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TS400052

TECHNICAL SPECIFICATION OF VACUUM CIRCUIT BREAKER FOR ELECTRIC COCO LOCOMOTIVE

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1. SUBJECT AND SCOPE

This technical specification describes the minimum technical requirements for the procurement of the VACUUM CIRCUIT BREAKER to be installed on 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 case of any discrepancy between the two, the Turkish language shall prevail.

IMPORTANT NOTE:

The present document shall be examined by the Bidder, together with the following document:
TS400048 – ELECTRIC LOCO General Technical Specification
in order to know general applicable requirements established at LOCO level.

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2. DEFINITIONS & REFERENCE DOCUMENTS

2.1. INTRODUCTION

In this Technical Specification, the following definitions apply:

- **“The 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 oversees use, maintenance, repair etc. the LOCO.
- **“The Administration”** means the Turkish Railway Vehicles Industry Inc. (TÜRASAS)
- **“The Contractor”** means the company who wins the tender to supply the good object of this specification.
- **“The Bidder”** means the company who want to join to the tender to supply the good object of this specification.
- **“Documentation”** means all or any specifications, drawings, reports, networks, operating and maintenance manuals and all other information whether on paper or on magnetic or other format which is prepared by the Contractor during the contract.

2.2. ACRONYMS AND DEFINITIONS

The acronyms used in this document are reported in the following Table

Acronyms	Description
TCDD	Turkish State Railways General Management
TCDDT	Turkish State Railways Transportation Inc.
TSI	Technical Specification for Interoperability
UIC	International Railway Association
RAMS	Reliability - Availability- Maintainability- Safety
TCMS	Train Control Management System
EN	European Standard
TSE	Turkish Standards Institute
UNI	National Standards Unit
EC	European Community
ISO	International Standard Organization
CAD	Computer Aided Drawing
LOCO	Electrical Mainline Locomotive
NoBo	Notified Body
TSI LOC&PAS	Document 1302/2014 / EU of the European Commission Amended by: ► M1 Commission Regulation (EU) 2016/919

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	► M2 Commission Implementing Regulation (EU) 2018/868 ► M3 Commission Implementing Regulation (EU) 2019/776 ► M4 Commission Implementing Regulation (EU) 2020/387 ► M5 Commission Implementing Regulation (EU) 2023/1694 ► C1 Corrigendum, OJ L 10, 16.1.2015
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 2023/1695/EU of the European (the technical specification for interoperability relating to the control-command and signalling subsystems of the rail system in the European Union)
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
LV	Low Voltage
MV	Medium Voltage
HV	High Voltage
VCB	Vacuum Circuit Breaker
EHS	Earthing Switch
TSA	Trafo Surge Arrester
SW	Software
CBM	Condition based maintenance
LRU	Line Replaceable Unit
LCC	Life Cycle Cost

Table 1 – Acronyms and Definitions

2.3. REFERENCE DOCUMENTS

In the following table the documents used for

Ref	Document	Title
1	TS400048	Electric Loco General Technical Specification
2	TB50160	Standard List
3	TB50165	RAMS Target Allocation
4	012GX0000201-000	Electric Type Locomotive Mechanical Lay-out
5	TB2348	The rules that the contractor to obey and the responsibility of the contractor

Table 2 – Reference Documents

ÜRA F.005	This Technical Specification cannot be REPRODUCED OR USED for any purposes without the written consent of TÜRASAS	07.04.2016 Rev:02
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2.4. SCOPE OF SUPPLY

2.4.1. HARDWARE

The Bidder/Contractor shall provide all relevant components related to the equipment, installed in the LOCO:

- Vacuum circuit breaker
- Earthing switch + surge arrester
- All cables and connectors/connections relevant to the equipment as male and female with pins (crimp contact) shall be provided by Supplier
- If any, all other equipment and material which is necessary for functionality and installation

The quantity of equipment is given as in the following table:

Part Name	Per LOCO			TOTAL
	CAB1	Roof	CAB2	
VCB (including EHS and TSA)		1		1
LV Mobile Connector Kit		1		1
Spare Master Key (§5.3.1 - Key A)				1
Spare Slave Key (§5.3.1 - Key B)				1

Table 3 – Material Quantity

2.4.2. SOFTWARE

N/A

2.4.3. SPECIAL TOOLS

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

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

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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 (2D/3D)
- use instructions
- list of tasks where the tools usage is mandatory (Maintenance Cards shall refer to the relevant special tools when is needed)
- all the information for purchasing it correctly (technical data, builder, price, and so on) if the special tool is available on the market

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 published in accordance with TSE directives and related annexes
- **Unit System:** SI (International System of Units)

The complete standards list is indicated in the TB50160.

