






<b>TÜRASAS</b> Eskişehir Regional Directorate	<b>TECHNICAL SPECIFICATION</b>	Document No	<b>TS400069</b>		
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## TS400069

### TECHNICAL SPECIFICATION OF WHEEL FLANGE LUBRICATION SYSTEM ELECTRIC AND DIESEL ELECTRIC TYPE COCO LOCOMOTIVE

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## 1. SUBJECT AND SCOPE

This technical specification describes the technical requirements for the procurement of the Wheel Flange Lubrication System to be used in the COCO LOCO (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 specification, 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.

This Technical Specification and its annexes have been prepared in Turkish and English. In the event of any inconsistency between the two, the Turkish language shall prevail.

### **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

In this Technical Specification, the following definitions apply:

- “End Client” means the legal entities or private persons operating on the national railway lines of the Republic of Türkiye with using the LOCO.
- “Final User” means The End Client or its staff who is in charge of use, maintenance, repair etc. the LOCO.
- “Administration” means the Turkish Railway Vehicles Industry Inc. (TÜRASAS)
- “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 electronic media or other format which is prepared by the Contractor in the course of the contract
- “Bidder” means the company who want to join to the tender to supply the good object of this specification

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## 2.2. ACRONYMS AND DEFINITIONS

Acronyms and technical terms in the technical specifications and their annexes will be interpreted as follows.

Acronyms	Description
UIC	International Railway Association
RAMS	Reliability - Availability- Maintainability- Safety
TCMS	Train Control Management System
ERTMS	European Train Control System
TCDD	General Directorate Of Turkish State Railways
TCDDT	Turkish State Railways Transportation Inc.
EN	European Standard
TSE	Turkish Standards Institute
UNI	National Standards Unit
EC	European Community
ISO	International Standard Organization
CAD	Computer Aided Drawing
Co-Co	Diesel – Electrical Mainline Locomotive
NoBo	An organization within the scope of Directive 2016/797/EU, issued by the relevant European Union Commission, on the interoperability of railway systems within the EU. "Notified Body"
TSI LOC&PAS	Document 1302/2014/EU and related orders of the European Commission (Technical specification for interoperability of the rolling stock – locomotives and passenger railway vehicles subsystem of the railway system in the European Union)
TSI SRT	Document 1303/2014 / EU of the European Commission (technical specifications for the mutual operability of the Trans-European Conventional and High-Speed railway system concerning 'security in railway tunnels')
TSI CCS	Document 2016/919/EU of the European (Interoperability technical specifications for 'control-command and signalling subsystems of the Trans-European railway system)
TSI NOI	Document 1304/2014 / EU of the European Commission (Railway vehicles - technical specification for mutual operability related to 'noise')
CSM	Document 402/2013/EU of the European Commission (General security method for Risk Assessment)
I/F	Interfaces
LOCO	Electric or Diesel Locomotive
SOS	Scope Of Supply
LCC	Life Cycle Cost
LRU	Line Replaceable Unit
MTBF	Mean Time Between Failures
MKBF	Mean Kilometres Between Failure

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MKBSF	Mean Kilometer Between Service Failure
N/A	Not Applicable
TBC	To be Confirmed
TBD	To be Defined
IEC	International Electrotechnical Commission
IP	Ingress Protection
IRIS	International Railway Industry Standard
PRM	Person with Reduced Mobility
FAI	First Article Inspection
EMC	Electromagnetic Compatibility
WFL	Wheel Flange Lubrication

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 Target Allocation
5	012BX0000019-000	Wheel Flange Lubrication System
6	TB2348	Contractor's Responsibilities and Rules to be Followed

Table 2 –Reference Documents

### 2.4. SCOPE OF SUPPLY

#### 2.4.1. HARDWARE

The Bidder/Contractor shall provide all relevant components related to the WFL system to be used in the LOCO.

The Wheel Flange Lubrication system shall consist of:

- One air filter regulator
- One 2/2-way solenoid valve for pump activation
- One lubricant tank with integrated pneumatic pump
- One 3/2-way solenoid valve for lubricating distribution
- Two pre-turbolub distributor
- Four lubricant distributor with dirt trap
- Eight nozzles
- Control unit with integrated curve sensor
- Flexible hoses

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The quantity of WFL system is given in the following table:

Description	Per each LOCO	
	Drawing No	Quantity
WFL System	012BX0000019-000	<b>1</b>

Table 3 – Quantities

In addition to the main components of the WFL reported above, shall be considered as scope of supply:

- All the mechanical connectors (mating and fixed parts), accessories belong to connectors, other accessories
- Special cables, assembly parts (bolts, screw etc), supports and brackets for equipment belong to system
- Grounding points with relevant items (screws, nuts, etc.) for grounding terminal fixation

The Contractor shall provide the correct dimensioning of all fixing components according to the VDI 2230-1 requirements.

#### 2.4.2. SOFTWARE

Contractor shall give system software with equipment to guarantee system performance in the first product delivery. The Contractor will provide all the software for the maintenance and operation of the Wheel Flange Lubrication System so that the minimum will be as follows:

- 1) Operational Software
- 2) Diagnostic & Test Software

The SW development shall be at least as per the Basic Integrity level requirements defined in the EN 50716.

