



**BEML LIMITED**  
**BANGALORE**  
**R & D CENTER**

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Procurement Technical Specification  
Of Castings for DMRC RS-6 Project

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## 1. Introduction

### 1.1. General

This document specifies the requirements for Steel Castings to be supplied for Delhi Metro Rail Corporation Limited (DMRC) RS-6 Project.

BEML shall carry out all required works and activities as Contractor for DMRC RS-6 project while the Supplier shall be responsible for all works required in this PTS with regard to Castings and shall be responsible for supporting the BEML activities as contractor for DMRC RS-6 Project.

Presently DMRC has 4 Car Train set running at Delhi. To enhance the passenger carrying capacity, DMRC intends to convert the existing 4 Car Train set to 6 or 8 Car Train set by adding intermediate M & T Cars.

The configuration of train formation is as follows.

- DT-M-M-DT - (existing for 4 Car formation)
- DT-M-T-M-M-DT - (proposed for 6 Car formation)
- DT-M-T-M-T-M-M-DT - (proposed for 8 Car formation)

DT : Driving Trailer Car, M : Motor Car, T : Trailer Car

## 2. Definitions and Abbreviations

The following definitions and abbreviations are applicable to the PTS.

- “DMRC” means the Employer for the Mass Rapid Transport System (MRTS)
- “DMRC’s Representative” mean such persons appointed by DMRC to act as Engineer for the purpose of the MRTS
- “BEML” means the Contractor for procuring the Castings for DMRC RS-6 Project.
- “Supplier” means the Supplier for supplying Castings to BEML for DMRC.
- “PTS” means BEML’s Procurement Technical Specification.

## 3. General Requirements

The Supplier shall supply Castings in conformance to this PTS, purchase order requirements and the Applicable drawings.

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### 3.1. Defining of unclear aspects

If any term or clause is not described or not clear in the specification, Supplier shall discuss those with Design Team in BEML, prior to making a contract, to confirm their definitions.

After making a contract, Supplier shall follow the definition and opinions of Design Team in BEML

### 3.2. Responsibility of Supplier

Supplier shall have the responsibility for manufacture and defined performance testing with regard to the supply of castings.

### 4. Standards

Test and inspection standard applicable for the castings shall conform to the standards as per the applicable drawing.

### 5. Scope of Supply

#### 5.1. General

The supplier shall supply Castings in conformance to the PTS, purchase order requirements and the Applicable drawing.

#### 5.2. Submission of Documents

The supplier shall submit the following documents conforming to the applicable drawing/standards/specifications/PTS along with every batch of supplies.

- ✓ Dimensional check sheets
- ✓ Material test certificates (Chemical composition & Mechanical tests)
- ✓ NDT test reports along with X-ray films if specified in the drawing.
- ✓ Heat treatment record along with time temperature graph if specified in the drawing
- ✓ Any other document as applicable.

#### 5.3. Submission of Test Bars

Test bars shall be cast integral with the castings & heat treated along with the castings. The Supplier shall submit at least two nos. casting with integral test bar for each heat batch of casting supplies. Final acceptance shall be based on test bar results carried out by BEML.

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#### **5.4. Submission of one no. sample casting for First Article Inspection**

The supplier shall supply one no. free sample finished casting as per relevant drawing for First Article Inspection. BEML may decide to conduct destructive tests also on the casting. After obtaining approval from BEML only, mass production has to be taken up. The sample shall be subjected to 100% NDT tests covering full area of the castings. If sample fails the test, then 100% NDT tests shall be continued till desired results are obtained.

#### **5.5. Packing**

The supplier shall apply rust preventive coating on machined surfaces and any tapped holes etc. The tapped holes shall be plugged with dummy plugs after application of rust preventive coating.

The supplier shall provide proper packing to avoid transit damages during shipment of the Castings.

#### **5.6. Quality Assurance Program**

##### **5.6.1 General**

The supplier shall hold ISO 9001 certification and shall manufacture the product accordingly. The supplier shall submit a copy of ISO 9001 certification along with the offer. The supplier shall monitor and control the Quality systems as per ISO 9001 guidelines. BEML and/or DMRC/his representative may periodically conduct compliance audits of the supplier's Quality management system.

##### **5.6.2 Quality assurance plan**

The supplier shall develop and submit a Quality assurance plan (QAP) to BEML for review and approval based on ISO 9001 guidelines.

#### **6. Technical Requirements**

##### **6.1. General**

The material grade in respect of chemical composition, heat treatment, microstructure and mechanical properties shall be as stipulated in the drawing and applicable national/ international standards. The Supplier shall submit the reports for the above along with the casting supplies.

