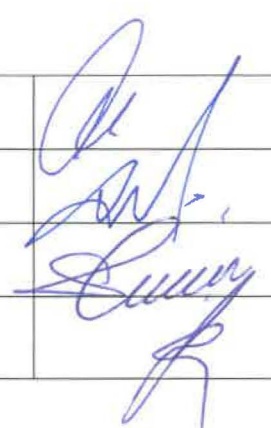


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TECHNICAL SPECIFICATION OF WHEEL

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1. SUBJECT AND SCOPE

This document describes the technical requirements for the procurement of the wheel component to be installed on the Co-Co Type Locomotive (hereafter called LOCO) produced by Turkish Railway Vehicles Industry Inc. (hereafter called ADMINISTRATION).

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 ADMINISTRATION and the Contractor.

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

IMPORTANT NOTE:

The present document shall be examined by the Bidder, together with the following document:

TŞ400048 – Electric General Technical Specification

TŞ400049 – Diesel General Technical Specification

in order to know general applicable requirements established at LOCO level.

2. DEFINITIONS & REFERENCE DOCUMENTS

2.1. INTRODUCTION

Within this Technical System Specification, the following definitions are applied to the words reported below:

- “the Administration” means the Turkish Railway Vehicles Industry Inc. (TÜRASAS)
- “the Contractor” 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 Contractor 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
- “End Client” means the railway company that will be the user of the locomotive.

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2.2. ACRONYMS AND DEFINITIONS

The acronyms and definitions used in this document are reported in the following Table.

Acronymus	Description
TÜRASAS	Turkish Railway Vehicles Industry Inc.
TSI LOC&PAS	Document 1302/2014/EU and relative amandments of the European Commission (Technical specification for interoperability relating to the rolling stock — locomotives and passenger rolling stock subsystem of the rail system in the European Union)
UIC	International Railway Association
RAMS	Reliability - Availability- Maintainability- Safety
TCMS	Train Control Management System
ERTMS	European Rail Traffic Management System
ADMINISTRATION	TÜRASAS
Admin. Personnel	TÜRASAS and/or Co-Co Project working groups assigned in the relevant subject
Bidder	The company who want to join to the tender to supply the good object of this specification
Contractor	The winner of the tender and the Contractor of the products covered by this spec.
EN	European Standard
TSE	Turkish Standards Institute
UNI	National Standards Unit
EC	European Community
ISO	International Standard Organization
CAD	Computer Aided Design
LOCO	Diesel/Electric Mainline Locomotive
NoBo	Established by the relevant commission of the European Union under the directive 2016/ 797 / EC on the ""Interoperability of the rail system within the European Union"" directive. “Notified Body”
TSI SRT	Document 1303/2014 / EU of the European Commission (the technical specification for interoperability relating to ‘safety in railway tunnels’ of the rail system of the European Union)
TSI CCS	Document 2023/1695/EU of the European (the technical specification for interoperability relating to the control-command and signaling subsystems of the rail system in the European Union)
TSI NOI	Document 1304/2014 / EU of the European Commission (technical specification for interoperability relating to the subsystem rolling stock — noise)

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CSM	Document 402/2013/EU of the European Commission (Common Safety Method for Risk Evaluation and Assessment)
N/A	Not Applicable
TBC	To be confirmed
TBD	To be defined
LRU	Line Replaceable Unit
LCC	Life Cycle Cost
CBM	Condition Base Maintenance
FAI	First Article Inspection
MDBF	Mean Distance Between Failure
MTBF	Mean Time Between Failure

Table 1 – Acronyms and Definition

2.3. REFERENCE DOCUMENTS

In the following table the documents used for reference document.

Ref	Document	Title
1	TS400048	Electric General Technical Specification
2	TS400049	Diesel General Technical Specification
3	TB50160	Standard List
4	TB50165	RAMS Targets Allocation
5	TB50172	Thermoacoustic Behaviour
6	012BX0000008-000	Wheel

Table 2 –Reference Documents

2.4. SCOPE OF SUPPLY

2.4.1. HARDWARE

The Contractor shall provide all relevant components related to the wheel installed in the LOCO.

The wheel system shall consist of:

- Monoblock Wheel

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The quantity of wheels is given in the following table;

Description	Per each LOCO	
	Drawing No	Quantity
Monoblock wheel	012BX0000008-000	12

Table 3 – Quantities

2.4.2. SOFTWARE

N/A

2.4.3. SPECIAL TOOLS

Generally, the usage of special tools shall be avoided to perform preventive and corrective maintenance.

If this is not possible, the Contractor shall provide a list of tools and 2 complete sets of special tools free of charge.