If any special software tool for uploading and monitoring the application software, downloading the diagnostic files or other functions (such as diagnostic data remote upload to cloud servers and/or CBM data analysis) is necessary, the Contractor shall provide the uploadable executable version of those related software tools to Administration, together with 6 licenses (valid for the lifetime of the Locomotive) and 6 sets of special connection cables, the SW user guide manual and the maintenance service.

In case of demanding alteration about the correction of the software by Administration during the starting up tests or guarantee period, Contractor shall carry out these changes freely.

In case of any confliction in specified requirement, Contractor will take necessary improvement precautions with the condition of covering the expenses himself/herself within the agreed time schedule with Administration.

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Contractor shall provide system starting up test reports which have been carried out on the Contractor's plant or test reports belong to the trial tests of the updated software before the publishing of the updated software formally.

#### 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 Bidder/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
Other International Standards:	DIN, NF F, UNI, CEI etc.
National Standards:	Technical documents and associated annexes issued under TSE directives.

System of units shall be SI (International System of Units).

In conformity assessments to be carried out by the Bidder/Contractor, and in respect of other requirements to be fulfilled by the product subject to this Technical Specification and its constituent equipment and sub-components, where such requirements are not explicitly defined herein, the directives, standards and requirements listed above shall be applied in the order of priority specified.

Where compliance with these directives, standards and requirements is not possible, other relevant international standards, European national standards, national standards, TCDD guidelines, and requirements stipulated by national legislation may be applied.

If a gap exists in the standards with the defined order of priority, such a gap shall be filled by the subsequent standard.

In case of any amendments to the standards/norms referred to under this clause during the execution of the Contract:

- The Contractor shall notify the Employer in writing within twenty (20) working days following the date of entry into force of such amendment.
- Within one (1) calendar month after providing such notification, the Contractor shall prepare the necessary processes to comply with the new requirements and submit them to the Employer for approval. However, the approval process shall not exceed two (2) months (60 calendar days) from the date the amendment enters into force.
- The Employer shall review the process and notify the Contractor of its decision within fifteen (15) working days.

Amendments to directives, standards, or norms shall not prevent completion of certification.

By reviewing this Technical Specification and its annexes, the Bidder/Contractor shall confirm that the product, its constituent equipment and sub-components comply with the latest applicable versions of the relevant standards. The Bidder/Contractor shall be obliged to notify the Employer in writing, together with proposals, in case of:

- Any inconsistency, contradiction, or violation with international standards,
- Problems that may arise in implementation,

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- Matters that are deemed technically beneficial to amend,
- Issues not specified in this Technical Specification or its annexes but necessary/mandatory for the manufacture of the system/equipment.

The complete standards list is indicated in the TB50160.

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

Standard	Title
EN 17050	Conformity assessment - Supplier's declaration of conformity
EN 45545	Railway applications - Fire protection on railway vehicles
TSI LOC&PAS 1302/2014 Amended 2023/1694	Technical Specification of Interoperability: Rolling Stock - locomotives and passenger rolling stock subsystem of the rail system in the European Union
TSI CCS 2016/796 Amended 2023/1695	Technical Specification of Interoperability: Control Command and Signalling TSI
TSI Noise 1304-2014 Amended 2023/1694	Technical Specification of Interoperability: Noise
TSI SRT 1303/2014 Amended 2019/776	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 50153	Railway applications - Rolling stock - Protective provisions relating to electrical hazards
EN 50155	Railway applications – Electronic equipment used in railway vehicles
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: Railway vehicles – Devices
EN 15427	Railway application – Wheel/rail friction management. Flange lubrication
EN 15427-2-1	Railway applications - Wheel/Rail friction management - Part 2-1: Properties and Characteristics - Flange lubricants
EN 50126	Railway applications - The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS)
EN 50125-1	Railway applications – Environmental conditions for equipment – Part 1: Equipment on board rolling stock
EN 60529	Degrees of protection provided by enclosures (IP code).
UIC 615-1	Tractive units – Bogies and running gear – General conditions applicable to component parts
ÜRA F.005	This Technical Specification can not be REPRODUCED OR USED for any purposes without the written consent of TÜRASAS
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VDI 2230-1	Systematic calculation of highly stressed bolted joints – Joints with one cylindrical bolt
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Table 4 – Applicable Standards

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

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. 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) / Designated Body (DeBo). 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 EN 17050 Norm and shall include also the following documents:

- Conformity declaration (The bidder shall submit it at Stage 1, see §12 Table 6)
- Conformity report with all conformity evidence (The Contractor shall submit it at Stage 3, see § 12 Table 8)
- Type test reports (The Contractor shall submit them at Stage 3, see § 12 Table 8)

3.1 certificates for the products according to EN 10204 (the Contractor will submit them in Stage 3, see § 12 Table 8) will be delivered to the Administration by the Contractor.

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

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4.2. EC CERTIFICATION OF CONFORMITY AS INTEROPERABILITY CONSTITUTE  
N/A

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## 5. TECHNICAL SPECIFICATIONS

### 5.1. INTRODUCTION

The TSI Co-Co locomotive shall be equipped with a Wheel Flange Lubrication Systems designed according to 012BX0000019-000 drawing and following the requirements of EN 15427 and UIC 615-1 standards.

The lubrication of the rolling stock wheel flanges has the function to reduce the wear of both the wheels and the rail. The lubrication system shall be obtained by a lubricant spray device.

