



# TRANSNET ENGINEERING

## 20/21/22E BATTERY USER REQUIREMENT SPECIFICATIONS

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## Document information

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## Document revisions

| <b>Revision Number</b> | <b>Changes made</b>                | <b>Approval</b> |
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| <b>Revision 1</b>      | Remove original battery dimensions | DC Kleynhans    |
|                        |                                    |                 |
|                        |                                    |                 |

## Executive Summary

This document defines the requirements and specifications for the replacement batteries for the 20/21/22E electrical locomotive fleet of Transnet Freight Rail (TFR).

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# 1. INTRODUCTION

- 1.1 Transnet Freight Rail requires a replacement battery for the current batteries used on all the CRRC electrical locomotives.
- 1.2 This document contains the requirements that cover the supply, delivery, evaluation, installation, manual and warranty of the batteries required for the electrical locomotives specified in the document.
- 1.3 Evaluation of the information for the batteries is to be performed at Koedoespoort unless specified otherwise.

# 2. REQUEST FOR INFORMATION REQUIREMENTS

- 2.1 Tenders shall be reputable suppliers of batteries with field experience of batteries used in rolling stock applications.
  - 2.1.1 Tenderers shall submit a list of batteries, which have been supplied to the rolling stock industry. All contact details of relevant contact persons at the railroads in question must also be supplied.
- 2.2 Tenderers shall acknowledge, provide complete information, or indicate compliance with respect to all clauses covered under section 2 to 10.
- 2.3 Tenderers shall provide drawings, diagrams and additional literature to clearly describe the operation of the batteries.

# 3. CONDITIONS OF INFORMATION

- 3.1 The Supplier / Manufacturer shall be solely and entirely responsible for all information supplied to work carried out in fulfilment of this information requested. This shall embrace the manufacture, supply, delivery, installation, demonstration, as well as logistic back-up of the supplied batteries.
- 3.2 The potential supplier shall call a review(s) to discuss technical detail of their battery specifications with Transnet.
  - 3.2.1 The Supplier / Manufacturer shall not be allowed to proceed with manufacture / supply of the batteries until having received “Approval in Principle” from Transnet.
- 3.3 Approval or consent given by Transnet in respect to any drawings, etc. shall not be taken as relieving the Contractor / Supplier / Manufacturer of his responsibilities in terms of the contract.

# 4. SCOPE AND GENERAL TECHNICAL INFORMATION

- 4.1 The scope of the user requirement specification is to define the requirements for a replacement battery for the current batteries. and in the process be able to maintain the electrical locomotive fleet for Transnet Freight Rail. After numerous failed attempts to get the required batteries this document will give the suppliers an opportunity to propose a **battery solution**. The constraints are as follow. The locomotive requires a 108V supply with an amp-hour supply of 170Ah or higher. Space available without any modifications are 10 slots with each slot’s dimensions 178mm wide, 507mm long and 345mm height. The slots are in two layers with each layer containing 5 slots. The dimensions for each slot must contain the cells and mono block container with electrical connections. Stainless Steel boxes to contain the batteries/cells are acceptable. Each slot must contain two 6 volts batteries.

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|------------------|-----------------|---|
| Locomotive model | Ampere Hour(Ah) | Dimensions (LXWXH)<br>(one slot only including container) |
| 20/21/22E        | 170Ah or higher | 507mmX178mmX345mm)  |

- 4.2 The batteries to be offered shall comply fully with the following standards:
- 4.2.1 SANS 60077-1:1999 (Railway applications – Electrical equipment for rolling stock. General Service conditions and general rules.).
  - 4.2.2 SANS 60254-1:2005 (Lead-acid traction batteries - General requirements and methods of test.).
  - 4.2.3 SANS 61373:2010 (Railway applications - Rolling stock equipment – Shock and vibration tests.).
  - 4.2.4 BS EN 45545-2:2013. (Railway applications – Fire protection on railway vehicles. Requirements for fire behaviour of materials and components.)
  - 4.2.5 BS EN 45545-5:2013. (Railway applications – Fire protection on railway vehicles.)
  - 4.2.6 BS EN 50547:2013. (Railway applications – Batteries for auxiliary power supply systems.)
  - 4.2.7 BS EN 60695-11-10:2015. (Fire hazard testing. 50 W flame test methods.)
  - 4.2.8 BS EN 60707:1999. (Flammability of solid non-metallic materials when exposed to flame sources.)
  - 4.2.9 ISO 9001: Quality
  - 4.2.10 ISO14001: Environmental management
- 4.3 The type of batteries shall be maintenance free, sealed; valve regulated lead-acid (VRLA) batteries.
- 4.4 The capacity of the batteries must be stated @ 5 hour to 1.6V per cell for the 6V battery.
- 4.5
- 4.6 Service life of batteries must be at least 7 years at 25 °C and cycle life must be 1000 cycles at 80% DOD (depth of discharge)
- 4.7 Recommended storage and operating temperatures should range between ~5 °C ~ 50 °C for storage; ~5 °C ~ 45 °C for discharge and 0 °C ~ 40 °C for charging.
- 4.8 Operational humidity should be up to 90% non-condensing.
- 4.9 The date of manufacture should be not more than three months before delivery and preferably there have to be hard time stamp on the battery.