Nevertheless if they are essential for maintenance (upon Contractor and ADMINISTRATION 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 (and of course 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

The Contractor shall provide the software tools necessary to manage the life cycle of the system (monitoring and troubleshooting SW, special connection cables and adaptors, diagnostics and CBM data cloud access and analysis, etc.).

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3. STANDARDS TO BE COMPLIED

The LOCO 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.

The complete list of standards applied at LOCO is provided in TB50160.

All the norms have to be with the version indicated in the current TSI LOC&PAS list; if the norm is not listed in the TSI list, has to be applied the version of the norm available at the signature of the contract.

The Bidder/Contractor should satisfy the standards indicated in Table 4.

Standard	Title
EN 17050	Conformity assessment - Supplier's declaration of conformity
EN 45545-1,-2,-3,-4,-5,-6	Railway applications - Fire protection on railway vehicles
TSI LOC&PAS 1302/2014	Technical Specification of Interoperability: Rolling Stock - locomotives and passenger rolling stock subsystem of the rail system in the European Union
TSI CCS 2023/1695	Technical Specification of Interoperability: Control Command and Signalling TSI
TSI Noise 1304/2014	Technical Specification of Interoperability: Noise
TSI SRT 1303/2014	Technical Specification of Interoperability: Safety in Railway Tunnels
EN ISO 14040	Environmental management - Life cycle assessment - Principles and framework
IEC 61373	Railway applications – Rolling stock equipment – Shock and vibration tests
EN 13260	Railway applications – Wheelsets and bogies – Wheelsets – Product requirements
EN 13262	Railway applications – Wheelsets and bogies – Wheels – Product requirements
EN 50126	Railway applications - The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS)
EN 13979-1	Railway applications – Wheelsets and bogies – Monobloc wheels – Technical approval procedure – Part 1: Forged and rolled wheels
UIC 510-2	Trailing stock: wheels and wheelsets. Conditions concerning the use of various diameters
UIC 510-5	Technical approval of monobloc wheels – Application document for standard EN 13979-1
EN 13715	Railway applications – Wheelsets and bogies – Wheels – Tread profile

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EN 10204	Metallic products – Types of inspection documents
EN 50121-1	Railway applications - Electromagnetic compatibility - Part 1: General
EN 50121-3-1	Railway applications - Electromagnetic compatibility - Part 3-1: Rolling stock - Train and complete vehicle
EN 50121-3-2	Railway applications - Electromagnetic compatibility - Part 3-2: Rolling stock - Apparatus
EN 50125-1	Railway applications – Environmental conditions for equipment – Part 1: Equipment on board rolling stock

Table 4 – Applicable Standards

The Bidder shall review and confirm compliancy to the above list of applicable norms, any deviation shall be submitted to ADMINISTRATION 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.

4. TSI REQUIREMENTS AND RELATED DOCUMENTATION

4.1.1. TSI CERTIFICATION

The LOCO shall be certified according to current version TSI LOC/PAS, TSI NOI, TSI PRM, TSI SRT and TSI CCS by Notified Body (NoBo). LOCO shall be certified by the Designated Body (DeBo) in accordance with national legislation and national rules. The Contractor shall provide whole calculations, drawings, analysis, test reports and other kind of documentation which is requested by TSIs for the present Scope of Supply. Within the scope of Supply, Contractor Provide the documentation required for the compliance matrix to be created by NoBo.

The Contractor/Bidder shall provide the declaration of conformity of its Scope of Supply to the relevant technical specifications and applicable norms.

The declaration of conformity shall be in accordance to the EN17050 Norm and shall include also the following documents:

- Conformity declaration (The bidder shall submit it at Stage 1, see §12 Table 8)
- Conformity report with all conformity evidence (The Contractor shall submit it at Stage 3, see § 12 Table 10)
- Type test reports (The Contractor shall submit them at Stage 3, see § 12 Table 10)

3.1 certificates for the products according to EN 10204 (The Contractor shall submit them at Stage 3, see § 12 Table 10) shall be submitted by the Contractor to the Administration.

The documentation presented by the Contractor relevant to the Conformity report with all conformity evidences and test reports will be examined for approval by the NoBo/DeBo in charge of certification of the LOCO.

If there is a need for corrections to the documents or new documents are required depending on the examinations made by the NoBo/DeBo, the relevant documents will be provided by the Contractor.

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The Contractor is obliged to meet the documents that are not foreseen at the tender stage but are requested by NoBo later on.

4.1.2. EC CERTIFICATION OF CONFORMITY AS INTEROPERABILITY CONSTITUENCE

The wheel system object of present Technical Specification is an Interoperability Constituent. The Bidder can join the tender with or without EC Certification of Conformity.

In any case the wheel system/equipment/component shall be supplied with its own EC certification of conformity according to the applicable and valid TSI regulation by the Contractor.