The system is designed to spray small quantities of lubricant onto the flange of the wheels. Due to wheel rotation, this lubricant will be deposited on the corner of the rail head, and acts as a lubricant for all the vehicles that pass over the rails.

The LOCO will have a maximum speed of 120 km/h.

The supply voltage of the WFL System shall be 110 VDC; the maximum air pressure in the WFL system shall be 8 bar.

### 5.2. PRODUCT DEFINITION

The main equipments of the WFL system supplied by the Contractor shall be:

- One air filter regulator with manometer to reduce the pressure of the air supplied by the LOCO system to maximum 8 bar.
- One 2/2-way solenoid valve activated by the control unit that allow the passage of compressed air from the regulator to the pneumatic pump integrated in the tank.
- One lubricant tanks with a capacity of minimum 10 liters. The lubricant tank shall include a lubricant level gauge connected with the Control Unit and shall provide all components to allow easily an inspection and maintenance.
- One pneumatic pump integrated in the tank and designed in accordance to EN 50155 and EN 61373 standard.
- One 3/2-way solenoid valve activated by the main control unit relay (MCR) of the LOCO that allow the passage of lubricant in different way based on the LOCO travel direction.
- Two pre-turbolub distributor (one per each travel direction) with one input and two outputs.
- Four lubricant distributor with one input and two outputs and with a dirt trap system integrated.
- Eight spray nozzles to be placed so that they can provide lubrication to the flanges of the wheels of the first and last axle of each bogie. According to the travel direction, the lubricant shall be applied to wheels of 1st and 4th axle or 3th and 6th axle of the vehicle.
- One control unit for the management of the WFL system and the interface with the TCMS of the vehicle.

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The WFL System shall work automatically and the frequency may be managed and shall be adjustable by the TCMS. Anyway, it shall be possible to manually activate/deactivate the WFL System.

The WFL System shall be distant dependent type and shall have a Control Unit and a Curve Sensors in order to apply extra lubricant on the wheel flange while the vehicle is entering the curves. The quantity of the lubrication at the curve shall be adjustable and sufficient enough to create suitable film layer on the wheel at the cant. The Control Unit and the Curve Sensors shall be supplied by the Contractor.

Control unit, curve sensor, protection circuits and all electrical connections shall be arranged on a panel and mounted in a suitable of the LOCO.

On this panel shall be present a physical pushbutton for the function test of the WFL system and four lights (LED) for essential warning and information in turkish language:

- Green LED: Sistem Çalışıyor (Power On)
- White LED: Yağlama Yapılıyor (Lubrication Status)
- Yellow LED: Yağ Seviyesi Uyarısı (Lubrication Level Warning)
- Red LED: Arıza (Fault)

The lubricant to be used in the system shall be biodegradable and shall be compliant with chapter 4 of EN 15427-2-1 as specified by the TSI LOC&PAS 2023.

It shall be grease with a maximum grade of NLGI 000, in order to have a proper consistency to provide easy spraying. It shall be resistive washing out by rain, snow etc. and it shall create an effective film layer of lubricant on the wheel flange and on the contact face of the rail.

The lubrication system shall ensure the fixed mixture between air and grease. The air and grease shall be mixed in the pneumatic pump.

The range of the compressed air system in the LOCO is 8-10 bar, but for some periods it can vary between 6-12 bar.

The WFL system shall have an air pressure regulator (supplied by the Contractor) to reduce the pressure of the compressed air in the WFL system to a maximum of 8 bar.

Galvanized steel drawn pipes and flexible hoses that can withstand to the external impacts shall be used in the system.

The connections shall be strong enough to withstand the system pressure, easily fitted/unfitted, and shall provide the requirement tightness.

The mentioned pipes, hoses and all fasteners shall be supplied by the Contractor.

On the driver desk shall be present a Test Button (out of the scope of supply of the Contractor): this button can be pushed to start a lubrication cycle in order to have a function test of the WFL System. During this test the WFL will make impulsive sprays (the solenoid valve will be ON for 3 seconds). This button can also be used to manually generate impulsive spray.

The WFL Control Unit supplied by the Contractor shall have an additional digital input for the driver desk's Test Button.

The same test function made by the physical Test Button on driver desk can be also performed via the TCMS screen.

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In case of any “Fault” or “Minimum level of lubricant quantity”, the System shall automatically shut down and cut off the lubricant passage at the lubricant tank outlet and shall give the related warnings to the TCMS.

In case of a failure or an undesired situation, the lubricant drop or leakage from the nozzles shall not be allowed by the system to lubricate the gauge face of the rail or the wheel tread.

#### 5.2.1. INSTALLATION OF EQUIPMENTS

The spray nozzles of the WFL System shall be installed on the bogie according to the EN 15427 requirements and it's important that they are positioned in front to the wheels of the first axle of bogie in accordance with the travel direction of the LOCO. In this way, an effective lubrication of the wheel flange can be provided, the correct spray angle and setting can be maintained and the lubricant can be centrifuged on the bottom of the wheel.

Nozzle mounting shall be such that adjustment for proper position can easily be made after wheel reprofiling or other needed conditions.

Control unit shall be mounted inside of the carbody. Lubricant tank with pneumatic pump shall be mounted under the carbody frame and brackets/bolts shall be verified by the Contactor according to the VDI 2230-1 requirements.

None of the parts of the lubricating system shall come into direct contact with the locomotive's wheels or the rails.

