TS400026

TECHNICAL SPECIFICATION OF DEAD MAN DEVICE ELECTRIC AND DIESEL ELECTRIC TYPE COCO LOCOMOTIVE

R&D Center Coordinator	Serkan ÇÖKMEZ	
Electric Machinery Factory Manager	Necati C. OTAŞ	
Locomotive Factory Manager	Oğuzhan HOŞGÖR	
Quality Control Coordinator	Tuba N. EROĞLU	

Prepared by	Serdar AĞALAR	Güzin TUTAR		
Date of Prep.	08.07.2026			

Revision Table			
Rev.	**Date**	**Description of Revision**	**Revised By**
A	03.11.2026	Under the heading **5.3. ELECTRICAL MAIN SPECIFICATIONS**, the term "Supply Interruption Tolerance Class: S3" has been changed to "Supply Interruption Tolerance Class: S2."	Serdar AĞALAR

CONTENTS

1. SUBJECT AND SCOPE 5
2. DEFINITIONS & REFERENCE DOCUMENTS 6
2.1. INTRODUCTION 6
2.2. ACRONYMS AND DEFINITIONS 6
2.3. REFERENCE DOCUMENTS 7
2.4. SCOPE OF SUPPLY 8
2.4.1. HARDWARE 8
2.4.2. SOFTWARE 8
2.4.3. SPECIAL TOOLS 9
3. STANDARDS TO BE COMPLIED 10
4. TSI REQUIREMENTS AND DOCUMENTATION 12
4.1. TSI CERTIFICATION 12
4.2. EC CERTIFICATION OF CONFORMITY AS INTEROPERABILITY CONSTITUENCE 12
5. TECHNICAL SPECIFICATIONS 13
5.1. INTRODUCTION 13
5.2. FUNCTIONAL REQUIREMENTS 13
5.3. ELECTRICAL MAIN FEATURES 14
5.4. APPLICATION SOFTWARE 14
5.5. DIAGNOSTIC 14
5.6. WEIGHT 15
5.7. MANUFACTURING 15
5.8. INTERFACE SPECIFICATION 16
5.8.1. MECHANICAL INTERFACE 16
5.8.2. ELECTRICAL INTERFACE 16
5.8.3. Digital Inputs/Outputs 16
5.9. EARTHING 17
5.10. ENVIRONMENTAL CONDITIONS 18
5.10.1. CLIMATIC CONDITION 18
5.10.2. NOISE, VIBRATION AND SHOCK 18
5.10.3. PROTECTION (IP) 18
5.10.4. ELECTROMAGNETIC COMPATIBILITY (EMC) 18
5.11. SYSTEM AND COMPONENTS LIFE 18
5.12. MATERIAL REQUIREMENT 18
5.12.1. GENERAL REQUIREMENTS 18
5.12.2. FIRE RESISTANCE BEHAVIOUR 19
5.12.3. SMOKE OPACITY AND TOXICITY 20
5.13. LABELS/MARKING 20
6. RELIABILITY, AVAILABILITY, MAINTAINABILITY AND SAFETY (RAMS) REQUIREMENTS 21
7. TRAINING AND MANUAL 22
7.1. TRAINING 22
7.2. MAINTENANCE MANUAL 22
7.2.1. MAIN FEATURES OF THE MANUAL 22

7.2.2. CONTENTS OF THE MANUAL 23
7.2.3. FORMAT OF THE MANUAL 24
8. TESTING, INSPECTION AND ACCEPTANCE 26
8.1. INTRODUCTION TO TEST AND INSPECTION 26
8.2. TYPE TESTS 26
8.3. ROUTINE TESTS 27
8.4. FIRST ARTICLE INSPECTION 27
8.5. CONTRACTOR TECHNICAL ASSISTANCE 28
8.6. COMMISSIONING 28
8.6.1. TYPE COMMISSIONING TEST 28
8.6.2. ROUTINE COMMISSIONING TEST 28
9. AUTHORIZATION TO START PRODUCTION 29
9.1. DESIGN FREEZING 29
9.2. AUTHORIZATION TO START PRODUCTION 29
9.3. AUTHORIZATION TO START MASS PRODUCTION 29
10. ACCEPTANCE 30
11. PACKAGING AND STORAGE CONDITIONS 31
11.1. PACKAGING 31
11.2. STORAGE CONDITIONS 32
11.3. MOUNTING AND HANDLING 32
12. DOCUMENTS TO BE DELIVERED TO THE ADMINISTRATION ALONG WITH THE PRODUCT/EQUIPMENT 33
13. INTELLECTUAL AND INDUSTRIAL PROPERTY ISSUES 37
14. WARRANTY 38
14.1. WARRANTY CONDITION 38
14.2. SYSTEMATIC FAULT / EPIDEMIC FAILURE 38
15. OTHER ISSUES 40
16. ANNEXES AND NOTES 41

