

INTEGRAL COACH FACTORY , CHENNAI- 600 038					
SCHEDULE OF TECHNICAL REQUIREMENTS FOR INFRASTRUCTURE FACILITIES TO MANUFACTURE FORGING ITEMS FOR APPROVED VENDOR REGISTRATION AT ICF					ICF/MD/SPEC-142
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1. SCOPE

This Specification of Technical Requirement is applicable to all vendors seeking approval for manufacturing and supply of finished forging components for various components manufactured by Integral Coach Factory.

Items generally covered in this STR are Axle box guide, Brake gear pins, Draft key, Draw gear pin, Hanger block and Bogie bolster suspension hanger. ICF reserves the right to alter the above-mentioned list.

2. IN-HOUSE REQUIREMENTS


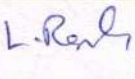



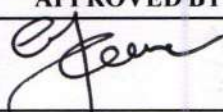
- The vendor must possess a valid **ISO 9001** Quality Management Certification.
- Suitable software shall be available for Process Simulation (Forge Simulation / FEA), CAD / CAM for Dies and Components, Material & Heat Treatment Tracking.
- Manufacturing facilities must be permanent, established, and meet statutory approvals like factory license, pollution clearance, and safety certifications.
- All stages from forging, machining, heat treatment, surface preparation for painting, testing, phosphating and painting must be in-house.
- Raw material to be procured from IR/RDSO/ICF approved steel manufacturers.
- Traceability of materials must be maintained from raw material to finished product.

2.1. Manpower Requirements

- 2.1.1. Qualified foundry engineer/metallurgist.
- 2.1.2. Trained Personnel for Destructive testing
- 2.1.3. Certified NDT Level II/III personnel.
- 2.1.4. Trained inspection and QC staff.

2.2. Land and Building




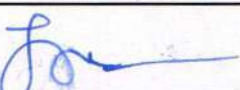
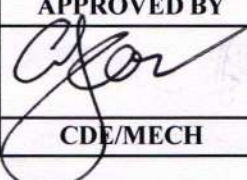
- 2.2.1. Covered area: Minimum 1000 square meters.
- 2.2.2. Adequate covered space shall be available for raw material storage, forging, heat treatment, machining, testing, and storage of finished products.
- 2.2.3. Well-ventilated and illuminated work areas with appropriate foundations.
- 2.2.4. Provision of automated material handling systems, advanced dust and fume extraction, and climate-controlled inspection zones.

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2.3. Machinery & Equipment with Minimum Capacities

Power Hammer / Hydraulic Forging Press	Minimum 1000 kN (100 Ton), Punching of rectangular hole in pin should be available
CNC Lathe / Capstan Lathe	Min. 400 mm swing, 750 mm bed length, accuracy ± 0.02 mm
Drilling Machine (Pillar or Radial)	Min. 25 mm drill capacity in mild steel
Milling Machine	Table size 800 x 250 mm, power feed
Heat Treatment Furnace (Electric/Oil/Gas)	900–1200°C working range, Min. 1 ton per batch, temperature uniformity $\pm 10^\circ\text{C}$ Furnace should control the internal atmosphere to avoid scaling and decarburization
Tempering Furnace Electric / Gas / Oil-fired with temperature controller and recorder	150°C to 700°C, adjustable and uniform across the chamber, temperature uniformity $\pm 10^\circ\text{C}$
Sealed Quench Furnace with Gas	Working temperature: 850°C – 950°C
Carburizing	Atmosphere control with endothermic/ exothermic gas
Quenching Tank (Oil / Water)	Minimum volume: 2,000 – 5,000 liters , Material: MS with inner refractory lining or SS-304
Shot Blasting / Cleaning Unit	Minimum 500 kg/hr throughput
3 axis CNC machining centre	Of required numbers
Phosphating baths	Hot phosphating bath as per IS 3618
Hardness Testing Machine (Brinell/Rockwell)	Load range 60–3000 kgf, conforms to IS:1500 / ISO 6506
Universal Testing Machine (UTM)	Capacity 50–100 kN (5–10 tons), computerized preferred
Charpy Impact Testing Machine	Up to 300 Joules, ambient and sub-zero testing capability
Ultrasonic Flaw Detector	Frequency range 1–5 MHz, with 0.1 mm resolution