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 Employer in writing, together with proposals, in case of:

- any inconsistency, contradiction, or violation with international standards,

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

Standard	Title
EN 17050	Conformity assessment - Contractor's declaration of conformity
EN 45545 series	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
EN 50121-3-2	Railway applications - Electromagnetic compatibility
EN 50124-1	Railway applications - Insulation coordination
EN 50126	Railway applications - The specification and demonstration of reliability, availability, maintainability and safety (RAMS).
EN15380	Railway applications - Classification system for railway vehicles - Part 5: System Breakdown Structure
EN 50153	Railway applications - Rolling stock. Protective provisions relating to electrical hazards
EN 50155	Railway applications - Electronic equipment used on rolling stock
IEC 60529	Degrees of protection provided by enclosures (IP Code)
EN 61373	Railway applications - Rolling stock equipment – Shock and vibration tests
EN 50163	Railway applications - Supply voltages of traction systems
EN 50388	Railway applications - Power supply and rolling stock - Technical criteria for the coordination between power supply (substation) and rolling stock to achieve interoperability
EN 60077	Railway applications - Electric equipment for rolling stock

Table 4 – Applicable Standards

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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/Contractor shall comply with the specific standards indicated; all norms shall be considered with the version indicated in the relevant TSI list. If a norm is not listed in the TSI list, the latest version available at the time of contract signature shall apply.

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4. TSI REQUIREMENTS AND 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 with the EN17050 Norm and shall include also the following documents:

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

The circuit breaker object of present Technical Specification is an Interoperability Constituent.

The Bidder can join the tender with or without EC Certification of Conformity.

In any case the circuit breaker shall be supplied with its own EC certification of conformity according to the TSI LOC&PAS by the Supplier.

The EC certification of conformity shall include also the following documents:

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

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

The documentation presented by the Bidder or the Supplier relevant to the EC Certification of Conformity according to the TSI will be examined for approval by the Notified Body in charge of TSI certification of the LOCO nominated by ADMINISTRATION.

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

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5. TECHNICAL SPECIFICATION

5.1. INTRODUCTION

This document defines the requirement for the design and test of the components defined into section §2.4 for the LOCO project.

HV line is reported in the scheme below:

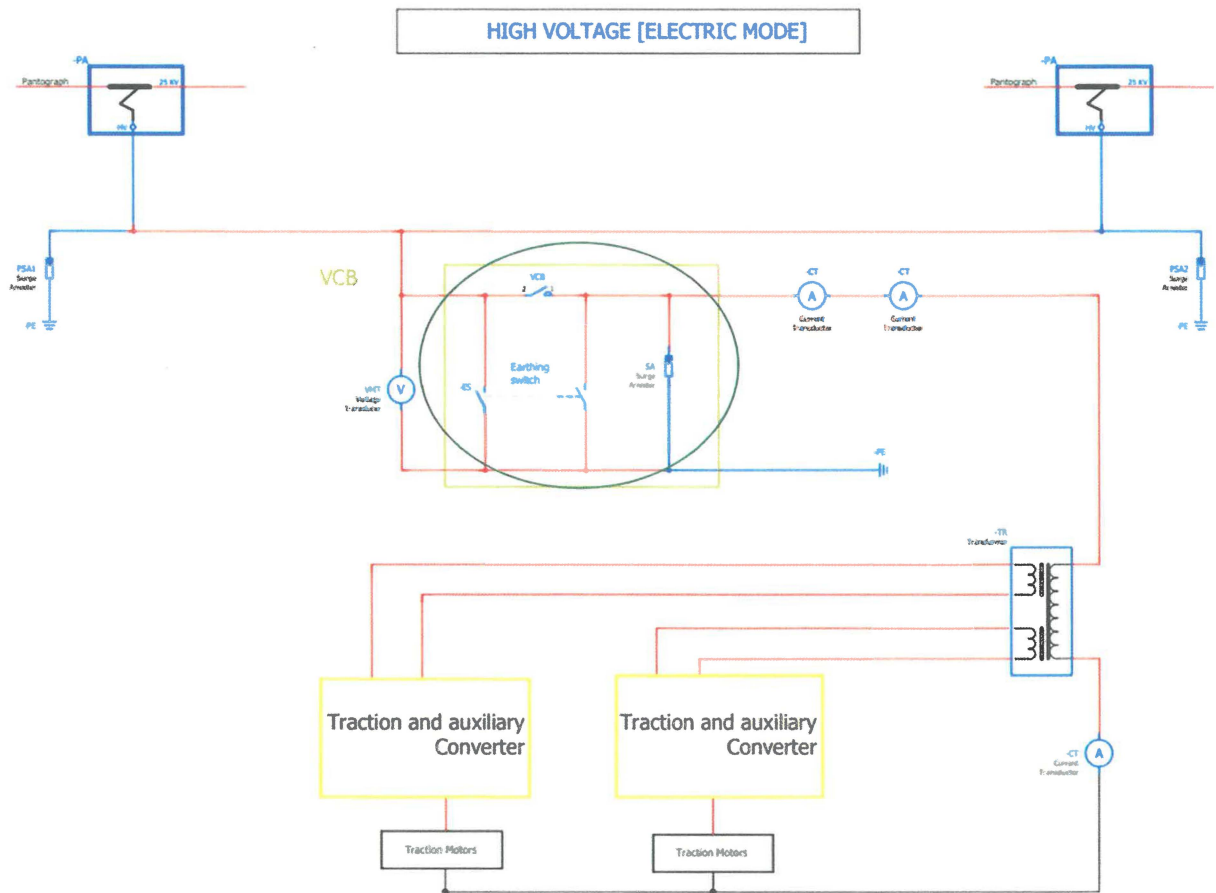


Figure 1 – HV connection scheme concept

Elements included into this technical specification are circled by green colour.

Following section will describe the main characteristics of the components listed in section §2.4. Bidder shall provide a reference list, showing that the proposed equipment/system manufacturer's products are operated in minimum three projects and in commercial operations with minimum 120 km/h speed.

5.2. VACUUM CIRCUIT BREAKER

The main circuit breaker will be used as a line circuit breaker to open and close the power circuit and to cut the circuit in overload or short circuit situations.

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Vacuum circuit breaker shall have following minimum characteristics:

Nominal maximum working voltage	27500V
Nominal minimum working current	500A
Frequency	50Hz
Peak current (short circuit)	50kA
Nominal breaking current (short circuit)	20kA
Rated insulation voltage	30kV
Rated impulse withstands voltage (1.2/50us)	125kV
Operational category	C3

For auxiliary low voltage equipment, shall be considered following parameters:

Nominal control voltage	Un	110Vdc
Voltage range		$0.7 \leq V \leq 1.25 \text{ Un}$
Max required power (charging)		180W (at Un and Tamb=20°C)
Max time to charge		<12s
Nominal holding power		$\leq 35\text{W}$ (at Un and Tamb=20°C)
Opening required power		0W
Mechanical opening time		$\leq 50 \text{ ms}$
Mechanical closing time		$\leq 65 \text{ ms}$
Minimum mechanical life		250.000 cycles

Shall be included with the vacuum circuit breaker a series of minimum 8 auxiliary switches type SPDT (4 Normally open and 4 Normally closed) for detecting the open and close position, directly connected to the vacuum contactor position for Loco functions.

The material for the auxiliary contacts needs to be hard silver or gold.

Shall be also included an auxiliary contact for the state of the vacuum breaker circuit (vacuum ready to close or vacuum not ready to close).

Vacuum control shall be opto-isolated from LV train line, shall be considered a directly integrated wiring or a diagram scheme to be applied on the roof equipment to avoid possibility to:

- Close vacuum in case of earthing switch closed
- Close earthing switch in case of vacuum closed

A transient inductor shall be considered and included, attached to the vacuum, to protect the HV line from transient spikes generated by the Vacuum.

