

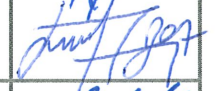
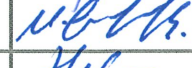
**[TŞ-02.075]**

[Rev. D4817]

## Gaziray Commuter Train Project Wheelset Technical Specification

[Issued Date : 27/10/2021 ]

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## III. LIST OF ACRONYMS & ABBREVIATIONS

|             |                                                       |
|-------------|-------------------------------------------------------|
| <b>DeBo</b> | Designated Body                                       |
| <b>EMU</b>  | Electric Multiple Unit                                |
| <b>EN</b>   | European Norm                                         |
| <b>FAI</b>  | First Article Inspection                              |
| <b>IEC</b>  | International Electro technical Commission            |
| <b>ISO</b>  | International Organization of Standardization         |
| <b>LRU</b>  | Line Replaceable Unit                                 |
| <b>N/A</b>  | Not Applicable                                        |
| <b>NoBo</b> | Notified Body                                         |
| <b>PRM</b>  | Person with Reduced Mobility                          |
| <b>RAMS</b> | Reliability, Availability, Maintainability and Safety |
| <b>SI</b>   | International System                                  |
| <b>TBC</b>  | To be confirmed                                       |
| <b>TBD</b>  | To be defined                                         |
| <b>TOR</b>  | Top of Rail                                           |
| <b>UIC</b>  | Union International Chemin de Fer                     |



## 1 INTRODUCTION

### 1.1 SUBJECT

This document describes the technical requirements for the procurement of the wheelsets to be installed on the bogies of Electrical Multiple Units (hereafter called EMU) produced by Turkish Railway Vehicles Industry Inc. (hereafter called TÜRASAŞ).

The bidder shall offer a solution totally compliant with the requirements of this specification.

After signing the contract, possible deviations from this specification or from other specifications and norms mentioned in this document, shall be validated by written agreements between TÜRASAŞ and the Supplier.

The Bidder shall make clause by clause comment into present technical specification together with their offer.

This technical specification and its annexes already prepared in Turkish and English language. The Turkish language shall be prevailing in case of any discrepancy among them.

#### **IMPORTANT NOTE:**

The present document shall be examined by the Bidder, together with following document:  
**TŞ-01.139 –GENERAL TECHNICAL SPECIFICATION**  
in order to know general applicable requirements established at train level.

### 1.2 DEFINITIONS

Within this technical system specification, the following definitions are applied to the words reported below:

- “the Administration” means the Turkish Rail Vehicle Industry Co. (hereafter called TÜRASAŞ)
- “the Designer” means BLUE Engineering that is the company responsible for the design EMU set
- “the Supplier” means the company who wins the tender to supply the good object of this specification
- “documentation” means all or any specifications, drawings, reports, networks, operating and maintenance manuals and all other information whether on paper or on magnetic or other format which is prepared by the Supplier in the course of the contract
- “the Bidder” means the company who want to join to the tender to supply the good object of this specification

### 1.3 DOCUMENTS AND STANDARDS

The EMU shall be designed, assembled and tested according to the following international reference standards:

European Standards: TSI, EN;  
International standards: UIC; ISO; IEC;  
System of units shall be SI.

Table 1 reports the applicable standards request for the scope of supply.

| Standard    | Year | Title                                                                                                                                                                                                       |
|-------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TSI LOC&PAS | 2023 | COMMISSION REGULATION concerning a technical specification for interoperability relating to the 'rolling stock locomotives and passenger rolling stock' subsystem of the rail system in the European Union. |
| EN 45545-2  | 2023 | Railway applications - Fire protection on railway vehicles - Part 2: Requirements for fire behavior of materials and components                                                                             |
| EN 13260    | 2020 | Railway applications - Wheelsets and bogies - Wheelsets – Product requirement                                                                                                                               |
| EN 13261    | 2020 | Railway applications - Wheelsets and bogies - Axles. Product requirement                                                                                                                                    |
| EN 13262    | 2020 | Railway applications - Wheelsets and bogies - Wheels. Product requirement.                                                                                                                                  |
| EN 13749    | 2021 | Railway applications - Wheelsets and bogies - Methods of specifying structural requirements of bogie frames                                                                                                 |
| EN 13103-1  | 2017 | Railway applications - Wheelsets and bogies - Part 1: Design method for axles with external journals                                                                                                        |
| EN 13715    | 2020 | Railway applications - Wheelsets and bogies - Wheels - Tread profile                                                                                                                                        |
| EN 13979-1  | 2020 | Railway applications - Wheelsets and bogies - Monobloc Wheels - Technical approval procedure - Part 1: Forged and rolled wheels                                                                             |
| EN 50126    | 2017 | Railway applications - The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS)                                                                                  |
| UIC 510-2   | 2004 | Trailing stock: wheels and wheelsets. Conditions concerning the use of wheels of various diameters                                                                                                          |
| UIC 510-5   | 2007 | Technical approval of monobloc wheels - Application document for standard EN 13979-1                                                                                                                        |

**Table 1 – Applicable standards**

If it is not specified otherwise, the applicable version of the standards mentioned in the text of the document is the one specified in Annex 1 of “TŞ-01.139 –General Technical Specification” or in the above table.

