T.S. 250.764

TECHNICAL SPECIFICATION FOR E5000 NATIONAL ELECTRIC LOCOMOTIVE BOGIE SUSPENSION SPRINGS

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Revision			
Rev	**Date**	**Explanation**	**Revised by**
A	29.03.2023	Clause 4.2.2 is updated. EN 61373 deleted. Clause 4.2.5 is updated Clause 4.2.6 is updated	M.Turan ŞENGÜL
B	03.03.2025	Article 6.2.1; 8.11; 8.12; 9.1 updated. Article 10.2; 11. and Annex-2 added.	Furkan ÇUHACI

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1. SUBJECT

This technical specification covers the minimum technical specifications, inspection, receipt and other issues related to the supply of springs to be used in the suspension of the E5000 Type Electric Mainline Locomotive to be manufactured in TÜRASAŞ.

2. DEFINITIONS

Abbreviations and technical terms in the technical specifications and annexes shall be interpreted as follows.

Table 1 - Definitions

TCDD	General Directorate of State Railways of the Republic of Turkey
TCDDT	Turkish State Railways Transportation Inc.
TÜRASAŞ	Turkish Railed Vehicles Industry Inc.
ADMINISTRATION	TÜRASAŞ and / or E5000 working groups assigned in the relevant subject
TSI	Technical Specifications for Interoperability
UIC	International Union of Railways
EN	European Standard
DIN	International German Standard
UNI	National Standards Unit
EC	European Community
ISO	International Standard Organization
FEM	Finite Element Analysis
CAD	Computer Aided Design
E5000	5 MW Electric Mainline Locomotive
NoBo	Established by the relevant commission of the European Union under the directive 2008/57 / EC on the "mutual operability of railway systems within the Union" directive. "Notified Body"
TSI LOC&PAS	Document 1302/2014 / EU of the European Commission (technical specifications for the interoperability of the Trans-European railway system with respect to the 'locomotives and passenger wagons' subsystem)
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-commandl and signaling 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)

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3. STANDARDS TO BE OBSERVED

In the conformity evaluations to be made by the Contractor and / or other conditions that are not specified in this Technical Specification, but the E5000 National Electric Locomotive subject to this technical specification, the equipment and the sub-components of the E5000, the directives, standards and demands listed below in order of priority shall be complied with.

In cases where it is not possible to comply with these directives, standards and demands, if the Administration approves the detailed evaluation provided by the Contractor, other relevant international standards, European standards, national standards and TCDD directives, conditions required by national legislation may be used.

- TSI LOC&PAS
- TSI SRT
- TSI CCS (In terms of Compliance Check)
- TSI NOI
- CSM 402/2013/EU
- Published technical documents and annexes on the relevant TSI directives
- EN STANDARDS
- UIC STANDARDS
- IEC, ISO, Other international norms and standards (DIN, NF F, UNI, CEI, etc.)
- National standards (TS… etc.)

If there is a relevant gap in the standards whose priority order is as stated above, this gap will be filled by the next lower / important standard.

In case of any change in the standards / norms specified in the scope of this article while the work is continuing, the Contractor shall;

- notify the Administration in writing within 5 (five) working days after the date on which the amendment is published and entered into force.
- issue the necessary processes for adaptation to the new situation at the latest within 1 (one) calendar month after the publication of the amendment and enter into force and submit it to the Administration for approval..
- The Administration shall examine the process within 15 (fifteen) business days and notify the Contractor of its decision.

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The change of directives, standards and norms will not prevent the completion of the certification.

The Contractor is responsible for reviewing these technical specifications and its annexes and reporting to the Administration in writing (along with suggestions);

- Any conflict or violation of international standards,
- Any problems that may occur in application,
- Any matter that would be beneficial to change from a technical aspect,
- Matters not mentioned in the technical specifications and its annexes but are necessary/required for production.

4. TECHNICAL SPECIFICATIONS

The technical features of the springs are expressed under the following headings.

