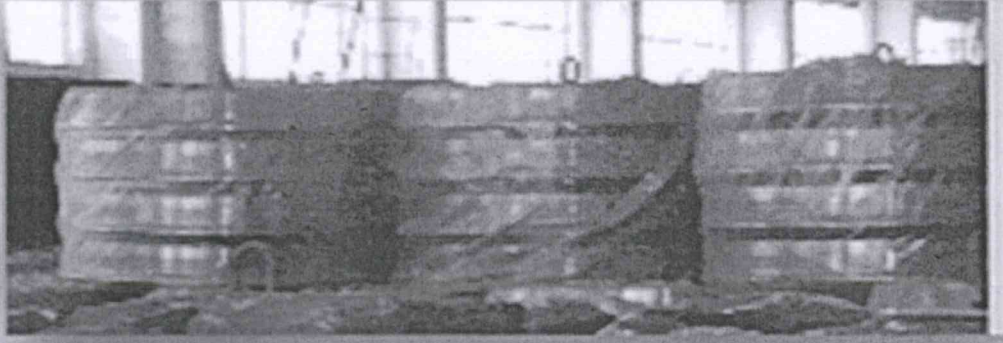


Annex-4: Circle toughness characteristic test pieces location

Açıklama
1: Annma Çapı



Annex-5: Sample photos for packaging



Annex-6: Picture of monoblock wheel identification marks

NOTLAR

Markalama a,b veya c yüzey/yerlerinden herhangi birine varsa teknik şartnamede belirtilen işlemleri karşılayacak şekilde yapılacaktır.

Marking shall be made on any of the surfaces a, b or c. It will be made to meet the requirements specified in the technical specifications, if any.

A Görünüşü
Ölçek 1/1

Parça No : 03
Parça Adı : 101636 no lu TCDD Yapımcılık yazısı nedeniyle yerli
Doğ. No : 17.08.2021
Yapılan Doğrulama Notu : İnşa

Parça No	Parça Adı	Adet	Resim No	Norm	Malzeme	Ölçü	Ağırlık (Kg)
ISO 1302	ISO 8015	EN 22553	Genel Tolerans	ISO 2768	1	1	1
EN 15085-2 Üretici Sertifikası Sınıfı	CLD CLD	CLD CLD	Kaynaklı İml.	ISO 13920	AD	BD	ED
Proje Koor./Onay	Abdülkadir UNAL	Ölçek	Çelik Dokum	ISO 12708	1m2	1m2	1m2
İşlemler/Kontrol	S. Toğa KANDILIR	12.5					
Hazırlayan	Enhan SOLAK						