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Magnetic Particle Testing (MPT) Kit	Shall have electromagnetic crack detector with facility to apply longitudinal and circular magnetization.
Dye Penetrant Testing (DPT) Kit	Visible and fluorescent kits with developer and cleaner
Overhead Crane / Hoist	Min. 1 ton lifting capacity
Power Hacksaw	Capacity to cut billets up to Ø100 mm / 100×100 mm
Band Saw Machine	Horizontal type, 1–1.5 HP motor, cutting size up to 150 mm
Billet Shearing Machine	Hydraulic or mechanical, cutting force ≥ 100 tons
Compressors	Min 2 nos. of 75cfm each
Hand Grinder (Angle Grinder)	100–125 mm disc size, 750W–1000W rating, heavy-duty industrial grade
Pencil Grinder (Die Grinder)	High-speed rotary tool, 20,000–30,000 RPM, air/electric driven
Spray Painting Booth	Enclosed or semi-enclosed, dust-free area with proper ventilation

2.4. Environmental & Safety Compliance

- 2.4.1 PPE (helmets, gloves, eye shields) must be provided.
- 2.4.2 Proper ventilation, exhaust, and safety protocols near heat treatment areas.
- 2.4.3 All electrical and mechanical installations must meet IS: 5216 and IS: 3016 for safety.


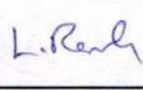


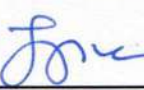
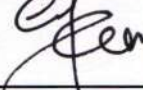
2.5 Material Handling

3. TESTING FACILITIES

The firm shall have the following facilities in house:

3.1 Chemical Testing

- 3.1.1 **Spectrometer:** Optical emission spectrometer shall be available for determination of all the elements stipulated in governing standard.
- 3.1.2 **Wet Analysis Lab:** Facility for chemical verification using standard reagents and titration methods.
- 3.1.3 Firm shall have an in house NABL accredited laboratory or firm shall have a tie-up with a NABL lab.

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3.2 Mechanical Testing

- 3.2.1 Universal Testing Machine (UTM):** Firm shall have UTM of min. 20T Capacity, equipped with all provisions for assessment of mechanical properties as mentioned in governing specification. Computer controlled UTM is preferable.
- 3.2.2 Impact Testing Machine:** Charpy/Izod impact machine of minimum capacity 300J, with provisions to cool the specimen upto -40°C.
- 3.2.3 Hardness Tester:** Suitable hardness tester such as Brinell hardness tester or Rockwell B/C scale.

3.3 Microstructure Examination



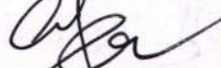
- 3.3.1 Metallurgical Microscope:** Capable of magnifying upto 1000x magnification, with facility for capturing the microstructure with analysis software.
- 3.3.2** Shall have facility for metallographic polishing and etching.
- 3.3.3** Metallurgist or Suitably trained personnel shall be available for metallographic polishing, etching , identification of heat treatment etc.,

3.4 Non-Destructive Testing (NDT)

Firm shall have in house facility for Visual Testing, Dye penetrant testing, Magnetic particle testing and ultrasonic testing details of which is as given below:

- 3.4.1 NDT Personnel:** Shall Certified to Level II (SNT TC 1A/ IS 13805/ ISO 9712).
- 3.4.2 Dye Penetrant Testing (DPT):** Penetrants, developers, emulsifiers, as per ISO 3452-1.
- 3.4.3 Magnetic Particle Testing (MPT):** Bench type Electromagnetic crack detector with facility for applying longitudinal and circular magnetization
- 3.4.4 Ultrasonic Testing (UT):** Ultrasonic flaw detector of suitable instrument type (Pulse-echo pulser/receiver, digital A-scan, portable. Option: phased array (PAUT) + TOFD module for higher accuracy/sizing)

