



BEML LIMITED
BANGALORE
R & D CENTER

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**Procurement Technical Specification
Of Forgings for DMRC RS-6 Project**

| | Name | Date | Signature |
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1. Introduction

1.1. General

This document specifies the requirements for Steel Forgings 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 Forgings 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 Forgings for DMRC RS-6 Project.
- “Supplier” means the Supplier for supplying Forgings to BEML for DMRC.
- “PTS” means BEML’s Procurement Technical Specification.

3. General Requirements

The Supplier shall supply Forgings 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 Forgings.

4. Standards

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

5. Scope of Supply

5.1. General

The supplier shall supply Forgings 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 along with every batch of supplies.

- ✓ Dimensional check sheets
- ✓ Material test certificates (Chemical composition & Mechanical tests)
- ✓ Macroetched test report

5.3. Submission of Macro etched sample

1 No. forging in the heat treated condition shall be subjected to Macro etching and the etched sample shall be submitted for review and approval.

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5.4. Submission of one no. sample Forging for First Article Inspection

The supplier shall supply one no. free sample forging in the machined/semi machined condition for First Article Inspection. BEML may decide to conduct destructive tests also on the Forging. After obtaining approval from BEML only, mass production has to be taken up.

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 Forgings.

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 Forging supplies.

6.2. Workmanship and finish

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

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

6.3. Heat Treatment

The Forging shall be heat treated in properly constructed furnace, having adequate means of temperature control, which shall permit the whole of the forging being uniformly heated to necessary temperature. All forgings shall be suitably heat treated as per the requirements of the applicable drawings and corresponding material standard.

6.4. Painting

The Forgings shall be shot blasted to SA 2 ½ & 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 forgings 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) of paint shall be 80-160 microns.

6.5. 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 Forgings.

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

6.6. First Article Inspection (FAI)

The sample machined/Semi machined Forging 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 Forging. After clearance from BEML only, mass production to be taken up.**

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6.7. Inspection & Testing

6.7.1. 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.

6.7.2. Visual inspection

Every forging, irrespective of lot size shall be examined visually for surface defects and irregularities. The Forgings shall be free from cracks, laps, seams, folds, bursts and any other defect that would impair the utility of the Forgings.

6.7.3. Chemical Composition Analysis

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

6.7.4. Mechanical tests

The hardness test, tensile test, impact 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 either separately from or attached to the Forgings to which they refer and heat treated along with the Forgings. Reports shall be submitted along with the Forging supplies.

6.7.5. Bend Test

Bend test shall be carried out in accordance with IS 1599:1985. where the dimension permit, test piece, 230 mm long and 32mm square with edges rounded off, shall be machined lengthwise from each test sample and bent cold by direct pressure round a former of diameter, appropriate to the class of steel until the sides of the test piece are parallel. The bent side shall not show any cracks after testing.

6.7.6. Grain flow

One forging from each delivery run batch shall be examined for grain flow by sectioning and macro etching. The macro structure shall not show any coarse randomly oriented dendritic structure. The Supplier shall submit the macro etched sample along with the supplies.

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6.7.7. 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. Marking

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

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