The vacuum circuit breaker will be switched on and off by TCMS. The Contractor shall provide the appropriate interface connection.

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5.3. EARTHING SWITCH AND SURGE ARRESTER

5.3.1. Earthing Switch

The manual earthing switch is parts of the main circuit breaker.

The manual earthing switch, to be installed in parallel to the vacuum breaker, shall have following minimum characteristics:

- Short circuit current level: The earthing switch shall be able to withstand short circuit current of 15 kA and time duration and 120 ms as defined in the EN 50388-1.

Shall be included into the earthing switch a series of minimum 4 auxiliary contacts type SPDT (2 normally open and 2 normally closed), directly connected to the earthing switch contactor position, for train functions.

Manual system shall be considered to manually open/close, from inside the car.

The earthing switch operation is part of the procedure that guarantees the electrical safety of maintenance staff. The procedure consists of the following steps:

1. Lock the Driver's Desk: The driver's desk is locked off by removing the key from the master controller.
2. Cut Off Pneumatic Supply to Pantographs: The pneumatic air supply to both pantographs is cut off by operating a safety valve with suitable keys.
3. Set the Earthing Switch to Ground Position: The earthing switch is set to the *ground position* by inserting and rotating Key A, which is available only when both pantograph valves are in the cut-off position.

To prevent the reverse operation (returning to the service position), a second key located on the VCB panel (Key B) must be rotated and removed.

This same Key B also enables the safe discharge of the traction circuit high-voltage capacitors.

Key Requirements:

- Both Key A and Key B shall be of the Kaba type.
- Key codes and colours will be defined during the detailed design stage.
- The key code is standardized and identical across all locomotive units

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5.3.2. Surge arrester

Trafo surge arrester (TSA) shall be installed close to the vacuum circuit breaker.

Main characteristics of this TSA are:

- Nominal discharge current in 8/20 μ s 20 kA peak
- Line discharge class (LD) 4
- High current impulse I_{hc} 4/10 μ s 100 kA peak (Max residual voltage ≤ 125 KV)
- Long duration current impulse 1350 A / 2000 μ s
- Short circuit rating I_s 50 Hz 63 kA rms for 0.2 s

Continuous operating voltage	Rated voltage	Residual voltage U_{res} at specified impulse current (Maximum value)									
		Steep current impulse wave 1/... μ s		Lightning current impulse wave 8/20 μ s					Switching current impulse wave 30/60 μ s		
U_c	U_r	10 kA	20 kA	2 kA	5 kA	10 kA	20 kA	40 kA	500 A	1000 A	2000 A
kVrms	kVrms	kVpeak	kVpeak	kVpeak	kVpeak	kVpeak	kVpeak	k kVpeak	kVpeak	kVpeak	kVpeak
33	41.3	104.4	112	87.4	91.7	95.7	104.4	116.8	80.8	83.1	85.7

5.4. WEIGHT

The Supplier shall be committed to the process of weight management required to meet target weights as the train design develops. The total maximum allowed weight for the complete system is **120 kg**, as referenced in:

- 012GX0000201-000 – Electric Type Locomotive Mechanical Layout.**

5.5. MANUFACTURING

The equipment shall be installed on the roof, if some parts of the equipment require holes/cuts, on the roof, to be installed, they must be clearly indicated in the offer.

In any case the installation requirement shall follow the maximum spaces and sections visible in layout.

All the components shall be supplied complete with all the mechanical interfaces necessary to be fixed on the roof.

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An example of complete vacuum equipment is visible in the image below:

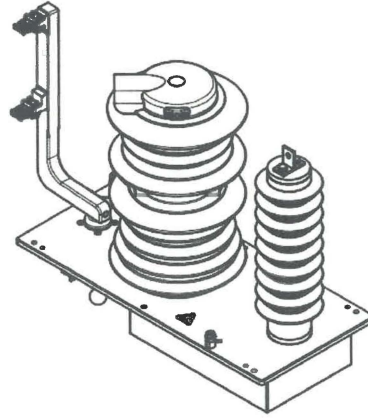


Figure 2 – Vacuum equipment with surge arrester and earthing switch, for reference

These are examples of the component maximum dimensions:

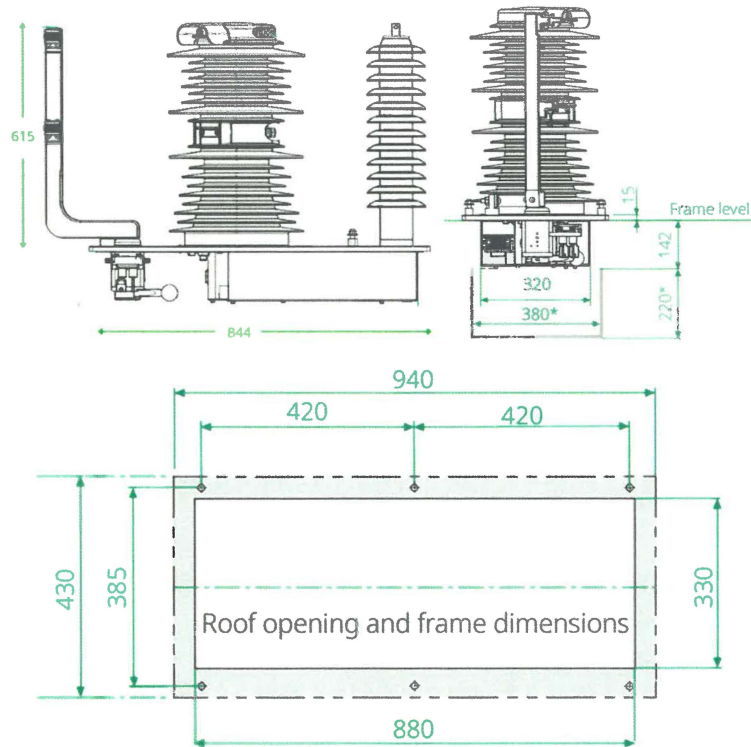


Figure 3 – Max Dimensions of VCB

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5.6. 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 must be defined by ADMINISTRATION during design meetings.

5.7. INTERFACE SPECIFICATION

5.7.1. Mechanical Interface

The maximum overall dimensions of the equipment can be found in the general layout drawing referenced:

- **012GX0000201-000: Electric Type Locomotive Mechanical Layout**

5.7.2. Pneumatic Interface

N/A

5.7.3. Electrical Interface

Vacuum equipment:

- shall be included a series of information to guarantee the correct installation of cables or cable glands for each HV cable (connected with terminal)
- shall be considered LV connectors, Harting type, for command and auxiliary contacts

HV earthing switch:

- LV connection via opportune IP65 connector, Harting type, if the connection is not already included in the vacuum connector

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.

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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 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.

5.9. ENVIRONMENTAL CONDITIONS

5.9.1. CLIMATIC CONDITION

The system object of the present document 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 are reported in the general technical specification:

- **TS400048 – Electric Loco General Technical Specification.**

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5.9.2. NOISE, VIBRATION AND SHOCK

General noise vibration and impact conditions are reported in the already mentioned in General Technical Specification 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.

5.9.3. PROTECTION (IP)

IP level of the component; for the LV control box, shall be min IP52 and for the surge arrester IP66.

5.9.4. ELECTROMAGNETIC COMPATIBILITY (EMC)

The equipment shall comply with the EMC requirements defined in 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.

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 VCB device due to spare parts unavailability.

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

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". To correctly define the requirement, it is necessary to know the hazard level of the train that, in this case, is HL2.

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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.

According to EN45545-1 and EN45545-2 standards the locomotive hazard level will be HL2 and operation category will be 2N (freight locomotive).

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

Applicable Product type (No)	Definition	Details	Requirement
EL5	Supply line system devices - Exterior	Surge arresters; isolators; switches; main circuit breakers	R23
EL6A	Supply line system and high power devices - Interior	Isolators; current and voltage transformers, main circuit breakers; contactors	R22
EL6B	Supply line system and high power devices - Exterior	Isolators; current and voltage transformers, main circuit breakers; contactors	R23

Table 5 – 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 adopt materials with required characteristic and 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 Project nominated by the ADMINISTRATION. The Contractor/Bidder shall be responsible to perform all necessary activities which are required by Notified Body.

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5.11.3. SMOKE OPACITY AND TOXICITY

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

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

5.12. LABELS/MARKING

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/markings 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.