Information about type of pipes, nozzles, electric cables and other components connection shall be provided by the Bidder during bidding phase within the system description document.

#### 5.3. APPLICATION SOFTWARE

It is under responsibility of the Contractor to develop the software control of the system to guarantee full required performances and required functionality for the system at SIL level.

Contractor shall provide application software.

If a special software tool for uploading application software, downloading diagnostic files or other functions is necessary, Contractor shall provide related software tool to Administration.

Contractor shall submit definitive software documentation which shows definition of necessity of SIL level for the system and software has been prepared according to SIL requirements according to EN 50716 at Stage 3 (see §12 Table 8 show)

#### 5.4. DIAGNOSTIC

N/A

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#### 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.

The target weights for the lubrication system (complete with lubricant) shall be  $\leq 30$  Kg.

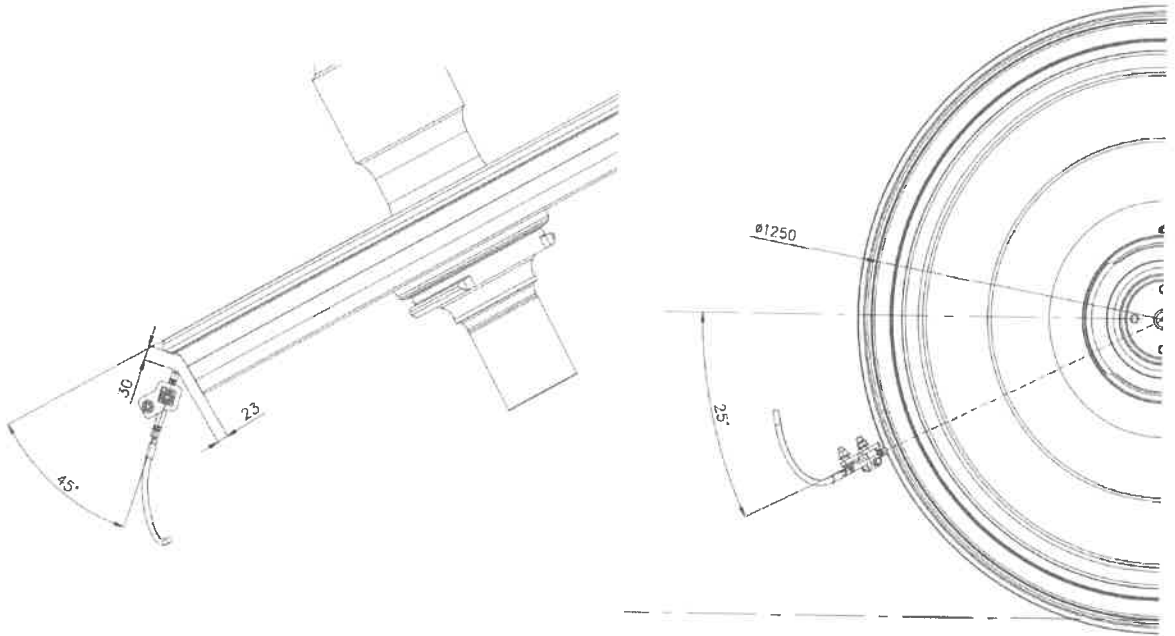
#### 5.6. MANUFACTURING

N/A

#### 5.7. INTERFACE SPECIFICATION

##### 5.7.1. MECHANICAL INTEFRACE

For the mechanical interface refer to the figure 1 reported below:



**Figure 1 - Nozzle installation requirements**

##### 5.7.2. PNEUMATIC INTERFACE

For the pneumatic interface refer to the drawing 012BX0000019-000.

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### 5.7.3. ELECTRICAL INTERFACE

#### General data:

Feeder voltage nominal:	110 V
Voltage range:	according to EN 50155 with nominal voltage = 110 V
Control and solenoid valve voltage:	110V
Temperature range:	-40°C / +70°C, 90% humidity atmosphere
Certification delivery according:	EN 50155, EN 50153, EN 50121-3-2

#### Adjustable controller modes:

Distance depending, curve depending by external curve sensor.

#### Signal interface:

The following signals shall be given to the WFL System by the TCMS (can be changed as a result of the opinions of the company designing the TCMS):

- A pulse (square wave) of 1 sec shall be given every 100 meters as minimum. The lubrication distance shall be easily adjustable for the desided distance with intervals of 100 m up to minimum 1000 m.
- The status/start signal shall be given only when the locomotive has a minimum speed of 10 km/h. The system shall not discharge the lubricant if the locomotive speed is lower than 10 km/h in order to prevent excessive deposit of lubricant on track at stations and marshalling yards.

The following signals shall be given to the TCMS by the WFL System as digital (0V – 110V) (signals can be changed as a result of the opinions of the company designing the TCMS):

- Lubrication normal (Power ON)
- Lubrication Status
- Lubricant Level Warning

These signals can also be visualized in the TCMS technical and diagnostic display on the driver desk.

The 3/2-way solenoid valve of the system shall be energized and switched by the main control unit relay (MCR) of the LOCO basing on travel direction of the vehicle (signal provided by MCR relay of active cabine).

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#### 5.7.4. DIGITAL AND/OR ANALOGUE INPUTS/OUTPUTS

It shall be included all the necessary wired connections to guarantee the correct functionalities of the system, such as to receive command from TCMS and to share to TCMS all necessary diagnostic and status signals. This functionalities and interconnections will be defined in detail during design phase.