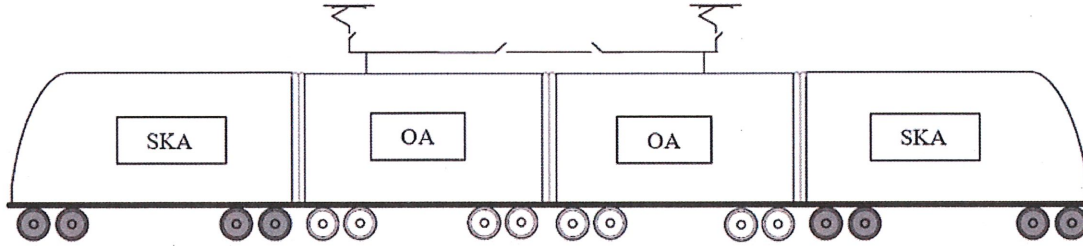
The Bidder shall review and confirm compliancy to the above list of applicable norms, any deviation shall be submitted to TÜRASAŞ for approval. The Bidder shall declare if its system/equipment is compliant with other national/international or railroad administration standards not mentioned in the above list.



#### 1.4 EMU TRAIN-SET CONFIGURATION

EMU is composed by:

- 4 cars: SKA car, OA car, OA car: SKA car



**Figure 1 – Trainset layout**

Types of the cars are explained below:

SKA = Leading car with driver cab

OA = Intermediate car

The SKA vehicles will be interchangeable and the OA vehicles will be interchangeable.

The EMU will be fixed configuration unit: the orientation of the different type of vehicles within a unit is fixed. The unit wheel arrangement will be the following: Bo'Bo'+2'2'+2'2'+Bo'Bo'

#### 1.5 EMU TRAIN-SET MULTIPLE CONFIGURATION

The configurations foreseen for the multiple unit operation are the following:

4 cars + 4 cars

4 cars + 4 cars + 4 cars



## 2 SCOPE OF SUPPLY

### 2.1 HARDWARE

Motor and trailer bogie wheelsets and/or axles and/or monoblock wheels shall be supplied by the Supplier according to the order list provided by the Administration. If ordered by the Administration as a wheelset, the Supplier shall supply the products in accordance with all provisions of this specification. If the Administration orders only monoblock wheels and/or axles, the products shall be supplied disassembled, and are exempt from clauses 3.1.1 and sub-clauses.

The supply of ready to assembly wheelsets and their parts for one trainset are reported in the following tables:

| Part                      | Drawing No       | Per Car |     |     |     | Per 4 Car<br>Train Set |
|---------------------------|------------------|---------|-----|-----|-----|------------------------|
|                           |                  | SKA     | OA1 | OA2 | SKA |                        |
| Trailer Bogie<br>Wheelset | GZ11.04.04.11100 | -       | 4   | 4   | -   | 8                      |
| Motor Bogie<br>Wheelset   | GZ10.04.04.11100 | 4       | -   | -   | 4   | 8                      |

**Table 2 – Wheelsets quantity**

| Part               | Drawing No       | Per Car |     |     |     | Per 4 Car<br>Train Set |
|--------------------|------------------|---------|-----|-----|-----|------------------------|
|                    |                  | SKA     | OA1 | OA2 | SKA |                        |
| Trailer Bogie Axle | GZ11.04.04.30000 | -       | 4   | 4   | -   | 8                      |
| Motor Bogie Axle   | GZ10.04.04.30000 | 4       | -   | -   | 4   | 8                      |

**Table 3 – Axle quantity**

| Parça          | Teknik Resim No  | Araç Başına |     |     |     | 4 Araçlı Tren<br>Seti Başına |
|----------------|------------------|-------------|-----|-----|-----|------------------------------|
|                |                  | SKA         | OA1 | OA2 | SKA |                              |
| Monoblok Wheel | GZ90.04.10.00001 | 8           | 8   | 8   | 8   | 32                           |

**Table 4 – Monoblock wheel quantity**

### 2.2 SOFTWARE

N/A

### 2.3 SPECIAL TOOLS AND EQUIPMENT

The Bidder shall supply special tools and equipment according to TD-GZ.02.0013 as mentioned in Annexes.

### 2.4 CONFORMITY TO THE PROJECT REQUIREMENTS

The EMU train set shall be certified according to TSI PAS/LOC, TSI NOI, TSI PRM, TSI SRT and TSI CCS by Notified Body (NoBo) / Designated Body (DeBo).

The Supplier shall provide whole calculations, drawings, analysis, test reports and other kind of documentation which is requested by TSIs for the present scope of supply.

## **2.5 EC CERTIFICATION OF CONFORMITY AS INTEROPERABILITY CONSTITUENT**

The monoblock wheels are an Interoperability Constituent. The Bidder can join the tender with or without EC Certification of Conformity. In any case; the monoblock wheels shall be supplied with its own EC certification of conformity according to the TSI LOC&PAS by the Supplier. The Supplier shall provide the following documents together with monoblock wheels to TÜRASAŞ:

- TSI certificate of conformity
- Conformity report with all conformity evidences
- Type test reports

The Supplier can propose the Interoperability Constituent with the EC certification of conformity according to the previous version of the TSI LOC&PAS. In this case the Supplier shall also submit evidence that the proposed EC certification of conformity is valid and demonstrates the conformity to the TSI LOC&PAS.

The documentation presented by the Supplier relevant to the EC Certification of Conformity according to the TSI LOC&PAS will be examined for approval by the Notified Body (NoBo) / Designated Body (DeBo) in charge of TSI certification of the EMU nominated by the TÜRASAŞ. The Supplier shall be responsible to perform all necessary activities which are required by Notified Body (NoBo) / Designated Body (DeBo).

## **2.6 PROJECT MANAGEMENT**

### **2.6.1 Introduction to Project Management**

The Supplier and its sub-suppliers shall be responsible for the components and systems delivered. TÜRASAŞ has the right to request different solutions and/or modifications of a system or components in case they are necessary for reasons related to installation, operation, interfacing or other equivalent reasons. Such written requests shall be realized by the Supplier.

During the meetings, the minutes shall be drawn up and countersigned by the representatives of the parts participating the meeting.

Present document is a part of the contract between the Supplier and TÜRASAŞ. The Supplier is not entitled to distribute this document or any part of it to a third party.