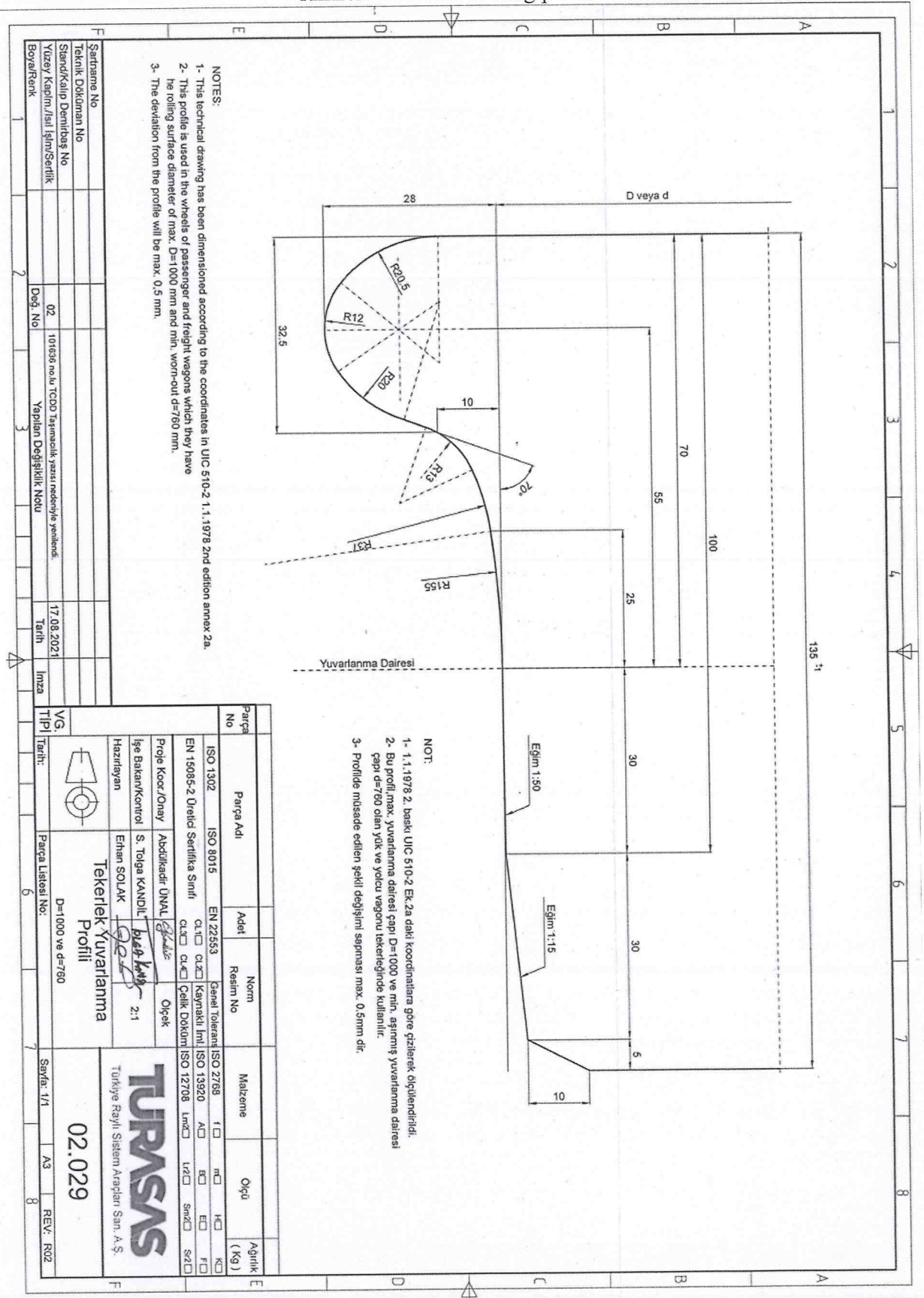
MONOBLOK TEKERLEK TANITMA İŞARETLERİ

TURASAS
Türkiye Raylı Sistem Araçları San. A.Ş.