Following data shall be shared by the Control Unit to the TCMS:

- Tank level
- Spray action monitoring
- Solenoid valve output monitoring

In order to ensure the correct and complete wiring, communication and exchange of information between the WFL System and the TCMS, the Contractor shall work with the company designing the TCMS if necessary.

#### 5.8. EARTHING

For protective provisions relating to electrical hazards on railway vehicles EN 50153 - standard is valid and shall be obeyed.

All equipment causing an electric shock shall be protected against direct contact.

All conductive surfaces of electrical equipment on the vehicle shall be connected to an earthing point for equalization of the electrical potential.

This includes conductive surfaces of cubicles, doors and covers.

Exceptions are small items of interior trim in an environment otherwise protected by bonding to car body and/or insulation (e.g. grips, coat hooks, etc.).

All equipment operating at AC-voltage >25V or at DC-voltage >60V shall be earthed for safety.

Each earthing point of the equipment shall be designed as follows: the earthing points shall be of good electrical conduction to ensure low touch voltage, the earthing points shall have large contact surface and shall be able to carry a possible short circuit current.

A design according to EN 60529, min IP20 (>12,5mm) is required for cubicles containing Band III voltages.

The min IP20 shall be achieved when there are situations when the cubicle is open and Band III voltage is live.

Each earthing point shall be easily accessible for assembly.

The Contractor shall provide an earthing diagram of its equipment including earthing bonds and shields.

The Contractor shall indicate which cables of his system will be shielded.

Cable shielding may only be used for shielding purposes and NOT as signal, ground or reference wires.

If Contractor does not request different connection, cable shields shall be grounded on both ends in order to obtain high shielding efficiency against electric and magnetic fields.

This requires potential equalisation between both grounding points, e.g. through chassis or appropriate structural components.

Grounding of cable shields shall be made with low impedance (large contact surface, preferably over 360 deg. circumference).

Grounding by means of sheath wires (pig tails) or connector pins is NOT permitted.

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The Low Voltage 0V level in the cars is floating, so shall be avoided an internal connection in the equipment between metallic chassis and the 0V connection; grounding connections in the equipment shall not be connected to car Low Voltage DC power supply.

## 5.9. ENVIRONMENTAL CONDITIONS

### 5.9.1. CLIMATIC CONDITION

The systems and equipment within the scope of this 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 in accordance with the EN 50125-1 standard are defined in the following document:

- TŞ400048 Electric CoCo Locomotive General Technical Specification
- TŞ400049 Diesel CoCo Locomotive 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 be able to demonstrate that the bogie equipment is tested and validated according to IEC61373.

### 5.9.3. PROTECTION (IP)

The design shall provide adequate IP level for protection of the equipment/components pending on their functions.

Electric/electronic equipment shall be protected from external ambient with a minimum IP65 level.

### 5.9.4. PAINTING

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.

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#### 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 service life for systems/equipment/components within the scope of this specification shall be 30 years or more.

#### 5.11. MATERIAL REQUIREMENT

##### 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.

##### 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).

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

Applicable Product type (No)	Definition	Details	Requirement
M3	Hoses-Exteriors	Pipes and hoses for fuel, oils, hydraulics, pneumatics, water and drainage	R9
EL9	Printed circuit boards	Printed circuit boards without any attached technical equipment	R24 or R25
EL1B	Cables for exterior	Cables not compliant with one of the standards referenced in 4.2c	R16

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.

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/Bidder shall be responsible to perform all necessary activities which are required by Notified Body.

### 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

The system/equipment/components supplied shall be provided with technical markings, in order to fulfil requirements of electrical safety, and provide information to maintenance personnel. Wherever required for health and safety purposes, including where necessary to comply with legislation, parts shall be fitted with suitable safety and warning signs.

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In particular, the parts supplied, including all replaceable parts, shall be identified by a label showing:

- Serial number;
- Data of manufacturer
- Date of manufacture
- Contractor's part number (if any)
- Revision level;
- Company's part number (if any)

Format and positioning of all labels/markings shall be subject to approval by Administration. 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.

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## 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

Comprehensive training courses, covering the system/equipment supplied, shall be provided by the Contractor to Administration or Final User personnel free of charge.

The level of training shall be congruent with the complexity and criticality of the system/equipment in object, therefore training performed by the Contractor shall be properly prepared in order to be efficient and effective.

This training shall give to the trainees a general overview of the system/equipment, of its performance, as well as sufficient knowledge for carrying out periodic maintenance of the system/equipment and its components, fault finding and repair and carrying out works both of preventive and of corrective maintenance. Additionally the Contractor shall give detailed training about assembly/disassembly of system/equipment.

Generally the training activities are divided in two steps; the first concerning a general description of the system/equipment and depth training for carrying out scheduled maintenance needed during the first 2 years of operation.

The second step completes the knowledge about all maintenance aspects with particular care to overhaul activities.

The Contractor shall provide training at the Administration's facilities for a minimum of 1 days and a minimum of 8 participants, and at the Final User's facilities for a minimum of 1 days and a minimum of 8 participants.

The training documentation shall be prepared in English and Turkish languages in number of participants by the Contractor. The language of the training shall be Turkish.