All generic information requests and answers shall be communicated in written form or through e-mail, if an official form is required, and in the case the exchanged communication preludes to any kind of action.



**2.6.2 Project Management and Planning**

The Supplier shall submit a project plan within two weeks of contract award.

This project plan reports the schedule for all main activities and key events, including submission of all information identified in this specification and delivery of all parts and documentation. The plan shall be subject to approval of TÜRASAŞ, every time it is issued.

The Supplier shall attend regularly to the project progress meetings according to the established schedule proposed by TÜRASAŞ.

**2.6.3 Modifications**

All engineering changes made prior to FAI (First Article Inspection) shall be controlled by the Supplier's quality management system. Engineering changes made after FAI shall be supported by all relevant documentation and subject to written approval by TÜRASAŞ. Engineering changes shall be subject to all requirements of this specification and any supporting specifications.

The supplier shall take maximum care to refrain from any modifications/changes that will affect interface with other parts. In case it is necessary to carry out such a modification, TÜRASAŞ will be notified immediately.

The Supplier shall agree with TÜRASAŞ a modification implementation plan detailing timescales and locations where the work shall be carried out. This shall include modifications to any relevant spare parts.

The Supplier shall, on the day of completing any modification, provide TÜRASAŞ with the date of modification, serial number of components modified, new modification level of component and location of component. In addition, the status of the modification level on the component shall be updated.

Modifications made to improve the product or production without any effect on performance or spare part exchange can be decided by the Supplier. Traceability of modifications shall be given by the Supplier to TÜRASAŞ.

In case of modifications due to Supplier design inaccuracy or whatever cause under its responsibility, the subsequent recovering modifications and actions shall be done by the Supplier free of charge.

**2.6.4 Authorization to Start Manufacturing**

TÜRASAŞ will release to the Supplier the authorization to start the manufacturing according to the following steps.

**2.6.4.1 Design freezing**

After signing the contract, a dedicated meeting shall be held for freezing the design of the scope of supply between the Supplier, the Administration, the Designer and/or the End Client. The date and place of the meetings shall be agreed mutually.

The design freeze also means that the Supplier can start manufacturing the products used for type tests (according to item 4.4.1.1).



In case the dedicated meeting cannot be held because of unseen reasons like epidemic etc., the dedicated documentation shall be signed and shared by all four parties.

**2.6.4.2 Authorization to start serial production**

After successful completion of tests in accordance with clause 4.4.1.1 and 4.4.1.3, TÜRASAS will release to the Supplier the authorization to start the serial production.

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### 3 TECHNICAL REQUIREMENTS

#### 3.1 INTRODUCTION

Wheelsets shall consist of the following components:

| Part           | Drawing No                     | Motor bogie<br>wheelset<br>GZ90.04.10.00000<br>Q.ty | Trailer bogie<br>wheelset<br>GZ90.04.11.00000<br>Q.ty |
|----------------|--------------------------------|-----------------------------------------------------|-------------------------------------------------------|
| Wheel          | GZ90.04.10.00001               | 2                                                   | 2                                                     |
| Axle           | (powered) GZ10.04.04.30000     | 1                                                   | -                                                     |
|                | (non-powered) GZ11.04.04.30000 | -                                                   | 1                                                     |
| Gearbox<br>(*) | GZ90.04.10.00005               | 1                                                   | -                                                     |

**Table 5 – Wheelsets components (drawings and Q.ty)**

(\*) Gearbox is not included in the scope of supply.

##### 3.1.1 Wheelset Supply

If the Administration orders wheelsets as ready for use, the wheelsets shall be supplied in accordance with EN 13260 category 2b.

##### 3.1.1.1 Checking components before assembly

All components shall be according to the requirements on individual technical specifications, drawings and documents.

Before assembling, wheelsets shall be verified and reported on the appropriate document that all fittings respect the dimensions, shape and position tolerances and roughness provided by the drawings. The wheelsets shall be free from accidental dents, scratches due to manufacturing, blowholes, cracks, inclusions, shortages of materials or traces of oxide and anything else that may affect the quality of press fitting.

##### 3.1.1.2 Assembly rules

Wheelset assembly shall be according to EN 13260 and the installation instructions of the Supplier for individual components and all that is required in this technical specification.

In particular, the following check shall be carried out on each wheelset:

- Conformity of fitting diagram for press-fitting (wheel fitting force  $741\text{kN} < F < 1265\text{kN}$ )
- Dimensions: d-d1; h; a1; c-c1 (see par. 3.2.5 EN 13260)

The following assembly and disassembly rules on the wheelset shall be applied:

- **Gearbox:** The gearbox assembly on the axle shall be done by the gearbox supplier. The finished axle shall be sent to gearbox supplier to install and testing the gearbox. When finished, the gearbox supplier will send the product to TÜRASAŞ. All



transportation costs between the wheelset supplier and the gearbox supplier belong to TÜRASAŞ.

- **Wheels:** The assembly / disassembly of wheels shall be performed cold using the hydraulic system. The Supplier shall define and agree with the Administration the hub diameter tolerance.

#### 3.1.1.3 Surface defect

Surface defects of the wheelset can be eliminated, after prior agreement with the Administration, by cold machining (or grinding tool without altering the structure of the material) if that they meet the dimensional tolerances and balancing. If the Administration does not agree the Supplier shall provide new products.

In the first supply any filling material and any masking of defects give rise to the rejection of the whole supply presented to the testing.

#### 3.1.1.4 Balancing

The value of maximum residual dynamic imbalance allowed for non-powered wheelset shall be 75 gm, measured in the plane of the wheels.

For powered wheelset, balancing is obtained after the proper placement and balancing of each components.