4.1. General

4.1.1. Vehicle speed is maximum 140 km / h. Vehicle operating temperature is between -25 ° C / + 45 ° C. Springs must comply with these values.

4.1.2. Springs will comply with 1302/2014 TSI LOC&PAS.

4.1.3. Springs will comply with EN 13298 standard.

4.1.4. Springs will comply with EN 13906-1 standard.

4.1.5. Springs will comply with EN 10089 standard.

4.1.6. Springs and all related components must meet the EN 45545-2 + A1 standard. Springs will be evaluated for OC3 and HL2 levels in this standard.

4.1.7. Springs will comply with EN 2162-2 standard.

4.1.8. Springs will comply with EN 50125-1 standard.

4.2. Mechanical

4.2.1. All the tests specified in EN 13298 shall be done by the Supplier. Supplier shall send the approved test results of these tests with the delivery of the springs.

4.2.2. The springs supplied to the acceptance have to be painted with a black or grey colored elastic paint. Anywhere on the spring that will not affect the functionality the fallowing should be branded :

Company Name – Material Quality – xxx—yy---zzz
xxx : sequential and non-repetitive charge number
yy : last two digits of the year (in contrast paint)
zzz : sequential and non-repetitive piece squad number

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In Addition to the above marking, the springs will be grouped according to their height under the loads specified in drawings. The height under the mentioned loads of every single spring will be labeled in a visible place on the spring by the Supplier.
For the marking, silver matte metalized label with self-adhesive layer will be used.
The labels will be placed on the spring faces other than the end surfaces so that they can be read from outside when the springs mounted.