The bidder shall propose and detail in the tender phase the training activity to be carried out. Then Administration and the Contractors will discuss and agreed details pending on End Client requirements.

### 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 according to EN15380 and its annexes.

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

The Contractor shall be responsible for ensuring that the maintenance manuals remain up-to-date, accurate, and applicable until the end of the general warranty period of the final delivered product. During this process, the opinions, requirements, and requests communicated by the Administration and/or the End User shall be taken into consideration. The Administration reserves the right to request modifications, corrections, or additions in case the submitted maintenance manuals are found insufficient during its review. The Contractor shall be responsible for carrying out the necessary revisions in a timely and complete manner in line with such requests.

#### 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

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- 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
  - 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 Final User 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.

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- 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
- It is important to properly identify the LRUs/components by utilizing the same identification name reported by the technical drawings.
- All maintenance manuals shall be prepared in electronic format and delivered to the Administration through cloud-based storage with encrypted sharing platforms. The Contractor shall be responsible for delivering each new version/revision in electronic format and for keeping revision records of previous versions. No hard copies shall be delivered. The contractor shall deliver two copies of the manuals with two USB flash drives.
- 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 Final User)
- 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 Administration and the Contractor pending the respect of Final User requirements

## 8. TESTING, INSPECTION AND ACCEPTANCE

LOCO will be certified in accordance with the latest version of the TSI regulations. If all products and services (including hardware, software, system main and subcomponents) to be procured under the tender are evaluated within the scope of TSI requirements, the Contractor will be responsible for all relevant certifications for the equipment to be provided 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.

In the event that any system or component has been previously tested and its adequacy has been demonstrated, and the Administration waives the type test upon finding it acceptable, the Contractor shall submit the following documents to the Administration for approval:

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- A technical analysis explaining the differences between the previously tested product and the product used under the current contract,
- A technical report demonstrating that such differences have no adverse impact on the operation and performance of the product as defined in this specification,
- Approved test procedures, reports, and certificates pertaining to the previously tested product (including repair activities and checklists).

All test and inspection documents, as well as final reports—including the verification of design activities and the assessment of any improvements to the checklists, if applicable—shall be submitted to the Administration and shall only become valid upon approval by the 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, 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. 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 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.

## 8.3. 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.

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

#### 8.4. 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 in accordance with an inspection specification issued by Administration and/or End Client, 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.

During the First Article Inspection (FAI), the Contractor shall have available all pertinent documents related to the design and production process, test records, material certifications, etc. Any nonconformities identified during the FAI shall be considered a critical quality defect. If all requirements are not met, a Hardware Review shall be requested. The Contractor shall initiate a System Review process covering the hardware and associated software components, and shall implement the necessary corrective actions. Upon completion of the System Review, the FAI shall be repeated to verify that the nonconformities have been resolved. The System Review and the repeated FAI shall be carried out in such a manner as not to affect the project delivery schedule.

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 and international accommodation and travel expenses (including round-trip international airfare, accommodation, and transportation between workplaces) for all Administration personnel traveling to the Contractor's facilities for First Article Inspections (FAI) will be covered by the Contractor. Administration personnel will participate in First Article Inspections for a maximum of 6 personnel/ day.

#### 8.5. CONTRACTOR TECHNICAL ASSISTANCE

The Contractor shall provide all the technical assistance necessary for the first installation of the system(s) at Administration.

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

The Contractor shall attend to installation of equipment on the first LOCO, to commissioning in Administration and also to track test on Turkish Railway Network.

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## 8.6. COMMISSIONING

### 8.6.1. TYPE COMMISSIONING TEST

In order to demonstrate the compliance of the supplied products and sub-components (hardware and software) with the requirements of this technical specification and its annexes, static tests (at the Administration's facilities) and dynamic commissioning tests (on railway track) shall be carried out for the first prototype locomotive under the Contractor's responsibility, with the participation of the Administration and the End User, in accordance with the test procedures prepared by the Contractor and approved by the Administration and/or the Notified Body (NoBo).

If the tests to be performed are defined as a 'type test' within the scope of the TSI, the test procedure shall be submitted to and approved by the NoBo (Notified Body). The on-board static and dynamic tests shall be planned in coordination between the Contractor and the Administration and executed with the approval and participation of the NoBo.

### 8.6.2. ROUTINE COMMISSIONING TEST

On the serial LOCOs, routine commissioning test for the system will be performed by Administration in workshop and service track under the Contractor's responsibility.

## 9. AUTHORIZATION TO START PRODUCTION

The Contractor shall prepare a Project Plan covering all information specified in this specification, including the delivery schedule of parts and documents, key milestones, and major activities. The Project Plan shall be subject to the Administration's approval upon each issue. The Contractor shall commence production in line with the Project Plan and shall regularly participate in Project Progress Meetings within the defined schedule. If deemed necessary as a result of such meetings, the Contractor shall update the Project Plan.

Throughout the production process, the Contractor and its Subcontractors shall be responsible for the delivered components and systems. The Administration reserves the right to request modifications or alternative solutions for systems or components if deemed necessary due to installation, operation, interface, or similar reasons; such requests shall be mutually agreed upon during meetings with the Contractor.

Technical modifications prior to the FAI shall be managed under the Contractor's Quality Management System, whereas modifications after the FAI shall be subject to the Administration's approval. The Contractor shall monitor modifications in accordance with the plan and shall notify the Administration of each completed modification, including date, serial number, level, and location information.