#### 3.1.1.5 Electrical resistance

According to EN 13260, the electrical resistance of each wheelset measured between the treads of two wheels shall not exceed 0.01  $\Omega$ . The test voltage shall be in the range 1,8 V – 2,0 V DC.

The electrical resistance of the wheel and axle shall be suitable for the signaling system to be provided.

The means and method used for this measurement shall be defined in agreement between the Administration and the Supplier.

#### 3.1.1.6 Maximum permissible difference between the wheels diameters (new condition)

- On the same wheelset: max. 0.3 mm
- On the same bogie: 1 mm

#### 3.1.1.7 Surface protection

The wheelset (motor and trailer) shall be protect against corrosion.

- special anti-rust grease on coupling part;
- on the other parts shall be used anti-rust paint.

In particular, cavities arising from the overhang of the wheel hub on the wheel seats shall be protected or filled with an anticorrosion product to be agreed with the Administration.

#### 3.1.2 Axle Supply

The axles (powered and non-powered) shall be dimensioned according to standard EN 13103-1 and made according to EN 13261 category 2. Some characteristics of axle are following:

- coefficient of friction disc - brake pads: 0.35 (EN 13103-1)
- braking radius of the disc: 250 mm (TBC)
- max axle load: 19000 kg
- mass of complete wheel: 310 kg (TBC)
- mass powered axle 460 kg (TBC)
- mass non-powered axle 422 kg (TBC)
- mass of gearbox: 390 kg (TBC)
- max vehicle service speed: 140 km/h

### 3.1.2.1 Surface defect

Surface defects of axles can be eliminated, after prior agreement with the Administration, by cold machining (or grinding tool without altering the structure of the material) provided that they meet the dimensional tolerances and balancing. If TÜRASAŞ does not agree, the Supplier shall provide new products.

In the first supply any filling material and any masking of defects give rise to the rejection of the whole supply presented to the testing.

### 3.1.2.2 Surface protection

The axle shall be protected against oxidation as follows:

- special anti-rust grease on coupling part;
- on the other parts shall be used anti-rust paint.

Any alternative superficial protection proposed by the Supplier might be examined and approved by the Administration.

Areas where components are not mounted on the axle shall be protected against corrosion in accordance with EN 13261 category 3.

### 3.1.3 Monoblock Wheel Supply

The monoblock wheel shall be supplied as ready for installation in accordance with EN 13262 category 2. The motor monoblock wheel shall be ready for brake disc installation. Some characteristics of wheel are following:

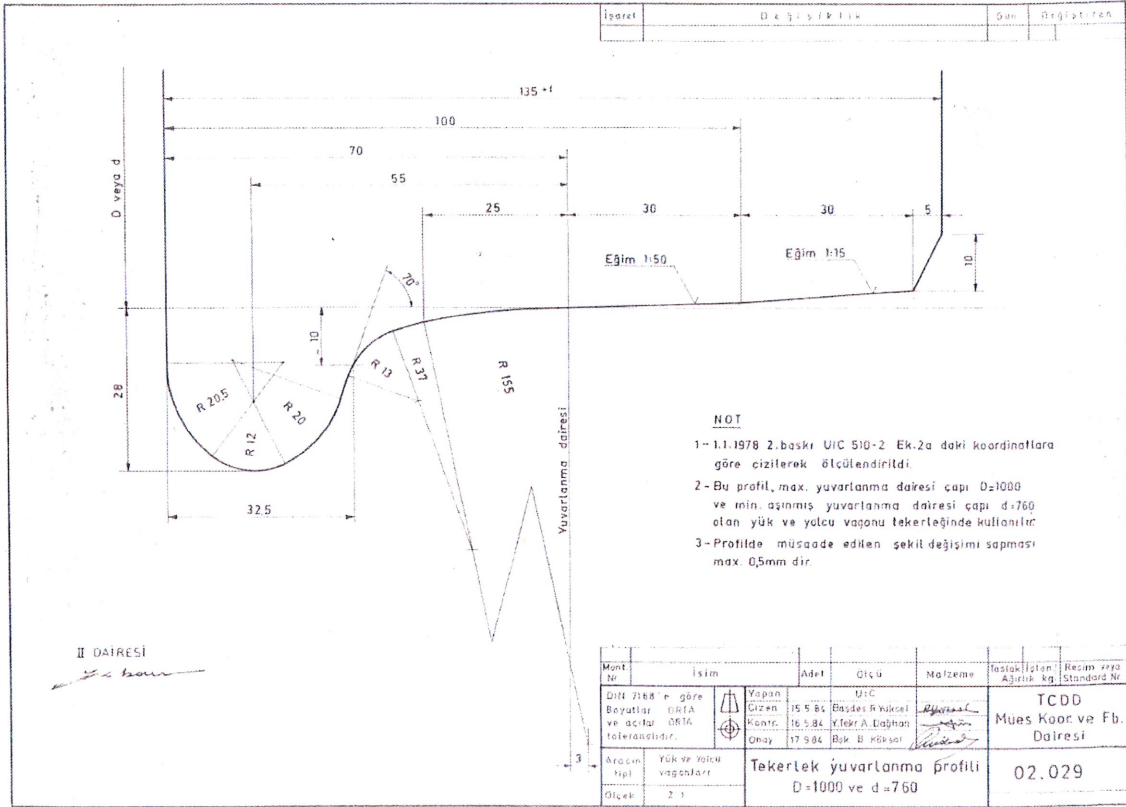
- wheel diameter at new: 840 mm
- wheel diameter at max wear: 770 mm
- rim width: 135 mm

Wheels shall have a monobloc structure. The size of wheel shall be dimensioned by Supplier in accordance with standard EN 13979-1. The calculations supporting the wheel selection shall be submitted to the NoBo or DeBo for approval.