4.2.3. Maximum weights of the springs :

- Primary Spring : 35 kg
- Secondary Spring : 77 kg

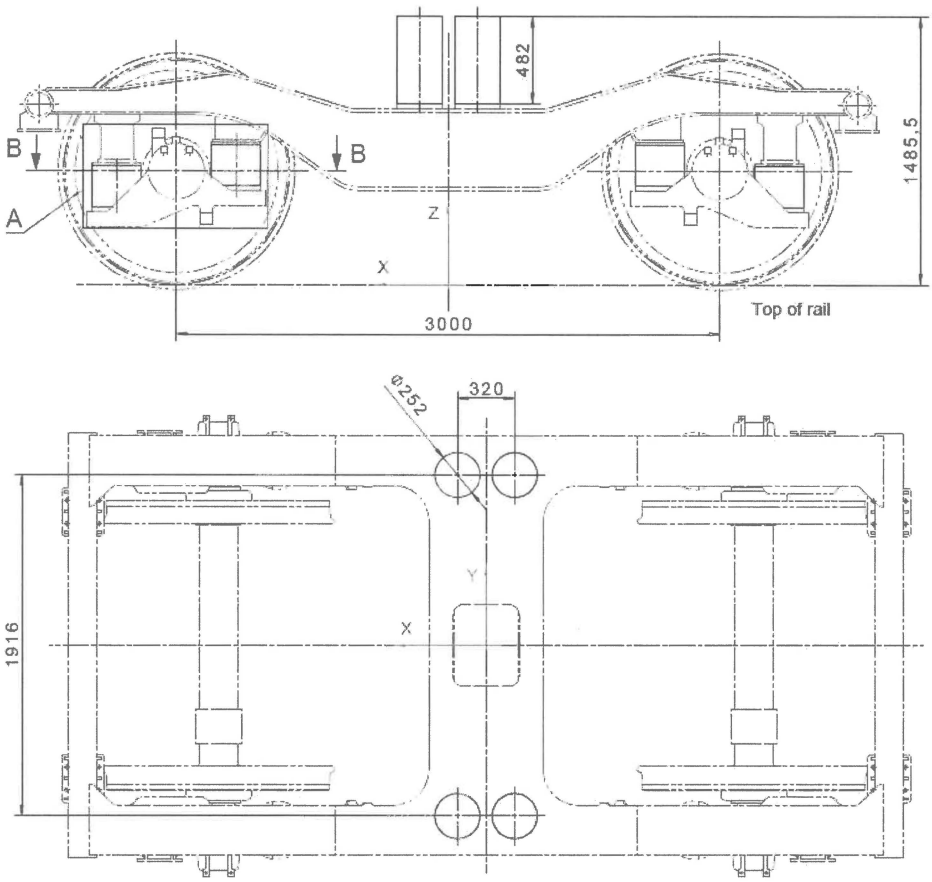

Figure 1. Axis Directions and Spring Placements

4.2.4. Spring specifications are defined in the fallowing headings. According to the specs shown in these headings the Contractor will submit to the Administration the technical drawings that includes 2-D dimensions and characteristic curves. The contractor will continue the procurement works after getting approval from the Administration with the relevant drawings. The Administration may request changes on the relevant drawings.

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4.2.5. Primary Spring :

Quantity per locomotive	: 16
Length of unloaded spring (L0)	: 260,8 mm
Bar diameter (d)	: 42,5 mm
Spring stiffness (R)	: 1290 N/mm
Mean coil diameter (Dm)	: 200,5 mm
Inner coil diameter (Di)	: 158 mm
Outer coil diameter (Da)	: 243 mm
Axial Load per spring	: 41 kN (Nominal) 75 kN (Max.)
Material	: Can be selected from Annex-1
Form	: EN 2162-2 Form D
Axial Load at La = 228 mm	: 41 kN± 3.28 kN

4.2.6. Secondary Spring :

Quantity per locomotive	: 8
Length of unloaded spring (L0)	: 576,8 mm
Bar diameter (d)	: 46 mm
Spring stiffness (R)	: 690 N/mm
Mean coil diameter (Dm)	: 206 mm
Inner coil diameter (Di)	: 160 mm
Outer coil diameter (Da)	: 252 mm
Axial Load per spring	: 65,4 kN (Nominal) 95 kN (Max.)
Material	: Can be selected from Annex-1
Form	: EN 2162-2 Form D
Axial Load at La = 228 mm	: 65,4 kN± 5.232 kN

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5. CONTROL AND TESTS

Together with the delivered shock absorbers, the following documentation will be given to TÜRASAŞ with the delivery. After the documentation control of the delivered materials, the following physical examinations will be made. According to the results obtained from these examinations, the whole lot will be accepted, and if any of the results are not found suitable, the whole party will be rejected.

5.1. Document Control

Documents to be controlled :

- Documents stated in the Delivery section
- Final dimension control sheets
- Visual inspection report
- Reports on all test results defined in the standards specified in the heading "Technical Specifications"

5.2. Physical Controls

The following examinations will be made on the samples to be selected according to the "Sampling" article of the specification.

5.2.1. Tensile Testing

Suitable test samples, which are heat treated together with the springs, shall be delivered to TÜRASAŞ as 2 pieces for each batch and they will be subjected to the tensile test. Test results will be compared with the values in Annex 1.

5.2.2. Chemical Composition Check

Chemical composition check will be performed by using the tensile test samples according to the Annex 1.

5.2.3. Dimension and Tolerance Control

All parts submitted for delivery will be subjected to measurement and tolerance control. It will be checked whether the parts comply with the values specified in the "Technical Specifications" headings.

5.2.4. Visual Inspection

In the visual inspection, it will be examined that the materials are new and the marking is suitable. Defects similar to damage, deformation, corrosion, etc. and residues, gaps, cracks, caused by manufacturing errors etc. shall not be observed, and no action will be taken to correct defects.

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5.3. **Sampling**

For the inspection of parts; The number of samples to be controlled is determined according to TS 2756-1 and TS 2756-0 and General Inspection Level (Level II), taking into account the delivered lot size. The number of samples determined will be checked according to the double or multiple sampling tables (table III.A, IV.A) according to the size of the lot, in accordance with TS 2756-1. AQL value will be taken as 1.5 in the controls.

6. MARKING AND PACKAGING

6.1. **Marking**

A permanent marking will be placed on the springs by the manufacturer company that will include all the technical information that is necessary about the springs.