The documentation related to the EC Certification of Conformity shall be accessible for examination by the Notified Body in charge of TSI certification of the LOCO nominated by the Administration.

Documentation of EC Conformity shall include at least the following:

- TSI Certificates
- Reports included in TSI Certificates
- EC Declaration of Conformity
- Document identifying the product to be matched with the certificates (technical drawing, product model number, etc.)

The Contractor shall enable an assessment by the NoBo at the Contractor location.

5. TECHNICAL SPECIFICATIONS

5.1. INTRODUCTION

Wheels shall be provided by the Contractor according to referral drawing: 012BX0000008-000 and shall comply with standards EN 13262, EN 13979-1 and EN 13715.

Wheels shall be minimum resistant to an axle load of 22,5 ton.

5.2. PRODUCT DEFINITION

The monoblock wheel is finished, ready to assembly, according to EN 13262 category 2:

- wheel diameter at new: Ø 1250 mm
- wheel diameter at max wear: Ø 1170 mm
- rim width: 135 mm

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

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The wheel profile of the Locomotive will be according to the following:

- Wheel profile: EN13715 – S1002 / h28 / e32.5 / 6.7%

5.2.1. ASSEMBLY RULES

Wheels assembly on wheelset shall be carried out by ADMINISTRATION.

Wheel fitting force shall be $830 \text{ kN} < F < 1415 \text{ kN}$.

The assembly of the wheels shall be performed cold. Administration and Contractor shall define and agree upon the tolerance on the diameter of the hub. The disassembly shall be performed cold for wheels using the hydraulic system.

5.2.2. SURFACE DEFECT

For wheels surface defect refer to EN 13262 standard.

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 ADMINISTRATION do not agree the Contractor shall provide new products.

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

5.2.3. BALANCING

The wheel shall be balanced. The maximum static imbalance of a finished wheel in the delivery condition shall be $\leq 125 \text{ gm}$ symbol E3.

5.2.4. ELECTRICAL RESISTANCE

According to EN 13260, the electrical resistance of each wheel measured between the treads of two wheels shall not exceed 0.01Ω . The test voltage shall be in the range $1,8 \text{ V} - 2,0 \text{ V DC}$.

The electrical resistance of the wheel and axle shall be complied with the signalling system to be provided.

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

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5.2.5. CORROSION PROTECTION

Protection against corrosion must be provided:

- on all fully machined surfaces, except for the surface of the rims and fitting area
- on the unmachined web and unmachined hub.

5.3. APPLICATION SOFTWARE

N/A

5.4. DIAGNOSTIC

N/A

5.5. WEIGHT

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

Monoblock wheel weight shall be ≤ 605 kg

5.6. MANUFACTURING

5.6.1. STEEL MANUFACTURING

Steel used in the manufacture of monobloc wheels will be produced by Siemens Martin, electric arc or Basic oxygen method and then material shall be killed in the furnace or ladle and shall be subjected to vacuum-degassing.

As a result of degassing process, the maximum amount of hydrogen in the molten steel will be 2,5 ppm.

The liquid steel shall be casted by continuous casting or ingot casting methods. If poured into ingots, the bottom casting method will be used.

5.6.2. MANUFACTURE OF MONOBLOC WHEELS

The wheels shall be manufactured by rolling from ingots or billets which allow two or more wheels may be produced after the end portions have been cut. Cutting the end portions will be sufficient to remove the faulty parts of the ingots. Any superficial defects will be completely eliminated before or during machining. If this is not possible, faulty sections will be rejected.

The cut ingots or billets shall be forged by pressing. If necessary, the final forming shall be made by rolling or drop-hammer forging. The wheel mark profile shall comply with EN 13715. During hot forming, adequate precautions will be taken to prevent grain growth and damage to the material, as the wheel is exposed to high temperatures for a long time.

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All ingots, billets, sections and wheels shall be marked with an appropriate identification mark during manufacture. However, the final marking of the wheels shall be carried out as indicated in the marking section of this technical specification.

5.6.3. HEAT TREATMENT

The rolling surfaces of the wheels shall be heat treated to ensure the mechanical properties specified in EN 13262 standard.

5.7. INTERFACE SPECIFICATION

5.7.1. MECHANICAL INTERFACE

Refer to drawing indicated in table 2

5.7.2. ELECTRICAL INTERFACE

N/A

5.7.3. DIGITAL AND/OR ANALOGUE INPUTS/OUTPUTS

N/A

5.8. EARTHING

N/A

5.9. ENVIRONMENTAL CONDITIONS

5.9.1. CLIMATIC CONDITION

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

General climatic conditions, following the EN 50125-1, are reported in the mentioned General Technical Specification.

5.9.2. NOISE, VIBRATION AND SHOCK

General noise, vibration and impact conditions are reported in General Technical Specification and Noise Requirement document.