The track and the wheel profiles of the EMU will be according to the following:

- Wheel profile drawing: TCDD 02.029\_A3 (see Figure 2)
- Track type: 60E1 according to EN 13674-1





**Figure 2 – TCDD applicable wheel profile**

### 3.1.3.1 Surface defect

Surface defects of wheels can be eliminated, after prior agreement with the Administration, by cold machining (or grinding tool without altering the structure of the material) provided that they meet the dimensional tolerances and balancing. If the Administration do not agree the Supplier shall provide new products.

In the first supply any filling material and any masking of defects give rise to the rejection of the whole supply presented to the testing.

### 3.1.3.2 Surface protection

With regard to the wheel, all machined surfaces, except for the rim surface and mounting area, as well as the unmachined hub and hub cap, shall be protected against corrosion.

### 3.1.3.3 Balancing

The allowed max imbalance of the wheel shall be 75 gm.

## 3.2 WEIGHT

The Supplier shall be committed to the process of weight management required in order to meet target weights as the train design develops.

The target weights for powered wheelset shall be  $\leq 1500$  kg (including gearbox, wheels and axle).

The target weights for trailer bogie wheelset shall be  $\leq 1050$  kg (including wheels and axle).



The target weights for powered axle shall be  $\leq 450$  kg.

The target weights for non-powered axle shall be  $\leq 420$  kg.

The target weights for monoblock wheel shall be  $\leq 320$  kg.

### 3.3 MANUFACTURING

The manufacturing of the ordered product shall be according to related standards of the product.

### 3.4 PAINTING

According to technical document TD-GZ.10.0055.

In any case, the wheelset shall be protected against oxidation as follows:

- special anti-rust grease on coupled part;
- on the other parts shall be used anti-rust paint: RAL code will be defined by the Administration

Any alternative superficial protection proposed by the Supplier shall be examined and approved by TÜRASAŞ.

### 3.5 INTERFACE SPECIFICATION

#### 3.5.1 Mechanical Interface

N/A

#### 3.5.2 Pneumatic Interface

N/A

#### 3.5.3 Electrical Interface

N/A

#### 3.5.4 Digital and/or Analogue Inputs/Outputs

N/A

#### 3.5.5 Earthing

N/A

### 3.6 ENVIRONMENTAL CONDITIONS

#### 3.6.1 Climatic Condition

The system object of the present document specification shall work properly in the specified climatic conditions (temperature, rain, snow, ice, dust, sand, wind and so on) in particular, ice, sand and snow shall not be cause of malfunction.

General climatic conditions are reported in the mentioned TŞ-01.139 General Technical Specification.

**3.6.2 Noise, Vibration and Shock**

N/A

**3.6.3 Protection (IP)**

N/A

**3.6.4 Electromagnetic Compatibility (EMC)**

N/A

**3.7 SYSTEM AND COMPONENTS LIFE**

The axles (powered and non-powered) shall be designed according to standard EN 13103-1, to ensure an unlimited durability in the ambit of the life cycle of the railway vehicle (30 years).

For the wheels, the intervals between two subsequent re-profiling shall be minimum 360.000 km (TBC), considered as a target of design in normal condition.

The manufacturer shall ensure that the quality of material used and the correctness of the production cycle, are likely to provide similar guarantees too.

**3.8 MATERIAL REQUIREMENT**

The monoblock wheel material shall be ER8 according to EN 13262.

The axle material (powered / non-powered) shall be EA1N according to EN 13261.

**3.8.1 General Requirements**

Materials shall be suitable to allow the normal maintenance activities without need to adopt special protections including welding, cuts and so one. They shall be suitable for the waste disposal without need of particular care.

All information about safety and health shall be provided, even for consumables like glue and cleaning agents.

The choice of materials shall be done to prevent corrosion in every usage condition.

**3.8.2 Fire Resistance Behaviour**

The trainset has been classified into Category A for rolling stock fire safety, according to TSI LOC&PAS for interoperability operation.

The supplied system/equipment/components including all their elements therefore shall be compliant to the applicable sections of EN 45545 family norms (-1, -2, -3, -4, -5, -6).

According to EN 45545-1 and -2 the trainset is ranked as 2N (or N2) where:

- 2 indicates the operation category
- N indicates the design category

The fire performance requirements established for materials are given by means of R(n) index reported by the EN 45545-2 "table 5".



These performances requirements of materials and components depend not only on their intrinsic nature but also on the location, the shape and the layout, the surface exposure, the relative mass and the thickness of considered material. In “table 2” of the EN 45545-2 are listed different products and their location on the trainset to identify the relevant R(x) requirements.

The Supplier shall follow the instruction of paragraph 4.2 “General” and paragraph 4.3 “Grouping rules” with the flowchart of Figure 1 “Assessment Process – grouping rules” of EN 45545-2 not only to identify all the material eventually not mentioned hereafter or not mentioned at all in the “table 2”, but also to verify if the requirements are applicable or not (i.e. in case of small quantity, small mass, small exposed areas and so on).

To complete the punctual requirements identification in EN 45545-2 “table 5”, the Hazard Level “HL2” shall be used. This hazard level has been determined on the basis train-set classification 2N and it identifies the relevant tests pass-no-pass condition.

Concerning the materials used for the scope of supply of present technical specification following requirements have been identified:

| Applicable Product type<br>(No) | Definition         | Details                    | Requirement |
|---------------------------------|--------------------|----------------------------|-------------|
| EX10                            | Parts of the drive | Wheel sets and brake discs | R9          |

**Table 6 – Material fire requirements**

The Supplier shall adopt materials with required characteristic and also identify other materials not mentioned above. The above R(x) list is not definitive; the Supplier shall complete it according the materials used in the scope of supply.

The Supplier shall give the list of the inflammable materials used with material type, quantity and fire resistance behaviour tests.