00.036

Sayfa: 1/1 A3 REV: R03

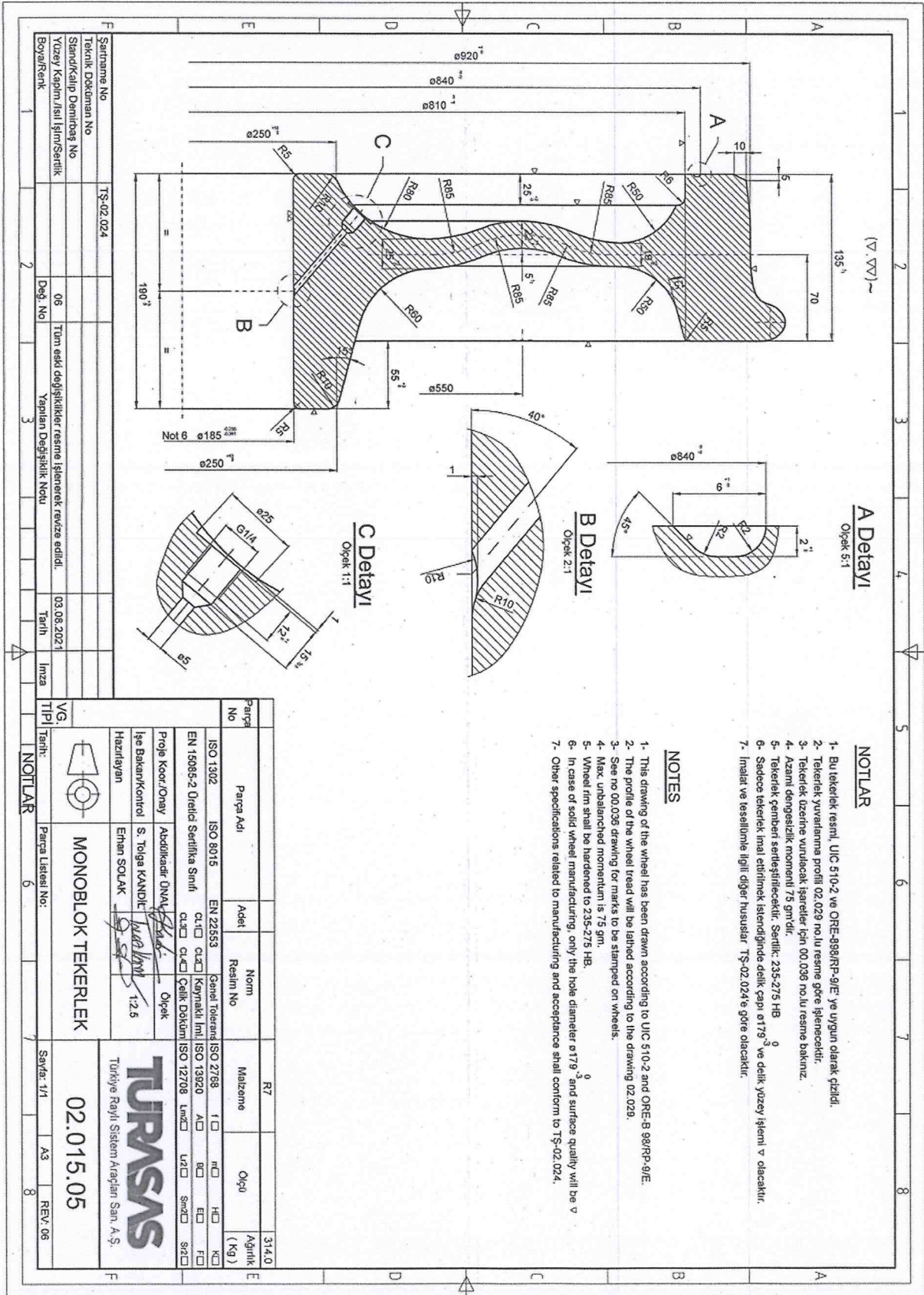
Annex-7: Wheel rolling profile