## 5. PHYSICAL REQUIREMENTS

- 5.1 The battery shall be supplied complete with connectors between cells and at the main positive and negative terminals. The connectors shall be of robust construction of adequate size to minimize voltage drop and be made of flexible insulated copper conductor cable. The inter-connectors and terminals shall be fully insulated.
- 5.2 The batteries must fit the existing battery container. The constraints are as follow. The locomotive requires a 108V supply with an amp-hour supply of at least 170 Ah. Space available without any modifications are 10 slots with dimensions 178mm wide, 507mm long and 345mm height. The slots are in two layers with each layer containing 5 slots.
- 5.3 The shipped batteries shall be fully charged, ready to be installed at site and should give a capacity of not less than 90% of rated value when tested at site at any time up to 6 months of its receipt.
- 5.4 Dimensions (length, width and height) should be stated.
- 5.5 Weight (sealed and fully charged) should be stated.

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## 6. BATTERY PROPERTIES

- 6.1 Type should be stated.
- 6.2 Make, material, number and thickness of plates should be mentioned.
- 6.3 The separator shall be low resistance micro porous material.
- 6.4 Terminals shall be fastened with non-capsulated bolts.
- 6.5 Internal pressure which the container can stand should be stated.
- 6.6 Maximum discharge current and recharge voltage should be stated.

## 7. TESTING

- 7.1 Test results must be supplied to confirm capacity at 5 hour discharge to 1.6 Volts per 2V cell for 6 V battery.
- 7.2 The test will be repeated on the Transnet Engineering premises to confirm results.
- 7.3 Pantograph lifting and power to control system test to be performed on the specified locomotives to confirm that the batteries support the specified requirements.
- 7.4 Shock and vibration tests to be performed based on vibration test requirements defined in SANS 60095-1 and SANS 61373. Category 1b must be used for the vibration test based on SANS 61373.

## 8. QUALITY ASSURANCE

- 8.1 Although Transnet Engineering reserves the right to inspect/audit/survey all material and/or components, it is the sole responsibility of the Supplier / Manufacturer to ensure that the articles and/or all components, whether supplied by himself or any sub-contractor are manufactured to specified requirements.
- 8.2 Service life of batteries must be at least 7 years at 25 °C and cycle life must be 1000 cycles at 80% DOD (depth of discharge)
- 8.3 Warranty of two years on each battery

## 9. INFORMATION TO BE SUPPLIED WITH THE TENDER

- 9.1 The tenderer shall give the supplier's / manufacturer's technical data with the tender including the following:
  - 9.1.1 Model number.
  - 9.1.2 Number of poles per cell
  - 9.1.3 Charge, discharge characteristics, and values for boost, float equalizing modes.
  - 9.1.4 Maximum internal resistance of the battery
  - 9.1.5 The cycle life with DOD (depth of discharge) characteristics
  - 9.1.6 Temperature effects on performance and capacity
  - 9.1.7 Self-discharge characteristics

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- 9.1.8 Storage conditions and relationship curves between remaining capacity and storage with different capacity at different temperature.
- 9.1.9 Relationship between OCV and DOD
- 9.1.10 Shock and vibration test certificate with pass criteria as defined in SANS 60095-1 and SANS61373.

## 10. TECHNICAL DOCUMENTATION

- 10.1 The tenderer shall supply all the following documentations, for all sets:
  - 10.1.1 Installation guide for the batteries.
  - 10.1.2 Operational and maintenance instruction for the batteries.
  - 10.1.3 Technical specification, testing data and installation diagram.
- 10.2 The tenderer shall provide list for all accessories and installation materials which will be used.

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**DOCUMENT AUTHORITIES**

**RESPONSIBLE PERSON**

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**SIGNATURE**

Handwritten signature of Dan Kleynhans in black ink, written over a horizontal line.

**COMPILER**

**Dan Kleynhans**

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**Walter Klingenberg**

**DESIGNATION**

**Principal Product Engineer**

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