The documentation presented by the Supplier relevant fire performance will be examined for approval by the Notified Body/Designated Body in charge of TSI certification. The Supplier shall be responsible to perform all necessary activities which are required by Notified Body.

## 4 GENERAL REQUIREMENT

### 4.1 RELIABILITY, AVAILABILITY, MAINTENABILITY & SAFETY (RAMS)

The Supplier shall make RAMS analysis according to TD-GZ.02.0013 as mentioned in Annexes.

### 4.2 MAINTENANCE MANUAL

#### 4.2.1 Main Features of the Manual

The Supplier shall prepare integrated manual for the operation and maintenance of its scope of supply equipment.

The manuals shall contain:

- supplied system/equipment description;
- preventive maintenance tasks description;
- corrective maintenance tasks description (repair instructions included).
- information in order to carry out the overhaul of the system/equipment and the heavy repair (if it is repairable and off train).

The manual will be used as the basis for train operation and maintenance by the End Client staff. The manual shall be prepared in electronic editable format and the language UK English and Turkish.

If the Supplier submit the manuals in their own format, the documents shall be in editable format.

#### 4.2.2 Contents of the Manual

The manual shall contain as minimum the following information/instructions:

##### Description and operation

- General description and operation of system/equipment
- Functional description and operation of all LRU's and components
- Mechanical and electrical data sheets for all LRU's and components.

##### Maintenance activities

- Preventive maintenance plan including the maintenance periodicity (frequency) table for system/equipment.
- Reported information shall be the same of those described by the preventive maintenance analysis and be linked with detailed maintenance instructions.
- Preventive maintenance plan shall report reference to specific/special tools needed for the maintenance works (if used).

- Maintenance instructions shall report step by step detailed description of each task of the maintenance plan in order to include all information necessary for carrying out the relevant work.
- The preventive maintenance plan shall include all activities foreseen for the system/equipment from daily inspection up to major repair/overhaul.

**Preventive maintenance card/instruction**

Each maintenance instruction shall include:

- task periodicity
- safety warnings
- cleaning materials
- recommended lubricants
- torque values
- special tools (if any): as special tool is intended either a tool (hardware and/or software) that is exclusively produced by the Supplier and is essential for system/equipment maintenance, either a tool available on market but expensive, sophisticated, with long lead time and so on
- step by step activity description with necessary schemes, drawings and illustrations, including:
  - scheduled activities (greasing, topping up, visual check, etc)
  - removal and refitting
  - off-train overhaul
  - final functional check

The Supplier is responsible to update the maintenance instructions until the end of the general warranty period of the last supplied equipment.

**Corrective maintenance card/instruction**

Each maintenance instruction shall include:

- trouble shooting
- safety warnings
- torque values
- special tools (if any).



- step by step activity description with necessary schemes, drawings and illustrations, including:
  - removal and refitting
  - off-train repair
  - failure diagnosis
  - final functional check

The Supplier is responsible to update the maintenance instructions until the end of the general warranty period of the last supplied equipment.

#### **Special tools**

The use of special tools shall be avoided, nevertheless if they are essential for maintenance (upon Supplier and TÜRASAŞ agreement), following information shall be supplied in a dedicated section of the maintenance manual:

- descriptions and technical data (including SW if present)
- drawings
- use instructions
- list of tasks where the tools usage is mandatory (maintenance cards shall refer to the relevant special tools when is needed).
- all the information for purchasing it correctly (technical data, builder, price, and so on) if the special tool is available on the market.

#### **4.2.3 Format of the Manual**

The format of the maintenance manual can vary according to the Administration and the End Client requirements, therefore here following are reported some rules generally applicable.

Specific requests shall be communicated when available.

- The manual shall report/contain the same references, drawings, schemes, component codes, part numbers, definitions, descriptions, terminology and so on used in the system/equipment configuration and design documentation to guarantee a perfect correspondence and to avoid mismatching during tasks performance.
- It is highlight the importance for a correct identification of LRUs/components by utilizing the same identification name reported by the technical drawings.
- The manual shall be transmitted by electronic means (CD copy) and in the final version a paper copy is also requested for each release.

- The documentation in electronic format shall be in a completely editable form (Office Word version TBD)
- The PDF format can be used as formal delivery of the documentation (in order to be used as official delivery towards the End Client)
- Pictures and photos shall be inserted and not simply linked.
- Photos should be only JPEG format.
- Pictures should be only TIFF format.

Derogations from above listed issues can be discussed and agreed between TÜRASAŞ and the Suppliers pending the respect of the End Client requirements.

### 4.3 TRAINING

N/A

### 4.4 TEST

#### 4.4.1 Introduction to Test and Inspection

The Supplier shall perform the tests and the inspection in accordance with the approved test procedure and the approved inspection specification.

TÜRASAŞ have the right to witness any of these tests and inspections at any stage of test and inspection procedure.

All test and inspection specifications and reports including all repair activities and check-lists shall be submitted and approved by TÜRASAŞ.

If it is a proven system, the Supplier for the system shall give a certificate of conformity indicating in which it has proven itself before and in which projects it has been used. In the request of TÜRASAŞ, the Supplier will show the existing test reports and certificates to TÜRASAŞ and the Notified Body (NoBo)/the Designated Body (DeBo).

#### 4.4.1.1 Type tests

Type tests are required to verify that the components of the system object of the scope of supply operate in accordance with the approved design data.

TÜRASAŞ's attendance to type tests does not end the responsibility of supplier from any inconsistencies.

The Supplier shall perform the type tests according to applicable EN standard, in particular:

- Wheelset according to EN 13260
- Monoblock Wheel according to EN 13262
- Powered and non-powered axle according to EN 13261

The Supplier shall perform type tests, in accordance with a test procedure approved by TÜRASAŞ. TÜRASAŞ and/or the End Client have right to attend or not attend the tests.