For shock and vibration the Contractor shall demonstrate that the bogie equipment is tested and validated according to IEC61373.

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5.9.3. PROTECTION (IP)

N/A

5.9.4. PAINTING

For wheel painting refer to drawing 012BX0000008-000 indicated in table 2.

The Bidder/Contractor can propose its own painting specification to ADMINISTRATION. The usage of this painting specification is dependent on ADMINISTRATION approval.

Concerning resistance to corrosion, design and processes shall take in account the effect of potential galvanic corrosion.

The colours of products have to be defined by ADMINISTRATION during design meetings.

5.9.5. ELECTROMAGNETIC COMPATIBILITY (EMC)

The equipment shall comply with the EMC requirements defined in EN 50121-1, EN 50121-3-1 and EN 50121-3-2.

5.10. SYSTEM AND COMPONENTS LIFE

The required life shall be equal or greater than 30 years.

5.11. MATERIAL REQUIREMENT

The Monoblock wheel material shall be ER9 according to EN 13262 standard Category 2 class.

5.11.1. 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.

The Bidder/Contractor shall give the list of every material used together with their offer.

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5.11.2. FIRE RESISTANCE BEHAVIOUR

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

According to EN 45545-1 and EN 45545-2 standards the locomotive hazard level will be HL2 and operation category will be 2N (freight locomotive). The Contractor shall submit to the Administration a certificate of conformity to this standard. This hazard level identifies the relevant tests pass-no-pass condition.

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 locomotive to identify the relevant R(x) requirements.

The Bidder 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).

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

Applicable Product type (No)	Definition	Details	Requirements
EX10	Parts of the drive	Wheel sets and brake discs	R9

Table 5 – Material Fire Behaviours

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

These requirements will be provided for HL2 hazard level.

The documentation presented by the Bidder or the Contractor relevant fire performance will be examined for approval by the Notified Body in charge of TSI certification of the National Co-Co Type Mainline Locomotive Project nominated by the ADMINISTRATION. The Contractor shall be responsible to perform all necessary activities which are required by Notified Body.

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5.11.3. SMOKE OPACITY AND TOXICITY

All the materials used do not emit toxic gases in such quantities as to be harmful.

The parameters taken as reference for the selection of materials, and the requirements they must meet, are described in "Table 5" of the EN 45545-2 standard with reference to the classification of the hazard level of the LOCO and the set of requirements R(n) to which the material is associated.

5.12. LABELS/MARKING

For wheel marking requirements refer to technical drawing 012BX0000008-000.

Wheels shall be marked in accordance with EN 13262 standard.

In case the marking specified in the technical drawing is incompatible with the relevant standard, the Contractor shall inform the ADMINISTRATION.

6. RELIABILITY, AVAILABILITY, MAINTAINABILITY AND SAFETY (RAMS) REQUIREMENTS

6.1. RELIABILITY, AVAILABILITY, MAINTENABILITY & SAFETY (RAMS)

The Contractor shall make RAMS analysis according to TB50165.

7. TRAINING AND MANUAL

7.1. TRAINING

N/A

7.2. MAINTENANCE MANUAL

7.2.1. MAIN FEATURES OF THE MANUAL

The Contractor 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 Loco).

The manual will be used as the basis for LOCO operation and maintenance by End Client staff.

The manual shall be prepared in electronic editable format and the language UK English and Turkish.

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7.2.2. 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 Contractor 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- LOCO overhaul
 - final functional check

The Contractor 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

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- torque values
- special tools (if any)
- step by step activity description with necessary schemes, drawings and illustrations, including:
- removal and refitting
- off- LOCO repair
- failure diagnosis
- final functional check

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

7.2.3. 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.
- In the manual, the parts should be shown by numbering on the exploded picture. Within the scope of this picture, there should be a list consisting of Part No, Stock or Part Code No, Part Name and Quantities
- The Manual shall 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 End Client)
- Pictures and photos shall be inserted and not simply linked.
- Photos should be only JPEG format.
- Pictures should be only TIFF format.

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

8. TESTING, INSPECTION AND ACCEPTANCE

LOCO shall be certified following the TSI LOC&PAS regulation. If the component shall be satisfy the TSI, the Contractor shall be responsible for all relative certification of the equipment presented to NoBo.

8.1. INTRODUCTION TO TEST AND INSPECTION

The Contractor shall perform the tests and the inspection in accordance with the Approved Test Procedure and the Approved Inspection Specification.

ADMINISTRATION and/or end Client have the right to witness any of these tests and inspections at any stage of test and inspection procedure.

Type test can be waived if system or components are already proven and confirmed to waive by End Client. In that case, the Contractor shall provide old test report or certificate to submit for approval. All test and inspection specifications and reports including all repair activities and check-lists shall be submitted by Contractor and approved by ADMINISTRATION.