LIST OF TABLES

Table 1 – Acronyms and Definitions 7
Table 2 – Reference Documents 7
Table 3 – Equipment quantity 8
Table 4 – Applicable Standards 11
Table 5 – Digital Inputs 16
Table 6 – Digital Outputs 17
Table 7 – Material Fire Behaviours 19
Table 8 – Stage 1 Offer Phase: list of requested documents and due date 33
Table 9 – Stage 2 list of requested documents and due date 34
Table 10 – Stage 3 list of requested documents and due date 35

1. SUBJECT AND SCOPE

This technical specification describes the technical requirements for the procurement of the DEAD MAN DEVICE 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 LOCO - General Technical Specification
TŞ400049 – DIESEL LOCO - 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. (TÜRASAŞ)
- "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

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
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
DMD	Dead Man Device

Table 1 – Acronyms and Definitions

2.3. REFERENCE DOCUMENTS

In the following table the documents used for

Ref	Document	Title
1	TS400048	Electric General Technical Specification
2	TB50160	Standard List
3	TB50165	RAMS Target Allocation
4	TS400049	Diesel General Technical Specification
5	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 DMD, to be used in the LOCO.

The Dead Man Vigilance Device system shall consist of:

- A control unit
- Sound indicators
- Foot switches
- All particular cables and connectors relevant to the Dead man's vigilance device as male and female with pins shall be provided by Contractor (fixed and mating connectors have to be included in the SOS)
- If any, all other equipment and material which are necessary for functionality and installation of Dead-Man System
- Mechanical fixation items, such as brackets, screws, nuts, bolts …

The quantity of Dead Man System's equipment is given in the following table:

Part Name				Per each LOCO
	CAB 1	Cabinet	CAB 2	Total
Control Unit		1		**1**
Sound Indicator	1		1	**2**
Foot Switch	1		1	**2**

Table 3 – Equipment quantity

2.4.2. SOFTWARE

The 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 system maintenance and operation of the system so that the minimum will be as follows:

1. Operational Software
2. If it is necessary Diagnostic &Test Software
3. All the documentation including software operation, user and maintenance manual as well as user manual for the all development & test software and diagnostic software.

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

If any, Contractor shall provide diagnostic software tools as 6 pieces (programs, special connection cables, licences, CBM data cloud access and analysis, etc.).

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 2 for the system and software has been prepared according to SIL requirements according to EN50128 at Stage 3 (see §12 Table 10).

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.

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.).

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 Administration 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 Administration for approval. However, the approval process shall not exceed two (2) months (60 calendar days) from the date the amendment enters into force.
- The Administration 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 Administration in writing, together with proposals, in case of:

- Any inconsistency, contradiction, or violation with international standards,
- Problems that may arise in implementation,
- 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 - Contractor'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
EN ISO 14040	Environmental management - Life cycle assessment - Principles and framework
EN 50121	Railway applications. Electromagnetic compatibility
EN 50124	Railway applications. Insulation coordination.
EN 50125-1	Railway applications – Environmental conditions for equipment – Part 1: Equipment on board rolling stock
EN 50126	Railway applications. The specification and demonstration of reliability, availability, maintainability and safety (RAMS).
EN 50153	Railway applications. Rolling stock. Protective provisions relating to electrical hazards
EN 50155	Railway applications - Electric equipment used on rolling stock
EN 61373	Railway applications. Rolling stock equipment. Shock and vibration tests
IEC 60529	Degrees of protection provided by enclosures (IP Code)
IEC 61508	Functional safety of electrical/electronic/programmable electronic safety related systems.
IRS 50641	Conditions to be fulfilled by automatic vigilance devices used in international traffic

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.