### 9.1. DESIGN FREEZING

During the Design Freeze phase, all design data, interfaces, technical drawings, and engineering calculations related to the systems, sub-systems, and components developed under the scope of the

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contract shall be finalized. This phase shall be carried out within the timeframes defined in the project schedule and is mandatory; no design changes shall be made without the written approval of the Administration.

The Contractor shall submit to the Administration all documents forming the basis for the Design Freeze (design reports, technical drawings, interface definitions, and, if applicable, prototype test results) complete and on time.

The Design Freeze shall be completed within the prescribed durations and in accordance with the project schedule.

## 9.2. AUTHORIZATION TO START PRODUCTION

According to the final design criteria mutually agreed upon as a result of the design freeze meetings, the Contracting Authority 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.

## 10. ACCEPTANCE

Acceptance report shall be issued by Administration after followings have been covered:

- Complete delivery of the products and sub-components (hardware/software) within the scope of supply
- Demonstration of compliance with all standards and technical requirements defined in this technical specification and its annexes, supported by conformity declarations, inspection, and test reports
- Complete submission of documentation to the Administration by the Contractor;
- Successful execution of the locomotive system's on-track tests (commissioning type tests);
- Successful completion of the approval process by the NoBo/DeBo.

Acceptance of the first product shall not be construed as acceptance of the entire quantity requested. Each item of the contract shall be evaluated individually, and acceptance shall be carried out separately for each item.

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## 11. PACKAGING AND STORAGE CONDITIONS

### 11.1. PACKAGING

The products and all their sub-components (hardware/software) shall be delivered in suitable packaging with sufficient strength to withstand impacts and transport damage, including effects from climatic conditions such as dust, rain, snow, sun, wind, etc.

Packaging boxes shall be stackable and suitable for lifting by forklift (where reasonably applicable) or overhead crane.

Even if the products cannot be mounted on the locomotive promptly and are stored for long periods (e.g., up to three years) without use, they shall be delivered in packaging that fully protects them from any damage.

All packaging and crates shall carry the following information in a clear, legible, and weather-resistant manner:

- Manufacturer's name, address, and registered logo
- Product name, part number, and technical specification number
- Serial number and manufacturing date (if applicable)
- Contract number and date
- Quantity of products in the package and serial numbers of components
- Batch number (if applicable)
- "Project No: XXXXXX" statement

If a box contains multiple components:

- Each component shall be labeled separately
- A component list shall be included inside and outside the box/crate
- Lists shall be finalized with the Administration's approval

Systems/equipment/components:

- Shall be packaged in sets required for the production of one locomotive
- Packages shall be arranged separately for mechanical and electrical production lines
- Package lists shall be finalized upon the Administration's approval and a copy shall be provided to the Administration prior to shipment

Products and all their sub-components (hardware/software) shall be wrapped in appropriately thick bubble wrap, secured to wooden crates, and delivered on pallets. Crate weights shall not exceed 400–500 kg. Deliveries shall be made to TÜRASAS Eskişehir Regional Directorate, with the costs borne by the Contractor.

If packaging or delivery documents are missing or non-compliant, the situation shall be recorded in a report, and the products shall be returned to the Contractor without acceptance. If the returned

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materials are reshipped after the contractual delivery date, delay penalties shall apply. The Contractor shall not be entitled to any claims due to delays caused by 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 6 shows the documentation which shall be given by the Bidders in the offer phase.

Table 7 and Table 8 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	Scope of supply list			Turkish and English
1.3	General description of the proposed system, including all the characteristics and functionalities and technical documentation and information requested in this specification as preliminary			Turkish and English
1.4	Preliminary 3D models or installation drawings showing the main external space envelope			English
1.5	Preliminary applicable schemes			Turkish and English
1.6	Preliminary definition of main I/F characteristics with the other LOCO systems			Turkish and English
1.7	List of tests (FAI, routine, type, commissioning and homologation) that shall be performed on components and systems			English
1.8	Declaration of Conformity to applicable standards According to EN17050			English
1.9	EC Declaration of Conformity according to the TSI LOC&PAS 1302 if the scope of Supply is considered “Interoperability Constituent”			English
1.10	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 (This certificate will belong to the manufacturer).			English
1.11	List of special tools and test equipment			Turkish and English
1.12	Design schedule, in line with project milestones			Turkish and English
1.13	Sub Contractor List			English
1.14	Detailed part list with price information of each part			Turkish and English
1.15	Delivery time from order			English
1.16	Escalation formula for spare parts			English
1.17	Explanation on how to pack in pieces			Turkish and English
1.18	10-year spare parts supply guarantee commitment (valid from the end of the warranty period)			Turkish and English
1.19	A commitment declaring that the products will be provided in accordance with the standards requested in the technical specification and TSI			Turkish and English
ÜRA F.005		This Technical Specification can not be REPRODUCED OR USED for any purposes without the written consent of TÜRASAŞ		07.04.2016 Rev:02

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Table 6 – 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 after signing the contract	English
2.2	Technical description of the system, with system characteristics and performance		English
2.3	Functional description (normal and degraded mode) of the system, included diagnostic description		English
2.4	Design justification analysis reports		English
2.5	Definition and specification of applicable I/F's characteristic (mechanical, pneumatics, electrical, signals, I/O data, etc.)		English
2.6	Certificates of the fire smoke behaviour of non-metal materials and electric cables		English
2.7	Certificates of behaviour versus applicable emissions requirements		English
2.8	Preliminary applicable analysis reports (performance, consumptions, structural strength, etc.)		English