The following prescription shall be observed if the test is defined as a type test in TSI:

- The procedure shall be shared by the Contractor and approved by NoBo,
- The test, and relative documentation, shall be done in either an accredited lab according to ISO/IEC 17025 or with the NoBo attendance
- The test, that will be done on the vehicle, shall be planned in coordination with NoBo (attendance required), Contractor and the Administration.

8.2. INSPECTION, EXPERIMENT AND TESTS TO BE PERFORMED BY THE CONTRACTOR

Inspection and tests stated in Table 6 shall be carried out by the manufacturer for each charge group of the manufactured wheels. During these inspections, the manufacturer shall reject the wheel itself with faults in the inspections listed in rows 3,4,6,7 and 9. If, after other inspections, it determines that the wheels do not meet the properties specified in this specification, it shall reject the full charge to which that wheel belongs. Quality control documents containing the test results of the wheels which are found to be in accordance with the technical specification shall be submitted to ADMINISTRATION upon delivery.

Inspection and acceptance procedures of each batch of wheels, which are completely manufactured, shall be carried out by ADMINISTRATION inspection and acceptance commission in the factory of the Contractor. The Contractor will notify ADMINISTRATION for these controls 30 days in advance. After examining the factory quality control documents of the wheels presented for inspection, physical and laboratory inspections specified in the specification shall be performed. If the results obtained from these inspections are found to be appropriate, the whole party shall be accepted and, if any of the results are not found to be appropriate, the whole party shall be rejected. The gauges that have been subjected to calibration inspections required to be used by ADMINISTRATION representatives during quality control shall be provided by the manufacturer.

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- **Physical Inspections**

After package inspection of the wheels by the inspection and acceptance commission, the tests stated in Table-6 row 3 shall be performed to the samples which will be selected.

- **Laboratory Inspections**

After physical inspection of the wheels, the tests stated in Table-6 row 1,4,5,6,7,8,9,10,11,12,13 and 14 shall be performed to the samples which will be selected. Laboratory inspections of the wheels shall be carried out at the facilities of the manufacturer. The referee laboratory examinations of the wheels shall be carried out by an independent accredited organization.

The Contractor shall replace the wheels that will be destructed during the inspections free of charge.

No	INSPECTION AND TESTS	Number of Wheels Tested at Each Charge		Number of Tests Applied to the Wheel	Inspection and Test Methods
		Number of Wheels in a Charge ≤ 250	> 250		
1	Chemical Analysis	1	1	1	EN 13262 ISO/TR 9769
2	Amount of Hydrogen (H ppm)	1	1	1	EN 13262 Annex F
3	Appearance Inspection (Appearance, Marking)	All	All	1	EN 13262
4	Dimensional Inspection Axial / Radial Runout	All	All	1	EN 13262
5	Micrographic Inspection	1	2	1	EN 13262 ISO 4967
6	Ultrasonic Inspection	All	All	1	EN 13262 ISO 5948
7	Magnetic Particle Inspection	All	All	1	EN 13262 ISO 6933
8	Residual Pressure Stresses	1	2	1	EN 13262
9	Permanent Static Imbalance	All	All	1	EN 13262
10	Tensile Test (on web)	1	2	1	EN 13262 ISO 6892-1
11	Tensile Test (on rim)	1	2	1	EN 13262 ISO 6892-1
12	Notch Impact Test	1	2	3	EN 13262 ISO 148-1
13	Hardness Depth of Rim Sections	1	2	1	ISO 6506-1
14	Uniformity of Wheel Rim Hardness within a Batch	All	All	1	ISO 6506-1

Table 6 - Inspection and tests

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If there are other mandatory tests other than the tests specified in the table above in the relevant standard content, they shall be applied to the products.

8.3. INSPECTION, EXPERIMENT AND TESTS TO BE CARRIED OUT BY THE CONTRACTOR UNDER THE SUPERVISION OF THE ADMINISTRATION PERSONNEL

1. When the party is ready, the Contractor shall apply to the Administration and invite the Inspection and Acceptance Commission. If deemed necessary, ADMINISTRATION may appoint personnel for acceptance at the Contractor facilities.
2. The Contractor shall apply all tests to the samples to be selected according to Table 7 under the supervision of ADMINISTRATION personnel at their facilities.
3. Samples shall be randomly selected by the inspection and acceptance commission from the party subject to shipment in the amounts specified in Table-7. If necessary, the amount of samples for non-destructive testing can be increased.

PARTY NUMBER	NUMBER OF SAMPLES
0-100	1
100-500	2
501-1000	3
1001-2000	4
More than 2000	5

Table 7 – Number of samples for inspection

8.4. 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.