- 3.4.4.1** Probe of suitable frequency range (0.5 MHz – 15 MHz instrument bandwidth; probes typically 0.5, 1, 2.25, 4, 5, 10 MHz)

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3.4.4.2 Pulser, Receiver dynamic range, Gain control, Pulse repetition frequency (PRF), Display, Measurement tools (DAC (or DGS), TCG (Time-Corrected Gain), B-scan/C-scan, gate markers, distance/velocity calibration)

3.4.4.3 Calibrations & controls (Velocity, amplitude, zero offset, wedge delay, linearity check, sensitivity check; ability to store procedures)

3.4.4.4 Data & reporting (USB / Ethernet export, raw A-scan data, PDF/CSV reports, image export)

3.4.4.5 The Ultrasonic testing Standards shall comply with (EN 12668-1/2 (instrument/probe characterization), ISO 16810, ASME Section V & relevant ASTM practice (A609, E213, etc.)

3.4.5 Radiographic testing: Firm shall have NABL accredited Radiographic testing facility with suitably trained staff for radiographic testing. Otherwise, firm shall have tie up with a NABL accredited laboratory for the same.

3.5 Dimensional and Visual Inspection

3.5.1 Vernier calipers, micrometers, dial gauges, GO & NO GO gauges.

3.5.2 Surface roughness tester.

3.5.3 Welding gauges and templates.

3.5.4 Only digital instruments shall be used for measurements.

3.5.5 3D Coordinate Measuring Machine (CMM) .

4 QUALITY ASSURANCE AND DOCUMENTATION

4.1 ISO 9001:2015 certification (mandatory).

4.2 Firm shall have ICF approved Quality Assurance Plan (QAP).


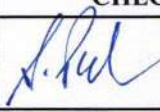
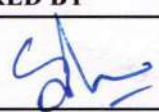
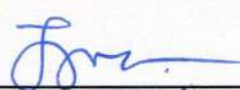
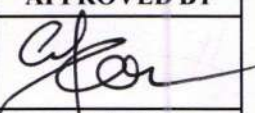
4.3 QAP shall consists of the following as minimum requirements.

4.3.1 Raw material control (traceability, chemistry, cleanliness).

4.3.2 Process control (forging ratio, temps, heat treatment).

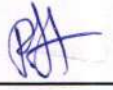
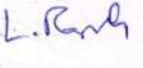
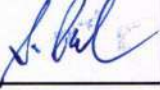
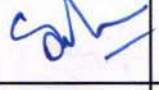
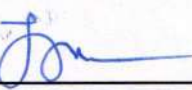
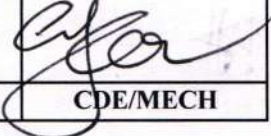
4.3.3 Testing & inspection (mechanical, NDT, dimensional).

4.3.4 Documentation & traceability (MTCs, reports, inspection notes).

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Sl.No	Stage	Inspection/Control
I	Manufacturing stage	
A	Raw material (billet/ingot)	Certificate review (chemistry, cleanliness, UT report if applicable), PMI (Positive Material Identification)
B	Cutting & billet preparation	Dimensional check, surface condition, end cropping to remove defects
C	Heating	Furnace calibration, temperature uniformity, time-temp record, no overheating
D	Forging operation	Deformation ratio, forging temp control, grain flow direction (macroetch sample)
E	Intermediate inspection	Visual check for laps, cracks, folds; dimension check
F	Heat treatment	Furnace temperature check, graph etc.,
G	Quenching oil tank	Quenching oil temperature control, agitation etc.,
H	Machining	Dimensional check vs drawing, surface finish
I	Final inspection	Visual, dimensional, marking & stamping
J	Packing & dispatch	Protection from corrosion, correct marking, packing list
II	Non-destructive testing (NDT)	
A	Visual testing (VT)	100% of surface.
B	Magnetic particle testing (MT) or Dye penetrant testing (PT)	100% of the batch
C	Ultrasonic testing (UT)	As per drawing requirements
D	Radiographic testing (RT) (If warranted by drg/spec)	As per drawing requirements