Table 7 – 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	Within one month before FAI with product/equipment delivery	English
3.2	Definitive schemes		English
3.3	Installation drawings		English
3.4	Installation instruction		Turkish and English
3.5	Detailed description of the supplied components or systems		Turkish and English
3.6	All the technical documentation and information requested during the project (including final version of documents of previous stages), included software documentation		Turkish and English
3.7	Procedures of tests (FAI, routine, type, commissioning and homologation) performed on components and systems		Turkish and English
3.8	Available reports of tests (routine, type, commissioning and homologation) performed on components and systems (including reports on all test results defined in the standards specified in the "Product Definition" section and visual inspection, dimensional inspection reports etc.)		English
3.9	List of special tools and test equipment		Turkish and English
3.10	LRU list		Turkish and English
3.11	Spare Parts and Equipment List (including order codes)		Turkish and English
3.12	Servicing and lubricating table		Turkish and English

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<b>Id.</b>	<b>Stage 3 - DETAIL Review</b>	<b>Time Schedule</b>	<b>Language</b>
3.13	Final documentation for Certification		Turkish and English
3.14	EC Certification according to the TSI LOC&PAS 1302 if the scope of Supply is considered “Interoperability Constituent”		English
3.15	RAMS and LCC documentation: see dedicated paragraphs		Turkish and English
3.16	User Manuals		Turkish and English
3.17	Maintenance Manuals (including periodic maintenance Schedule) (including failure repair documentation)		Turkish and English
3.18	Calculations, tests and analysis reports requested by TSI		Turkish and English
3.19	3.1 certificates of the product/equipment according to EN 10204		English
3.20	Documents showing compliance to EN 45545-2 (Certificate of Conformity, Test Report etc.)		Turkish and English
3.21	Warranty documentation		Turkish and English

Table 8 – 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.

In Stage 1, the IRIS document submitted by the Bidder will be examined by the Administration in terms of its compliance with the scope of the product/work subject to the 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 Stage 1 and Stage 3 will be provided to the Administration in 2 (two) USBs.

Notes:

- All components, including their sub-elements (cables, connectors, etc.), shall be provided as complete 3D models in “.step” format. Connectors shall be prepared separately from the 3D model to allow their use in harness design.
- 2D drawings shall be provided in “.dwg or .dxf” format (plus PDF).
- Electrical schematics shall preferably be provided in EPLAN Electric P8 format; alternatively, in .dwg/.dxf format (plus PDF).
- All documents shall be provided in editable format as well as in PDF.
- In case both Turkish and English are used in the documents, the Turkish version shall be considered authoritative.

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- Documents shall be delivered in a format compatible with the Administration's PLM system.
- All documents shall be prepared electronically and delivered to the Administration via cloud-based storage with secure access. After each update, relevant parties shall be notified by email in accordance with the communication matrix. Alternatively, the digital documents may be delivered on two copies of portable storage media.
- 3D design of electrical equipment and cables shall be provided in Catia Electric format (plus PDF) and/or in EPLAN Pro Panel or EPLAN Harness format.

### 13. INTELLECTUAL AND INDUSTRIAL PROPERTY ISSUES

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.
2. Administration shall be authorized to use the products 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.
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.
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.
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. WARRANTY

#### 14.1. WARRANTY CONDITION

The Contractor shall warrant the quality of the products supplied under this Specification against failures, malfunctions, assembly and workmanship defects, except for cases arising from natural wear and tear and maintenance neglect; for a period of 400,000 km of operation or 24 months from the commissioning date of LOCO, or 36 months from the delivery date of the products to the Administration, whichever expires first.

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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

Starting from the commissioning of the LOCO locomotive and during the warranty period, if a failure within the scope of the warranty occurs in more than 15% of the same part/component in the first 24 locomotives, or in more than 10% of the same part/component in the 25th and subsequent locomotives, due to the same reason, it shall be considered an “epidemic failure.”

Records of systematic failures shall be kept for a period of 24 months following the commissioning of the locomotive.

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.

In case systematic failures are confirmed, the necessary investigations shall be carried out in order to define an appropriate technical solution, including spare part replacement or modification, and a new warranty period for the solution defined within this scope shall be agreed with the Administration.

The Contractor shall perform, within the determined period, all necessary reinforcement, modification, material replacement, assembly and disassembly works at its own expense.

The expiration of the warranty period shall not relieve the Contractor of its obligations related to the subject matter of the contract. The Contractor shall remain responsible for remedying the systematic failures recorded by mutual agreement at the end of the warranty period.

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## 15. OTHER ISSUES

1. For matters not specified in the technical specification, the administrative specification shall apply.
2. The Contractor is responsible for all transportation costs.
3. The Contractor is responsible for work accidents that may occur during the work of the Contractor personnel at Administration.
4. The food and accommodation costs of the Contractor personnel belong to the Contractor.
5. The Contractor must comply with T.B. 2348 in its work within the boundaries of Administration.
6. 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.
7. The contractor must comply with all kinds of warnings, signs and writings within the boundaries of Administration.
8. 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.
9. 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

N/A