The Contractor shall perform the type test for the monoblock wheel according to TSI LOC&PAS and related standards.

The Contractor shall perform Type Tests, in accordance with a test procedure approved by ADMINISTRATION with ADMINISTRATION and/or End Client participation.

During testing, the criteria shall be observed and recorded. All alterations, adjustments and maintenance works required by ADMINISTRATION shall be carried out by the Contractor.

The Contractor has the responsibility for the success of mentioned Type Tests.

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8.5. 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 Contractor shall perform routine tests in accordance with a test procedure approved by ADMINISTRATION under his responsibility, and, if necessary, with ADMINISTRATION participation.

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

Records from Routine tests shall be kept by the Contractor and made available timely for ADMINISTRATION and/or end Client's inspection.

All copies of the approved routine test results shall be submitted. Additional copies of records of all tests/inspections results shall also be kept at the Contractor's work to be made available to ADMINISTRATION 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.

8.6. FIRST ARTICLE INSPECTION

The Contractor shall perform a First Article Inspection (FAI) of the components of the system object of the scope of supply at the Contractor's factory with ADMINISTRATION and/or end Client participation, prior to serial production in order to confirm that the hardware & software fully complies with the Contractor's scope of supply design and manufacturing process. Contractor shall submit FAI test procedure to ADMINISTRATION at least 4 weeks before FAI. If any changes are requested by ADMINISTRATION, Contractor shall comply with these requests.

At the FAI, the Contractor shall make available all pertinent design and manufacturing process documentation, test records, material certifications, etc. Should all the requirements of the FAI not be met, then the inspection shall be considered at a Hardware Review.

Upon acceptance of the FAI by ADMINISTRATION and/or end client, the Contractor is then free to proceed to manufacture all pertinent hardware. The hardware shall meet or exceed the quality standards set at the FAI, and must incorporate any comments made by ADMINISTRATION and/or end client at the FAI.

All domestic / international accommodation and travel expenses (international departure and arrival flight tickets, transportation between accommodation and workplace) of all Administration personnel who will go to the Contractor's facilities for the First Article Inspections (FAI) will be borne by the Contractor. ADMINISTRATION personnel will participate in First Article Inspections with a maximum of 20 person/day.

8.7. SUPPLIER TECHNICAL ASSISTANCE

The Contractor shall provide all the technical assistance necessary for the first installation of the system(s) at TÜRASAS, if requested by the ADMINISTRATION.

Installation procedures and check lists shall be provided by the Contractor during this operation in order to be verified and validated. Details will be discussed during evolution of the project.

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If requested by the Administration, the Contractor shall attend to installation of equipment on the first LOCO, to commissioning in TÜRASAS and also to track test if requested on Turkish Railway Network.

8.8. COMMISSIONING

8.8.1. TYPE COMMISSIONING TEST

N/A

8.8.2. ROUTINE COMMISSIONING TEST

N/A

9. AUTHORIZATION TO START PRODUCTION

The Administration will authorize the Contractor to start production according to the following stages.

If the contractor has previously supplied products to ADMINISTRATION within the scope of this technical specification, the content of this title will not be applied.

9.1. DESIGN FREEZING

After the contract is signed, procurement scope Design Freeze meetings will be held with the participation of ADMINISTRATION and the CONTRACTOR. The date and place of the meetings will be mutually agreed.

9.2. AUTHORIZATION TO START PRODUCTION

According to the final design criteria mutually agreed upon as a result of the design freeze meetings, the Administration will authorize the Contractor to manufacture the first product(s) within the scope of supply.

9.3. AUTHORIZATION TO START MASS PRODUCTION

The Contractor will be authorized by the Administration to start mass production after the FAI (First Product Inspection) is performed on the first product(s) produced by the Contractor after receiving the Authorization to Start Production.

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10. ACCEPTANCE

Acceptance report shall be issued by ADMINISTRATION after followings have been covered by the Contractor:

- All required components have been delivered.
- All documents have been delivered.
- Routine tests and/or controls (physical inspections, dimension and tolerance control, appearance control, document/report and certificate controls etc.) to be carried out at TURASAS have been successfully completed.

11. PACKAGING AND STORAGE CONDITIONS

11.1. 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.

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

Even in the scenario that the products cannot be assembled to the locomotive in a short period of time and are kept unused in the warehouses for a long period of time (3 years, etc.), the products shall be packaged and delivered in a suitable way so as not to be damaged in any way.

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 ADMINISTRATION. Generally ADMINISTRATION anticipates packs are divided for one locomotive production. Also packs should be divided for different production lines, i.e. mechanical and electrical. Lists of the boxes shall be finalized after approval of the lists by ADMINISTRATION. A copy of each list shall be sent to ADMINISTRATION at the beginning of the shipment.