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

The Contractor shall make RAMS analysis according to TB50165.

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7. TRAINING AND MANUAL

7.1. TRAINING

Comprehensive training courses, covering the system/equipment supplied, shall be provided by the Contractor to ADMINISTRATION or Costumer/Train Operator 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 at least 1 day training for ADMINISTRATION personnel for the equipment in ADMINISTRATION.

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 supplied in Turkish by the Contractor.

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 an integrated manual for the operation and maintenance of the equipment within the scope of supply, in accordance with the EN15380 standard and its annexes.

The manual shall contain:

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

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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

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- 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.

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- It is highlighting the importance for a correct identification of LRUs/components by utilizing the same identification name reported by the technical drawings.
- All maintenance manuals shall be prepared electronically and submitted to the ADMINISTRATION via encrypted sharing areas using cloud-based storage. The Contractor is responsible for submitting each new version/revision electronically and retaining revision records for previous versions. No printed copies will 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.

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8. TESTING, INSPECTION AND ACCEPTANCE

The 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.

Type test can be waived if system or components are already proven and confirmed to waive by end Final User. In that case, the Contractor shall provide old test report or certificate to submit for approval.

All test and inspection specifications and reports including all repair activities and checklists shall be submitted and approved by ADMINISTRATION.

The following prescription shall be observed if the test is defined as a 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

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

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

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8.3. 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.

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

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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 2 personnel/day.

8.5. SUPPLIER TECHNICAL ASSISTANCE

The Contractor shall provide all the technical assistance necessary for the installation, commissioning, and railway track test of the system(s) as deemed necessary by ADMINISTRATION. If necessary, on-site technical support shall be provided for any problems that may arise during this process.

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.

8.6. COMMISSIONING

8.6.1. TYPE COMMISSIONING TEST

If necessary, for the first prototype LOCO, the Contractor shall perform static (factory test on ADMINISTRATION workshop) and dynamic commissioning (on track) tests for the system to adequately demonstrate the requirements of this technical specification, in accordance with a test procedure to be prepared by the Contractor and approved by ADMINISTRATION, under ADMINISTRATION participation.

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.

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9. AUTHORIZATION TO START PRODUCTION

The CONTRACTOR shall prepare a Project Plan that includes all information specified in this specification, the delivery of parts and documents, key events, and the schedule of main activities, and shall submit it to the Administration for approval each time it is published. The Contractor shall commence production in accordance with the Project Plan and shall regularly attend Project Progress Meetings within the specified schedule. If necessary, the Contractor shall update the Project Plan as a result of the meetings.

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

Technical changes shall be subject to the Contractor's Quality Management System, while changes after equipment delivery shall be subject to the Administration's approval; the Contractor shall track changes in accordance with the plan and notify the Administration of each completed change with the 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; 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 to start mass production after receiving the Authorization to Start Mass Production by the ADMINISTRATION.

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10. ACCEPTANCE

The acceptance report will be issued by the ADMINISTRATION after the following conditions have been met:

- ✓ 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, at the Contractor's expense, to TÜRASAS Eskişehir Regional Directorate.

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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.

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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 or ISO9001 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

Table 6 – Stage 1 Offer Phase: list of requested documents and due date

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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 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

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	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)		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		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		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, 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 8 – Stage 3 list of requested documents and due date

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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.

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 and additionally provided on 2 USB flash drives. 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.

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13. INTELLECTUAL AND INDUSTRIAL PROPERTY ISSUES

The following points 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, under the administrative contract, 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, limited to the contract price. 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.

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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 two (2) 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

Upon commissioning of the Electric CoCo locomotive, any failures that occur repeatedly and in a non-random manner under specific conditions or inputs during the warranty period shall be considered systematic failures.

Additionally, after the mass-production locomotives have been put into operation 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 locomotives within annual periods during the guaranteed term is shorter than guaranteed MDBF or MTBF value, such failure shall be deemed as an epidemic failure.

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In case systematic/epidemic 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 period specified by ADMINISTRATION, all necessary reinforcement, modification, material replacement, assembly and disassembly works required for the elimination of systematic/epidemic failures, 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

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, up to the contract price, 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.

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16. ANNEXES AND NOTES

N/A