The Supplier has the responsibility for the success of mentioned type tests.

During testing, the criteria shall be observed and recorded in a logbook and necessary alterations, adjustments and maintenance works shall be carried out.

In the case components are already being used in similar projects the supplier shall submit to TÜRASAŞ for approval a report explaining in detail the reasons for which it believes the tests need not be carried out, providing evidence of that.

#### **4.4.1.2 Routine tests**

Routine tests are required to verify that the components of the system object of the scope of supply have been built in such a way that it satisfies the requirements of the approved design data as verified by the type test.

The Supplier shall perform routine tests in accordance with a test procedure approved by TÜRASAŞ under his responsibility, and, if necessary, with TÜRASAŞ participation.

During tests, the criteria shall be observed and recorded in a logbook and necessary alterations, adjustments and maintenance works shall be carried out.

Records from routine tests shall be kept by the Supplier and made available timely for TÜRASAŞ inspection.

Additional copies of records of all tests/inspections results shall also be kept at the Supplier's work to be made available to TÜRASAŞ or their representative on demand.

This test shall include functional test, visual inspection and dimensional inspection, as a minimum. The test details shall be approved.

#### **4.4.1.3 First article inspection**

The Supplier shall perform a First Article Inspection (FAI) of the components at the Supplier's factory with TÜRASAŞ and/or End Client participation in accordance with an inspection specification issued by Supplier and approved by TÜRASAŞ, prior to serial production in order to confirm that the component fully complies with the design criteria and manufacturing process. The supplier shall submit FAI test procedure and invitation to TURASAŞ at least 6 weeks before FAI. If any changes are requested by TURASAŞ, supplier shall comply with these requests.

At the FAI, the Supplier shall make available all pertinent design and manufacturing process documentation, test records, material certifications, etc. If all the requirements of the FAI not be met, then the inspection shall be considered at a hardware review.

The component shall meet or exceed the quality standards set at the FAI and shall incorporate any comments made by TÜRASAŞ and /or the End Client at the FAI.

#### **4.4.2 Supplier Technical Assistance**

If requested, the Supplier shall provide all the technical assistance necessary for the first installation and commissioning of the equipment at TÜRASAŞ.



## **4.5 WARRANTY**

### **4.5.1 Warranty Condition**

Supplier shall guarantee the quality of products within the scope of this specification against malfunctions, failures and assembly and workmanship defects.

While the warranty period is limited to 30 months starting with the date of delivery of the products to TÜRASAŞ, it is 24 months starting with the commercial commissioning of the EMU set.

The responsibility of preventive maintenance on the normally used parts and of corrective maintenance in cases where it is evidently clear that failure cause is not the own malfunctions of the unit, shall belong to TÜRASAŞ.

Throughout the warranty period, following the notification by TÜRASAŞ of any malfunction, the Supplier shall respond to that malfunction within three (3) working days. The Supplier shall take all required actions to repair or replace related equipment.

The Supplier shall make available in Türkiye throughout the warranty period the required service facilities in order to respond to the possible malfunctions and an enough spare parts within this time period.

### **4.5.2 Systematic Fault / Epidemic failure**

If a failure covered by guarantee occurs during the guarantee period in more than 25% of the same parts/components, such failure shall be assumed as “epidemic failure”.

In addition, if mean time between failures (general average failure time) for the failures occurring in main components/parts used in all sets within annual periods during the guarantee term is shorter than guaranteed MDBF or MTBF value, such failure shall be deemed as an epidemic failure.

In case of confirmed systematic faults, proper investigations shall be done in order to define a proper technical solution or modification including spare parts modification or replacement.

## **4.6 ACCEPTANCE**

### **4.6.1 Final Acceptance**

After successful delivery of the all products under scope of supply and required documentation the final acceptance report shall be issued by TÜRASAŞ.

## **4.7 PACKAGING, LABELLING AND STORAGE**

### **4.7.1 Packaging**

System/equipment/components shall be delivered in suitable packages with adequate strength to be resistant against shocks and transportation damages including effects of dust, rain, snow, solar, wind etc. in the climatic conditions foreseen by the TŞ-01.139 General Technical Specification.

Packing boxes shall be convenient for stacking one on another and shall allow easy lifting by fork-lift truck (where reasonably applicable) or travelling bridge-crane.

Following information shall be reported on the package (in a legible, non-erasable and non-removable mean):

- Name, address and registered logo of the manufacturer.
- Assembly part number and applicable tech. specification reference.
- Date of manufacturing and serial number (if applicable).
- Date and number of the contract.

Furthermore, if the content of a box consists of more than one component, a components list shall be added inside and outside of the box and each individual component shall be labelled. Determination of the content of these boxes shall be performed with the participations of TÜRASAŞ. Lists of the boxes shall be finalized after approval of the lists by TÜRASAŞ. A copy of each list shall be sent to TÜRASAŞ at the beginning of the shipment.

#### **4.7.2 Labels/Marking**

All marking of individual component shall be agreed to the requirements of their technical specification.

Regarding the wheel shall be identified as a minimum by the following marks:

- - manufacturer's mark;
- - cast number;
- - steel grade;
- - month and two last figures of the year of production;
- - position of residual imbalance and its symbol;
- - serial number after heat treatment

Regarding the axle shall be identified as a minimum by the following marks

- – manufacturer's mark;
- – cast number;
- – steel grade;
- – month and two last figures of the year of production;
- – number of the axle in the batch, following heat treatment.

These marks shall be located on one journal end and on the plastic ring that assembled on axle's visible area. The other side of journal end shall be dedicated to the wheelset manufacturer's marking.

For the wheelset shall be identified as a minimum by the following marks:

- type of wheelset;
- serial number;
- assembler's marks;
- assembly date;
- owner's mark.