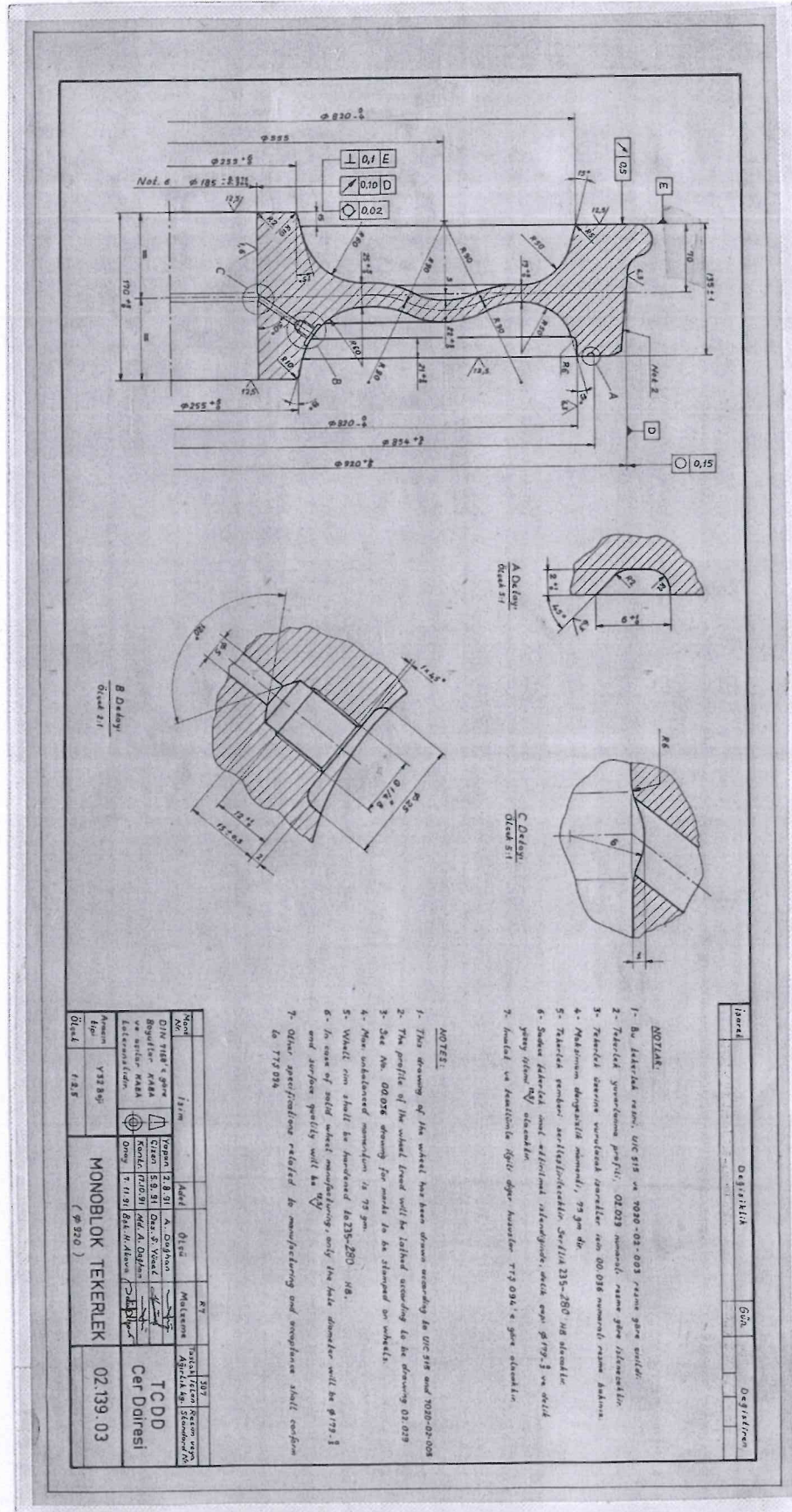
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Annex-8: Schlieren Bogie Monoblock wheel