6.2. **Packaging**

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

6.2.2. There will be pallets under the crates so they can be handled with a forklift. The weight of the crates with contents shall not exceed 400-500 kg. While selecting the crate material the detail that 4 crates will be stacked on top of each other shall be considered. The Contractor company name, the name of the material, the order, classification (technical specification number) and drawing number the number of items in the crate, the order numbers of the parts and manufacturing date (not to be affected by environmental conditions) shall be identified on the crates. A list including this information shall be submitted per crate along with the dispatch slip and invoice.

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

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

6.2.5. The contract number, the amount of product in the packaging, the product name and party number if any, etc. as well as the "Project No: 116G019" shall be on the packaging.

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7. DELIVERY

At product delivery :

- Warranty, maintenance and fault repair documentation
- All relevant technical documentation (3D models, 2D technical drawings, spring characteristic curves etc.)
- Accredited laboratory or NoBo approved conformity documentation under standard TS EN ISO/IEC 17050-2 for the standards specified under heading "Technical Specifications".
- Spare parts and equipment list (to include order codes)
- Documents including all the results of tests required in the standards under the "Technical Specifications" heading in the form of a 3.1 certificate according to EN10204

Are to be submitted to the Administration.

- The Contractor shall submit the EN conformity documents which are approved by NoBo and routine test documents. In addition, The Contractor is obliged to supply additional documents like Audit report, type test reports etc. that might be asked by the NoBo of the Administration.
- All documents that are not specified under this heading but under other headings that need to be submitted by the Contractor shall be submitted in the same way upon delivery to Administration.

8. GENERAL PROVISIONS

8.1. The locomotive shall be certified by a Notified Body (NoBo) specified by TÜRASAŞ according to the current version of TSI LOC&PAS, TSI NOI, TSI SRT and TSI CCS. The Contractor will provide all calculations, drawings, analyses, test reports and similar documents that are requested by the TSIs for the existing Supply Scope.

8.2. The conformity documents submitted by the contractor shall be approved by an accredited laboratory or NoBo.

8.3. The conformity reports submitted by the contractor (test reports and all conformity proof) shall be subject to approval by the NoBo assigned by TÜRASAŞ.

8.4. The contractor will provide the documentation necessary for the conformity matrix to be created by the NoBo. If there are documents that are not foreseen during the tender stage but later requested by the NoBo the Contractor is obligated to provide these documents. The contractor will prepare the TSI Declaration of Conformity for the products they will be supplying to TÜRASAŞ according to TS EN ISO/IEC 17050-2 and submit it to the administration with their offer.

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8.5. The Contractor Company shall have the ability to make the changes requested by TÜRASAŞ on the product.

8.6. The Contractor will support the integration of the springs into the locomotive, if requested by the Administration.

8.7. The Contractor shall provide the current and valid ISO 9001 Quality Certificate of the springs manufacturer.

8.8. The languages to be used in all the correspondence and technical documents from the Contractor shall be Turkish and English; all the correspondence and technical documents from the Administration to the Contractor shall be in Turkish and/or English. The Contractor shall be responsible for translating. All responsibility for errors arising from the translation of the documents shall belong to the Contractor. If there are any conflicts for this reason the Turkish copies of the documents shall be the basis.

8.9. Documents to be submitted to the Administration will be prepared by the Contractor and delivered to TÜRASAŞ within the deadline, as 3-dimensional models in step format, 2-dimensional drawings and technical documentation in pdf format five copies in hard copy and two copies in electronic form

8.10. There must be traceable label/markings on the units that match the 3.1 Certificates (on the component in legible position and form).

8.11. MTBF, LCC and MTTR values for the relevant product/equipment shall be calculated according to the principles specified in the TŞ400133 E5000 RAMS Requirements Technical Specification and its annexes given in Annex-2 of this technical specification.