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Sl.No	Stage	Inspection/Control
III	Destructive testing (DT)	
A	Tensile test	Ultimate Tensile Strength, Yield Strength, %Elongation
B	Impact test	Charpy / Izod & V notch (or) U notch as applicable
C	Hardness test	Brinell / Rockwell hardness tester
D	Chemical analysis	Ladle / product analysis using spectrometer, wet method if required.
E	Metallography (microstructure)	Heat treatment condition, grain size etc., as warranted by the specification
IV	Documentation & Records	
A	Material test certificate (MTC) of raw material (EN 10204 type 3.1 or 3.2).	
B	Furnace calibration & heat treatment charts.	
C	Chemical & mechanical test reports.	
D	NDT reports (UT, MPI, LPI).	
E	Dimensional inspection records.	
F	Final release note / inspection report.	
G	Traceability log (heat number, forging lot, test coupon link).	
H	Material test certificate (MTC) of raw material (EN 10204 type 3.1 or 3.2).	

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5 SAFETY AND ENVIRONMENTAL CONSIDERATIONS

- 5.1 Proper ventilation and dust extraction systems.
- 5.2 PPE for workers (gloves, helmets, eye protection).
- 5.3 Fire extinguishers and emergency exits.
- 5.4 Waste disposal systems for sand, slag, and chemicals.
- 5.5 Compliance with ISO 14001 (Environmental Management Systems) and ISO 45001 (Occupational Health & Safety).

6 PHOSPHATING PROCESS:


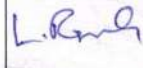



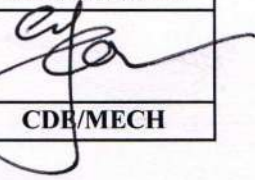
Firm shall have a validated HOT phosphating process which involve Surface Cleaning / Degreasing, Rinsing (Pre-Wash), Pickling (Acid Treatment), Rinsing, Phosphate Coating / Conversion Treatment and Sealing in accordance with IS 3618. Coating weight of the phosphate coating, strength of acid and alkali solutions , pointage of phosphate bath shall be measured in definite intervals and shall be documented .

7 SHOT PEENING FACILITY:

Firm shall have shot peening facility with adequate capacity for introducing compressive stress on the material. Firm shall have validated procedure for the same. Shots used in the process shall be assessed for quality while procuring as well as during functioning. Facility shall be available to determine the intensity of shot peening using Almen Strip. When measured as per EN 13298 Annexure C, intensity of shot peening shall be 0.4 – 0.6 mm.

8 Surface preparation

Firm shall have in house grit blasting / shot blasting facility to achieve surface roughness of Sa 2.5 or better in accordance with ISO 8501-1 (Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness — Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings)

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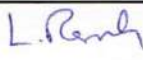

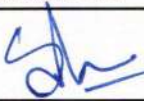
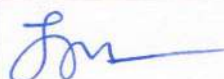
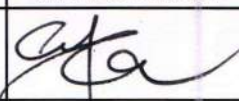
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9 PAINTING

- 9.1 Spray painting booth with exhaust and filtering system (min. 3 m × 3 m)
- 9.2 Firm shall have a well defined painting schedule in accordance with relevant drawing / specification with procedure for measurement of dry film thickness.

10 Handling of Non-Conforming Products

- 10.1 Non-conforming products must be tagged and segregated.
- 10.2 Root Cause Analysis (RCA) and Corrective & Preventive Action (CAPA) to be conducted.
- 10.3 Records of NCRs (Non-Conformance Reports) must be maintained.

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