Format and positioning of all labels/markings shall be subject to approval by TÜRASAS. Wherever possible, the position shall be such that labels can be viewed when the relevant part is installed within the vehicle.

Any company information, logo and brand etc. so located to products shall not be visible by passengers.

All labels shall be permanent and indelible.

#### 4.7.3 Storage Conditions

The Supplier shall provide any useful information it is deemed necessary for the correct storage of the goods delivered.

#### 4.7.4 Mounting and handling

N/A

### 4.8 DOCUMENTATION TO BE SUPPLIED TO TÜRASAS

The following tables report the list of requested documents (with schedule) to be supplied to TÜRASAS.

**Table 7** shows the documentation which shall be given by the Bidders in the offer phase.

**Table 8** and **Table 9** show the documentation which shall be provided by the Supplier for the preliminary technical review and the detail technical review respectively.

| Id. | Stage 1 -OFFER Phase                                                                                                                           | Time Schedule | Language            |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------|
| 1.1 | The answers and the statements to the present technical specification                                                                          | With offer    | Turkish and English |
| 1.2 | Preliminary 3D or 2D models and installation drawings showing the main external space envelope                                                 |               | English             |
| 1.3 | Preliminary applicable analysis reports of the wheel (movement scenario analysis, performance, consumptions, structural strength, etc.)        |               | English             |
| 1.4 | List of tests (routine, type, FAI, commissioning and homologation) that shall be performed on components and systems                           |               | English             |
| 1.5 | IRIS Certification of the Bidder (If the Bidder is an agency of the manufacturer, the Bidder shall show the manufacturer's certificate)        |               | English             |
| 1.6 | Conformity certification of the component (if is deemed proven by the Supplier, please see clause 4.4.1 and 4.4.1.1)                           |               | English             |
| 1.7 | List of special tools and test equipment with their prices (If not submitted, it is interpreted that no special tool and equipment are needed) |               | Turkish and English |
| 1.8 | Design schedule, in line with project milestones                                                                                               |               | Turkish and English |

| <b>Id.</b> | <b>Stage 1 -OFFER Phase</b>                                                                                       | <b>Time Schedule</b> | <b>Language</b>     |
|------------|-------------------------------------------------------------------------------------------------------------------|----------------------|---------------------|
| 1.9        | Detailed price list (should include at least the price of the component, test, engineering, training, RAMS, etc.) |                      | Turkish and English |

**Table 7 – Stage 1 Offer Phase: list of requested documents and due date**

| <b>Id.</b> | <b>Stage 2 - PRELIMINARY Review</b>                                                     | <b>Time Schedule</b>       | <b>Language</b> |
|------------|-----------------------------------------------------------------------------------------|----------------------------|-----------------|
| 2.1        | First level drawings with weight and centre of gravity indications in 3D and 2D formats | Within one month           | English         |
| 2.2        | Certificates of the fire smoke behaviour of non-metal materials                         | after signing the contract | English         |

**Table 8 – Stage 2 list of requested documents and due date**

| <b>Id.</b> | <b>Stage 3 - DETAIL Review</b>                                                                                                         | <b>Time Schedule</b>       | <b>Language</b>     |
|------------|----------------------------------------------------------------------------------------------------------------------------------------|----------------------------|---------------------|
| 3.1        | Definitive drawings with weight and centre of gravity indications in 3D and 2D format.                                                 | Within one month After FAI | English             |
| 3.2        | All the technical documentation and information requested during the project (including final version of documents of previous stages) |                            | Turkish or English  |
| 3.3        | Reports of tests (routine, type, FAI, commissioning and homologation) performed on components and systems                              |                            | English             |
| 3.4        | 3.1 certificates according to EN 10204                                                                                                 |                            | Turkish and English |
| 3.5        | EC Certificate according to TSI LOC&PAS (if monoblock wheels are ordered)                                                              |                            | English             |
| 3.6        | RAMS and LCC documentation: see dedicated paragraphs                                                                                   |                            | Turkish and English |
| 3.7        | User manuals                                                                                                                           |                            | Turkish and English |
| 3.8        | Maintenance manuals                                                                                                                    |                            | Turkish and English |
| 3.9        | Calculations, tests and analysis report requested by TSI                                                                               |                            | Turkish and English |

**Table 9 – Stage 3 list of requested documents and due date**

The Bidder shall review and confirm the above lists of documents for all the phases of the project. Any deviation shall be submitted to TÜRASAŞ for approval.

Notes:



- 3D models of all components shall be provided, shall be in “.stp” format and shall be complete with all elements, connection included.
- 2D drawings shall be provided in .dwg or dxf format (plus PDF).
- Other documents shall be provided in an editable format and in .pdf format.
- In the documentation, the Turkish version shall prevail in case of utilisation both Turkish and English languages.
- All documents in stage 1 shall be provided as hardcopy and softcopy in “CD” or “USB”.

## 5.ANNEX

### Annexed documents

|                  |                                          |
|------------------|------------------------------------------|
| TŞ-01.139        | General Technical Specification          |
| TD-GZ.02.0013    | RAMS Analysis- Requirements for Wheelset |
| GZ10.04.04.11100 | Motor bogie wheelset                     |
| GZ11.04.04.11100 | Trailer bogie wheelset                   |
| GZ90.04.10.00001 | Monoblock wheel                          |
| GZ10.04.04.30000 | Powered Axle                             |
| GZ11.04.04.30000 | Non-powered Axle                         |
| TCDD 02.029_A3   | Wheel profile drawing                    |

### Reference documents

|                  |                      |
|------------------|----------------------|
| GZ90.04.10.00005 | Gearbox              |
| GZ10.04.00.00000 | Motor bogie layout   |
| GZ11.04.00.00000 | Trailer bogie layout |