8.12. The springs are sub-component of the bogie and the RAMS targets of the springs are included in the E5000 Bogie RAMS Requirements document given in Annex-3 of TŞ400133. The values calculated by the Contractor for the springs shall be in accordance with these targets.

9. BIDDING

9.1. The Bidders are required to submit the following documents to the Administration in their bid.

No	Documents to be submitted with the Bid
1	ISO 9001 Quality Management System Certificate (belonging to the spring manufacturer)
2	Technical documents describing the general features of the unit (specifying the characteristics and functions of the product)
3	Commitment declaring that conformity with the standards specified under the "Technical Specifications" heading will be submitted
4	EN conformity certificate and/or EN declaration of conformity for the relevant standards if any
5	Commitment declaring that the Supplier will supply spare parts for at least 10 years
6	Spare parts list (All spare parts required for 1 locomotive with part numbers and prices)

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10. GUARANTEE

10.1. General

10.1.1. The Contractor is responsible for the accuracy of all the information they provide. The Contractor shall be responsible for possible errors that could arise in any stage of the production due to deficiency and/or error in the information. When such a problem occurs, it will be remedied in the shortest possible time by the Contractor in a way that does not impact the manufacturing process. The Contractor shall be responsible for any costs that are generated by such problems. All damages and losses suffered by the Administration and/or third parties for defective work the Contractor does in the scope of the job that is the subject of the tender shall be covered/compensated by the Contractor.

10.1.2. 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.

10.1.3. The Supplier shall provide a 36 (thirty six) month warranty as of the date of delivery for the products they deliver and/or a 24 (twenty four) month warranty as of the date that the components and/or equipment is assembled onto the locomotive without problem and deficiency

10.1.4. The Contractor shall guarantee with the offer 10 (ten) years of service and spare parts supply as of the date the warranty ends.

10.1.5. All delivery costs belong to the Contractor.

10.2. Epidemic Failure

10.2.1. If failures occur in the same equipment or due to the same equipment or if the equipment fails due to the same reasons and this situation has occurred in 3 or more products, these failures will be considered as EPIDEMIC FAILURE.

10.2.2. In addition, if the parts of the main equipment/systems in the locomotive have failed and therefore the main equipment has become inoperative, this main equipment will also be included in the scope of EPIDEMIC FAILURE.

10.2.3. Spare parts / repairs required for all operations arising from warranty and epidemic failures will be carried out / provided by the Contractor free of charge.

10.2.4. Components characterized as "epidemic faulty" will be replaced with new ones in all locomotives free of charge without the requirement of failure. The supply of the part, integration, assembly etc. related to this situation shall be carried out by the Contractor without any charge. For problems characterized as epidemic, the root cause of the failure shall be found and the Administration shall be notified in writing.

10.2.5. If necessary, the Contractor shall send the relevant expert(s) to TÜRASAŞ, at its own expense, to ensure that such failures are eliminated and not repeated.

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10.2.6. For systems / parts / components within the scope of epidemic failure; The warranty period from the taking of the necessary measures is limited to 30 months from the delivery of the products to TÜRASAŞ, and 24 months from the re-operation of the locomotives.

10.2.7. Epidemic Failure; If it does not prevent the locomotive from being put into service safely, the Contractor will repair the failure in the locomotive and / or replace the defective parts with new parts at its own cost within 30 calendar days at the latest from the date of receipt of this notice. In the event that the Contractor fails to fulfill its obligations within this period, the terms of the Administrative Specification and the contract shall apply.

11. ISSUES SUBJECT TO INTELLECTUAL AND INDUSTRIAL PROPERTY

11.1. All kinds of usage and property rights of the design, production, TSI certification and all tests and test results until the entrance to the commercial service of all the components of the E5000 National Electric Locomotive developed within the framework of the aforementioned specification shall belong only to the Administration without any limitation. All kinds of documents, projects shared with the Contractor within the scope of the work subject to the tender will not be used for other purposes in any way.

12. ANNEXES

Annex-1 Material Specs
Annex-2 TŞ400133 E5000 RAMS Requirements Technical Specification (Annex-3)

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