4. TSI REQUIREMENTS AND DOCUMENTATION

4.1. TSI CERTIFICATION

The LOCO shall be certified according to current version TSI PAS/LOC, 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 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 will submit them in Stage 3, see §12 Table 10) 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.

4.2. EC CERTIFICATION OF CONFORMITY AS INTEROPERABILITY CONSTITUENCE

N/A

5. TECHNICAL SPECIFICATIONS

5.1. INTRODUCTION

Dead man's control system shall be a SIL 2 safety system which controls the alertness of the driver.

It shall consists of a dead man control unit, a sound indicator, a foot control switch, a visual indicator and a push button (the last two not into scope of supply) and other input signals.

In case when the driver (for any reason) is not alert, the dead man's control unit produces light and sound signals.

If the driver does not react to light and sound signals, the dead man's control unit will begin the braking process of the LOCO opening the braking loop of the train.

Dead man's control unit shall be designed according mainly to following standards:

- EN 50155
- IRS 50641

5.2. FUNCTIONAL REQUIREMENTS

The system shall comply with all the requirements of TSI LOC&PAS, chapter 4.2.9.3.1. The main requirements for the Dead Man System are summarized in the following paragraph.
The system shall continuously monitor driver activity when the train is in driving configuration(driver desk active) and in motion, with motion determined through a predefined low-speed threshold interfaced by two digital inputs, priority will give to the ETCS until the ETCS is bypassed by means of the dedicated digital input. Monitoring shall be based on detecting interactions with recognised driver interfaces listed in chapter 5.8.3. A Lack of Driver Activity condition shall be triggered if no interaction is detected on any recognised interface for more than X seconds, where X is adjustable during maintenance activities within a range of 5 to 60 seconds. The same condition shall also be triggered if an identical driver action is continuously detected for more than 60 seconds without any additional interaction. Before triggering this condition, the system shall issue a warning to the driver to allow timely reaction, this occurs in two steps the first one lasting 2.5 seconds a blinking light on the driver desk and the second step lasting 2.5 seconds a buzzer in the driver cab. When a Lack of Driver Activity condition is detected while the train is in driving configuration and moving, the system shall automatically initiate an Emergency Brake application. The system shall also provide the status "Lack of Driver Activity Triggered" for interfacing with external systems, including the radio system by means one digital output and also on the ethernet interface.

The Dead Man system shall implement a Departure Authorization Control function that activates when the "train at standstill" information disappears, ensuring that any train departure is intentional and the driver is attentive. For a period of 5 seconds after the standstill condition is lost, the system shall monitor only the vigilance pedal and the vigilance button or touch sensor on the master controller knob, with driver activity defined as any change of state on these devices during this interval. If no such activity is detected, the system shall first issue a warning to the driver and, if no

response follows, it shall command the emergency brake. This function ensures that the absence of driver activity at the moment of departure is detected and mitigated to maintain safe operation.
All the functions and triggers are defined in the preliminary design stage but other conditions can be added by the Supplier and the Administration during detail phase.

5.3. ELECTRICAL MAIN FEATURES

The device need to be fully comply with the EN 50155 and IRS 50641.
Nominal Supply voltage: 110V DC
Interruption Voltage Supply Class: S2
Operating temperature range: OT3,ST1, H1
Electrical connections: using connectors for all the interfaces, terminals are not admitted

5.4. 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.

SIL level for the system is 2, a SIL certification of system including software and hardware, issued by independent authority according to relevant railway standards, shall be delivered by Contractor.

Temporary acceptance can be done without delivery of SIL certification, but final acceptance is subject to delivery of SIL certification.

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 10).

5.5. DIAGNOSTIC

The Dead man device shall be equipped with a diagnostic system, continuously running, and able to verify the status of the main components and share, via opportune output interfaces, all the main failure data to guarantee immediate information to the crew (on the MMI monitors).