##### **6.2. Workmanship and finish**

All Castings shall be made to conform to the dimensions on drawings supplied along with the purchase order. The Castings shall be free from injurious defects that will adversely affect machining or utility of the Castings.

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In the event of any casting proving defective from foundry causes in the course of preparation, machining or erection, such a casting may be rejected notwithstanding any previous certification of satisfactory testing and/or inspection.

### 6.3. Fettling and Dressing

All castings shall be properly fettled and dressed, and all surfaces shall be thoroughly cleaned.

### 6.4. Heat Treatment

The Castings shall be heat treated in a properly constructed furnace, having adequate means of temperature control, which shall permit the whole of the casting being uniformly heated to the necessary temperature. All Castings shall be suitably heat treated as per the requirements of the applicable drawings and corresponding material standards. The Supplier shall maintain time-temperature records for the heat treatment carried out and submit the same whenever asked for.

Test pieces shall be heat treated along with the castings they represent.

### 6.5. Painting

The castings shall be shot blasted to SA 2 ½ and primer painted with gray colour epoxy primer to Gr. EP1119 & Thinner 024 of M/s. KCC Paints, with DFT 40-80 microns. The primer painted castings after finish machining shall be finish painted with colour NCS 8500N to Gr. UT 5119 & Thinner 037U of M/s. KCC Paints, with DFT 40-80 microns. The total DFT (primer + finish) paint shall be 80-160 microns.

### 6.6. Machining

Machining as per the drawing requirement shall be carried out. Care shall be taken to ensure that the tolerances as specified in the drawing are achieved. Dimensional inspection report shall be submitted along with the Castings.

If specified in the drawing, the machined casting shall be measured for dimensions on a 3-axis Co-ordinate Measuring Machine (**CMM**) and the report shall be submitted.

### 6.7. First Article Inspection (FAI)

The sample machined casting submitted by the Supplier before mass production shall be subjected to First Article Inspection by BEML and/or DMRC/his Representative. **BEML may decide to conduct destructive tests also on the casting. Only, after clearance from BEML, mass production shall be taken up.** Castings shall be offered to BEML representative(s) for inspection before dispatch for pilot / proto lot.

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## **6.8. Inspection & Testing**

### **6.8.1. General**

The Supplier shall perform all tests in accordance with the Standards specified in the drawing, related material standard and purchase order. BEML and/or DMRC Representative have the right to witness any of these tests at any stage of test progress.

### **6.8.2. Visual inspection**

Every casting, irrespective of lot size shall be examined visually for surface defects and irregularities. The Castings shall be free from cracks, shrinkage cavities, blow holes, pin hole porosity, sand inclusions and any other defect that would impair the utility of the Castings.

### **6.8.3. Chemical Composition Analysis**

The supplier shall carry out ladle analysis on a sample of each melt and product analysis on a test piece or a casting representing each melt as per the material standards mentioned in the drawings and shall submit test reports.

### **6.8.4. Mechanical tests**

The hardness test, tensile test, impact test, bend test and any other test as per the requirements of the applicable drawings and corresponding material standards shall be carried out by the Supplier on the test bars cast either separately from or attached to the castings to which they refer and heat treated along with the castings. Reports shall be submitted along with the casting supplies.

### **6.8.5. Non-Destructive tests**

If any Non-destructive testing is specified in the drawing/ corresponding material standards, the Supplier shall ensure that the same is carried out by a reputed third party NDT agency having ISO 90001 certification, preferably having NABL accreditation and all the reports shall be certified by ASNT/ ISNT Level II qualified personnel.

The details of the agency with whom the vendor has tied up for NDT and the certificates of the qualified personnel shall be submitted along with the offer. For radiography inspection the site in charge & X-ray / Gamma rays cameras shall be approved by AERB/BARC. Agency employed for NDT testing shall be approved by BEML before executing order. The extent of testing shall be as per the drawing requirement. Test reports along with the X-ray films shall be submitted with the casting supplies. The serial number and heat number of the casting shall be clearly visible on the X-ray film to have traceability.

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#### **6.8.6. Performance tests**

If any performance test is specified in the drawing and the related material standard, the same shall be carried out and test report submitted. The details of the testing shall also be submitted.

#### **7. Repair of castings**

Generally Repair of castings is not permitted. However, minor repairs may be carried out with the prior permission of BEML, in accordance with the requirements of the individual material standards adopting qualified procedures and personnel.

#### **8. Marking**

Each casting shall be legibly marked with the following details for traceability.

- a) The number or identification mark by which it is possible to trace the melt and the heat- treatment batch from which it was made
- b) The serial no. of the casting
- c) The month & year of manufacture and
- d) The manufacturer's name or trade-mark.