The Contractor shall deliver the equipment that has been supplied for receipt with the manufacturing completed covered in suitable plastic so as not to be affected by environmental factors such as rain, wind and snow and so as not to be damaged during dispatch and stocking; and tied to wood crates from the outside to prevent dispersing. The Contractor shall deliver the products prepared in this form to the TÜRASAS Eskişehir Regional Directorate at their own cost.

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There will be pallets under the crates so that the load can be discharged with a forklift. On the crates, the name of the contractor, the name of the material, the order, classification, (technical specification number) and drawing number, the number of parts in the crate, the serial numbers of the parts, the date of manufacture, the contract number, the packaged product quantity, product name, batch number, if any, etc. (not to be affected by climatic conditions) will be specified. The list containing this information will be delivered on the basis of the crate, together with the delivery note and invoice.

The materials shall be placed inside the crates wrapped in a suitable thickness of plastic bubble wrap that will not allow the material to be affected by climate and environment conditions like rain, wind and snow or to be damaged during loading, dispatching and stocking.

If the packaging and/or the delivery documents of the products are not complete and/or not suitable this will be entered on record and the products will be returned to the Contractor without completing the delivery process. If the returned materials are resubmitted after the delivery date specified in the contract the late fine specified in the contract shall accrue. The Contractor shall not claim any rights for delays due to the packaging.

The contract number, the amount of product in the packaging, the product name and party number if any, etc. as well as the "Project Name: National Co-Co Type Locomotive" shall be on the packaging.

11.2. STORAGE CONDITIONS

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

In addition, the necessary conditions and procedures to be applied in order to prevent damage to the products stored in warehouses without being used for a long time will be delivered by the Contractor in detail.

11.3. MOUNTING AND HANDLING

All the components shall be supplied ready for installation and possibly already mounted and pre-regulated. Special care is requested to the Contractor to list all the necessary tools for mounting and maintenance.

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12. DOCUMENTS TO BE DELIVERED TO THE ADMINISTRATION ALONG WITH THE PRODUCT/EQUIPMENT

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

Table 8 shows the documentation which shall be given by the Bidders in the offer phase.

Table 9 and Table 10 show the documentation which shall be provided by the Contractor for the Preliminary Technical Review and the Detail Technical Review respectively.

Id.	Stage 1 -OFFER Phase	Time Schedule	Language
1.1	Clause by Clause commentary of present Tech. Specification	With offer	Turkish and English
1.2	Declaration of conformity according to EN 17050 within the scope of the standards specified in this technical specification and reference documents		English
1.3	EC Declaration of Conformity according to the TSI LOC&PAS 1302 if the scope of Supply is considered "Interoperability Constituent" (If not available, the Bidder shall provide a letter of commitment stating that "TSI certification for the product will be provided with delivery".)		English
1.4	Current and valid in regard to product manufacturing; - IRIS Certification of the Bidder (If the Bidder is an agency of the manufacturer, the Bidder shall show the manufacturer's certificate) or - ISO 9001 Quality Management System Certificate of the Bidder (If the Bidder is an agency of the manufacturer, the Bidder shall show the manufacturer's certificate)		Turkish or English
1.5	A commitment declaring that the wheels to be produced will be provided with TSI and EN conformity certificates in accordance with the standards required in the technical specifications and TSI		Turkish and English

Table 8 – Stage 1 Offer Phase: list of requested documents and due date

Id.	Stage 2 - PRELIMINARY Review	Time Schedule	Language
2.1	First level drawings with weight and centre of gravity indications in 3D and 2D formats	Within one month after signing the contract	English
2.2	Design justification analysis reports		English
2.3	Preliminary applicable analysis reports (performance, consumptions, structural strength, etc.)		English

Table 9 – Stage 2 list of requested documents and due date

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Id.	Stage 3 - DETAIL Review	Time Schedule	Language
3.1	Definitive drawings with weight and centre of gravity indications in 3D and 2D format.	Within one month before FAI and with product/equipment delivery	English
3.2	Installation drawings		English
3.3	Installation instruction		Turkish and English
3.4	Detailed description of the supplied components or systems		Turkish and English
3.5	All the technical documentation and information requested during the project (including final version of documents of previous stages)		Turkish and English
3.6	Procedures of tests (FAI, routine, type, commissioning and homologation) performed on components and systems		Turkish and English
3.7	Available reports of tests (routine, type, commissioning and homologation) performed on components and systems (including reports on all test results defined in the relevant standards specified in the technical specification, etc.)		English
3.8	List of special tools and test equipment		Turkish and English
3.9	LRU list		Turkish and English
3.10	Spare Parts and Equipment List (including order codes)		Turkish and English
3.11	Servicing and lubricating table		Turkish and English
3.12	Final documentation for Certification (including all certificates and documents showing compliance with the standards / norms specified in the technical specification)		Turkish and English
3.13	EC Certification according to the TSI LOC&PAS 1302 if the scope of Supply is considered "Interoperability Constituent" (see 4.1.2)		English
3.14	RAMS and LCC documentation: see dedicated paragraphs		Turkish and English
3.15	User Manuals		Turkish and English
3.16	Maintenance Manuals (including periodic maintenance Schedule) (including failure repair documentation)		Turkish and English
3.17	Calculations, tests and analysis reports requested by TSI		Turkish and English
3.18	3.1 certificates of the product/equipment according to EN 10204		English
3.19	Documents showing compliance to EN 45545-2 (Certificate of Conformity, Test Report etc.)		Turkish and English
3.20	Guarantee documentation		Turkish and English