Contractor shall declare what is the connection to be considered to TCMS.

For the connection to TCMS, Contractor shall cooperate with TCMS the Contractor for the definition of all the information available.

All kind of failures shall be available at LRU level; complete LRU list, maintenance troubleshooting and instructions shall be defined by the the Contractor and validated by the Administration before the first installation.

A self-test feature shall be included into the Dead Man Control Unit, to guarantee functionalities of the system.

Functionalities of this feature shall be described by the bidder during design phase.

5.6. WEIGHT

The total equipment weight shall be maximum 10 kg.

5.7. MANUFACTURING

The dead man's control unit shall consist of a box with one electronic module inside, this module shall contain complete logic circuitry of dead man's control unit.
All input signals shall be isolated with opto-couplers and the output signals shall be galvanic isolated with relays.
The electronic boards shall be manufactured in compliance with IPC Class 3 requirements.
The Contractor shall indicate possible compliance with IPC-A-610G-R (Rail Transit Addendum to IPC-A-610G: Acceptability of Electronic Assemblies).

During the usage of the dead man's control unit, the box of this unit shall be sealed, to visibly inform if maintenance personnel or crew personnel has open the box.
The speaker can be placed in a sturdy metal housing, to protect it mechanically, the membrane of the loudspeaker shall be made of plastic and the loudspeaker shall be water and dust protected.
Input connection shall be made with opportune connector.
The foot switch device shall be made of aluminum alloy AlSiO12 with plastic surface protection film in grey color.
The device shall be fastened to the vehicle with at least 4 screws.
At the time of fastening process shall not be necessary to remove the foot button from the pedal switch box (which is the support system of the foot button).
In the pedal switch box, there shall be at least 3 electrical switches element with a contact for rated current min and breaking capacity min 300 mA /150 Vdc/30 ms. The pedal auxiliary switches must be of the type snap-action switches with positive opening operation and self-cleaning contacts, designed for high reliability at low current operation (24V/2mA) and compliant with the requirements of the IEC 60947-1 and IEC60947-5-1.
The expected mechanical durability must be at least 30 million operations.
One mechanical limiter shall be placed on the foot switch device for mechanical protection of the electrical switch element. The position of this mechanical limiter shall not have the influence on safe switching of the switch element.
For ensuring the larger factor of friction, pedal shall be cover with rubber or the surface of pedal shall be made by perforated aluminium.
The foot switch device shall be very robust and doesn't require any kind of maintenance.

5.8. INTERFACE SPECIFICATION

5.8.1. MECHANICAL INTERFACE

Dead Man Device control unit shall be or panel type or rack type, if possible 19" max 3U (or smaller).
Foot pedal shall be adequate to be installed in the driver desk bottom area.
Speaker shall be adequate to be installed into roof of the cabin area.

5.8.2. ELECTRICAL INTERFACE

Contractor shall declare the type of connector used in the system, all connectors shall be supplied as mating and fixed parts and complete with all the pins.

5.8.3. Digital Inputs/Outputs

TBD according to the required functionalities.
The Dead-Man system shall monitor driver activity by processing both digital inputs. For all recognised digital inputs, the system shall detect every 0→1 and 1→0 transition, and each transition shall be considered a valid driver action for resetting the activity monitoring timer.
The system shall provide the necessary interfaces for the following digital inputs and outputs, as detailed in the tables below:

Digital Inputs				
Category	**Description**	**Cab 1**	**Cab 2**	**Total**
Standstill Information	Not-standstill information for ETCS	-	-	2
Standstill Information	Not-standstill information for WSP	-	-	2
Driver Desk	Driver desk enable	2	2	4
Driver Activity Reset	Dead-man pedal	3	3	6
Driver Activity Reset	Dead-man touch sensor on master controller	1	1	2
Driver Activity Reset	Horn	2	2	4
Driver Activity Reset	External light commands	2	2	4
Driver Activity Reset	Pneumatic brake controller	1	1	2
Driver Activity Reset	ASC Lever	1	1	2
Driver Activity Reset	Master Controller	1	1	2

Table 5 – Digital Inputs

Digital Outputs		
Category	**Description**	**Quantity**
Output Command	Lamp command	1
Output Command	Acoustic signaling	1
Output Command	Emergency brake activation	1
Output Command	Activity timer reset	1

Table 6 – Digital Outputs

5.9. 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.
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.