Annex-9: Y-32 Bogie Monoblock wheel

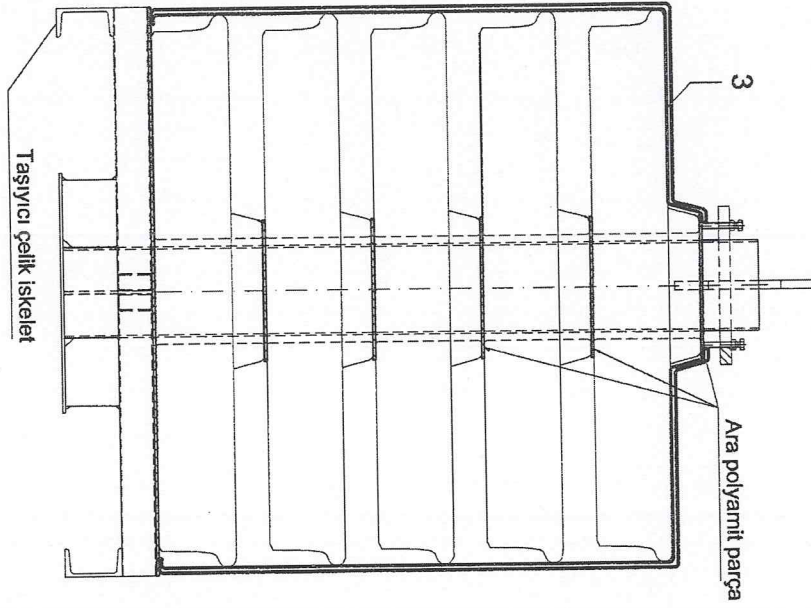
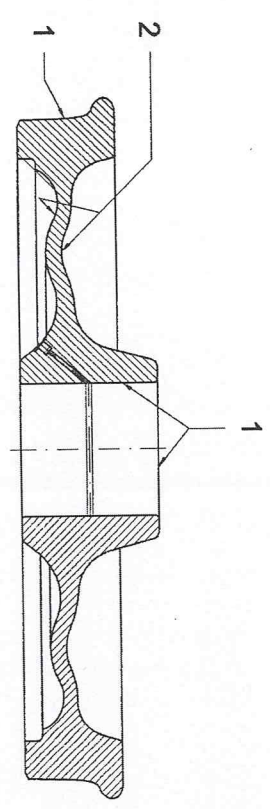


Annex-10: Stopper

İşaret	Değişiklik	Gün	Değiştiren
2	Rondela		A $\phi 13,5 \times \phi 17 \times 0,8$ Cu
1	Tapa		8.8
Mont. Nr.	İsim	Adet	Ölçü
			Malzeme
			Taslak İşlen. Resim veya
			Ağırlık kg. standard Nr.
DIN 7168'e göre Boyutlar ORTA ve aşılar ORTA toleranslıdır.		Yapan 2.8.91 A. Dağhan	TCDD Cer Dairesi 02.139.04
	Gizen 16.9.91 Des. A. Çataksinler		
	Kontrol 17.10.91 Md. A. Dağhan		
	Onay 7.11.91 Bsk. H. Akova		
Aracın tipi	Y32 Boji	TAPA	
Ölçek	1:1		

Annex-11: Monoblock Wheel Protection and Packing

Sartname No		TŞ-02-024		Kaip No				Yüzey				Islıl İşlem, Sertlik				Boyut				Renk			
Değ. No				Yapılan Doğrultuk Nolu				Tarih				İmza				VG. TİPİ							

Tasıyıcı çelik iskelet

Ara poliamit parça

1 - Pas ve korozyon önleyici yağ.
2 - Epoksi astar boya RAL 9005 (Siyah) µm
3 - Koryucu örtü

Nakliye ve stoklama esnasında korozyondan koruma.
PE ambalajı malzemesi kalınlık 300 µm - 500 µm

NOT : Paketteki tekerlek sayısı 4 veya 5 adet olabilir.

Adet	Parça Adı	Parça No	Malzeme	Ölçü	Ağırlık (kg)	Norm-Tasvir Resim No
	INCE	<input type="checkbox"/>	ORTA	<input checked="" type="checkbox"/>	KABA	<input type="checkbox"/>
	ISO 1302	µm, mN	N/mm²	N/mm²	DIN 7168	INCE
	Proje Koordinatörü	O. AYDEMİR	Çizen	D. HOCALAR	Onay	T. KÖRGEN
	İşe Bakın	O. AYDEMİR	Kontrol	O. AYDEMİR	Onay Tarihi	16.03.2010
	QIÇEK	Monoblock tekerlek korozyondan koruma ve ambalaj				
	TÜVASAŞ					1065.02.672
	Türkiye Vagon Sanayi A.Ş.					
	Parça Listesi No. Sayı :					Satış :