Table 10 – Stage 3 list of requested documents and due date

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

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The IRIS certificate submitted by the Bidder in Stage 1 will be examined by the Administration for compliance with the scope of the product/work subject to tender.

The documents specified in Stage 3 shall be delivered to the ADMINISTRATION both before the FAI and together with the product/equipment.

The documents to be delivered by the Contractor in Phase 3 shall be provided to the ADMINISTRATION in 2 (two) USB devices and in hard copy.

Notes:

- 3D models of all components shall be provided, shall be in “.step” format and shall be complete with all elements.
- 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”

13. INTELLECTUAL AND INDUSTRIAL PROPERTY ISSUES

13.1 Any projects and documents shared with the Contractor within the scope of the work subject to the tender shall not be used for any other purpose. The Contractor shall share all technical information only with the Administration

13.2 Administration shall be authorized to use the products and documents to be supplied by the Contractor (right of usage) - without prejudice to any mandatory legal provisions applicable and without any detriment to the Contractor’s dignity and reputation.

13.3 In case of proven violation of an intellectual and / or industrial property rights by the Contractor, the Contractor shall be liable for any direct, reasonable and properly documented damages resulting directly from such violation. If the Administration faces legal sanctions, it is allowed to recourse such sanctions to the Contractor within the scope of liability of the Contractor mentioned above. Upon the request of the Administration, the Contractor is obliged to fully inform and certify to the Administration whether the service to be undertaken is a matter of intellectual and industrial property.

13.4 This technical specification is a part of the contract between the Contractor and the Administration. The Contractor does not have the authority to distribute this document or any part of it to third parties without the approval of the Administration.

13.5 If an official document is requested and mutual communication causes any mistake; all possible information requests and their responses shall be made in written format and via e-mail.

14. GUARANTEE

14.1. WARRANTY CONDITION

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

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

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

Throughout the warranty period, following the notification by ADMINISTRATION of any malfunction, the Contractor shall respond to that malfunction within three (3) working days and replace the malfunctioning parts and equipment or repair and fix the malfunction. The Contractor shall make available in Turkey throughout the warranty period the required service facilities in order to respond to the possible malfunctions and a sufficient number of spare parts or fully complete equipment within this time period.

Responsibility for making sure that none of the information, document, certificate, component, system, machine, software, technology and design the Contractor supplies to the Administration violates any brand, patent or third-party ownership rights belongs to the Contractor.

The contractor company shall provide a 10 (ten) year service and spare parts guarantee, valid from the end of the warranty period.

14.2. SYSTEMATIC FAULT / EPIDEMIC FAILURE

During the warranty period, if a failure covered by the warranty occurs in more than 15% of the first 24 locomotives and more than 10% of the 25th and the following locomotives in the same parts/components for the same reason, this failure will be considered an “epidemic failure.”

In addition, if mean time between failures (general average failure time) for the failures occurring in main components/parts used in all locomotives 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.

15. OTHER ISSUES

15.1. For matters not specified in the technical specification, the administrative specification shall apply.

15.2. The Contractor is responsible for all transportation costs.

15.3. The Contractor is responsible for work accidents that may occur during the work of the Contractor personnel at TÜRASAS.

15.4. The food and accommodation costs of the Contractor personnel belong to the Contractor.

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15.5. The Contractor must comply with the safety, protective safety, occupational health and safety instructions and provide the protective materials required by the work and follow their use.

15.6. The contractor must comply with all kinds of warnings, signs and writings within the boundaries of TÜRASAS.

15.7. All software used by the contractor (Computer Aided Design Programs (CATIA, AutoCAD etc.), MS Office. FEM Analysis Programs etc.) will be licensed. All responsibility in this regard belongs to the Contractor.

15.8. The Contractor is responsible for all kinds of damages and losses to ADMINISTRATION or third parties in relation to the obligations fulfilled within the scope of the work subject to the tender.

16. ANNEXES AND NOTES