5.10. ENVIRONMENTAL CONDITIONS

5.10.1. 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

5.10.2. NOISE, VIBRATION AND SHOCK

General noise vibration and impact conditions are reported in the already mentioned in General Tech Spec and Noise Requirement document.

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

5.10.3. PROTECTION (IP)

N/A

5.10.4. ELECTROMAGNETIC COMPATIBILITY (EMC)

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

5.11. SYSTEM AND COMPONENTS LIFE

The service life for systems/equipment/components within the scope of this specification shall be 30 years or more.
In case of any component obsolescence happening during the 30 years lifetime, the upper level LRU may be replaced with an equivalent LRU with identical Functionality, Dimensions, Interfaces and Aspect. The Contractor shall detail the obsolescence management plan able to prevent possible service life interruption of the dead man device due to spare parts unavailability.

5.12. MATERIAL REQUIREMENT

5.12.1. 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.

5.12.2. FIRE RESISTANCE BEHAVIOUR

According to TSI LOC&PAS materials requirements for fire resistance behaviour are expressed through the index R(n) described in the standard EN 45545-2, "Table 5". 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.

These requirements for materials depend not only on the component intrinsic nature, but also on the position, shape and layout, surface exposure, relative mass and thickness of the material considered.

To identify the relevant R (n) requirements, in "Table 2" of the standard EN 45545-2 several products and their position on the train are listed.

In the table below the material requirements for the components of the cars are reported.

Applicable Product type (No)	Definition	Details	Requirement
EL1A	Cables for interior	Cables not compliant with one of the standards referenced in 4.2c	R15
EL10	Small Electrotechnical products	Examples include low power circuit breakers, overload relays, contactors, contactor relay, switches, control or signalling switches, terminals, fuses	R26
EL9	Printed circuit boards	Printed circuit boards without any attached technical equipment	R24 or R25

Table 7 – Material Fire Behaviours

Any material used, even if not included in Table above, must meet the requirements specified in chapter 4 of the EN 45545-2 standard.

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

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

5.12.3. 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.

5.13. 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.

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/marking shall be subject to approval by Administration. Wherever possible, the position shall be such that any company information (Logo and brand etc) cannot be viewed when the relevant part is installed within the vehicle.

All labels shall be permanent and indelible.

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

The Contractor shall make RAMS analysis according to TB50165.

7. TRAINING AND MANUAL

7.1. TRAINING

Comprehensive training courses, covering the system/equipment supplied, therefore 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 give 1 day training for Administration personnel for the equipment in Administration facilities.
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 Contractor 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.

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
  - 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.
- 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)
- 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 or PNG format.
- Pictures should be only TIFF or PNG 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:

- 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 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 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.

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 partinent 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 facilities.

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.

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 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 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.

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.

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 TÜRASAŞ 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

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.

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	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 or ISO 9001 Certification of the Bidder (If the Bidder is an agency of the manufacturer, the Bidder shall show the manufacturer's certificate)		English
1.11	List of special tools and test equipment		Turkish and English
1.12	Project 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

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	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 or declaration of conformity of the fire smoke behaviour of non-metal materials and electric cables		English
2.7	Certificates or declaration of conformity of behaviour versus applicable emissions requirements		English
2.8	Preliminary applicable analysis reports (performance, consumptions, structural strength, etc.)		English

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

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 / 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	Avaliable reports of tests (routine, type, commissioning and homologation) performed on components and systems		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
3.13	Final documentation for Certification		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

Id.	Stage 3 - DETAIL Review	Time Schedule	Language
3.17	Maintenance Manuals (including periodic maintenance Schedule, failure repair documentation)		Turkish and English
3.18	Calculations, tests and analysis report 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 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.

In Stage 1, the IRIS or ISO9001 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.
- 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

The following issues should be taken in account:

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 right 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.

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.

15. OTHER ISSUES

Following points have to be considered:

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

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

16. ANNEXES AND NOTES

N/A