Expression of Interest (EOI) for identification of vendors for supply of Underslung Diesel Engines for Diesel Electric Tower Car (DETC)

BHEL invites Expression of Interest (EOI) from reputed, technically and financially sound vendors for supply of underslung Diesel engines. These underslung Diesel engines shall be used for Diesel Electric Tower Car (DETC) manufactured by Indian Railways.

The annual requirement of this material is approx. (100 - 150) nos.

Pre-Qualification Requirement (PQR) can be downloaded from website (www.bhel.com). The interested parties may submit their Expression of Interest along with compliance of PQR through email within 30 days of the EOI publication date.

Interested vendors may contact following BHEL Bhopal representative for further technical details:-

1) I. Chattopadhyay, AGM (CET)
   BHEL Bhopal, Pipiani-462021 (MP), India
   Ph: +91-755-250-5220,Mob: 9425604503
   Email: ichat@bhel.in

2) Abhideep Choudhury, Manager (CET)
   BHEL Bhopal,Pipiani-462021 (MP), India
   Ph: +91-755-250-5487,Mob: 9406903591
   Email: achowdhary@bhel.in@bhel.in

3) Sanjay Bhengra, Dy. Manager (CET)
   BHEL Bhopal,Pipiani-462021 (MP), India
   Ph: +91-755-250-2246 ,Mob: 7587571158
   Email: sanjay1@bhel.in

Notes:

A. All corrigendum, corrections, amendments, clarifications etc., to the EOI will be hosted on BHEL website (www.bhel.com). Bidders should regularly visit website(s) to keep themselves updated.

B. Vendor may be considered technically suitable for supply of material after thorough evaluation of response against EOI.

Technical Pre-Qualification Requirement (PQR) of Underslung Diesel Engines for Diesel Electric Tower Car (DETC)

Ref. No. CET/3.4/K/C02 Date: 13.06.2025

Technical Pre-Qualification Requirement for Underslung Diesel Engines is as under:

Sl.no.	Description	Vendor to comment and submit relevant documents	
1.	Diesel engine should be as per BHEL specification no. CET/3.4/SP0020/T07 (Rev.04), Dtd.28.08.2024. (Copy enclosed).	Yes/No	Clause by clause comments of specification.
2.	The offered engine should be duly type tested and approved by RDSO/Railway Production Unit for regular use in underslung Diesel Electric Tower Car (DETC).	Yes/No Yes/No	1. For Qualifying in EOI, OEM's of traction engine should be a successful supplier of underslung diesel engines for DEMU/DETC/Loco applications to Indian Railways or to any other world Railway system. In this regard documentary evidences should be submitted. 2. Diesel engines for actual supply for underslung DETC application has to be duly type tested and approved by RDSO/ICF for qualifying in actual tender stage. Same may be confirmed.
3.	The supplier should have servicing facilities anywhere in India throughout the warranty period. After the warranty period is over he shall, on call, give service support for troubleshooting and for obtaining spares parts.	Yes/No	With compliance, the supplier shall submit a list of service network with their service points all over India.
4.	Manufacturing and supply experience of same/similar underslung Diesel engine supplied in preceding 3 years to any Railways across the world to be submitted.	Yes/No	Unpriced PO copy along with supply proof (like challan, invoice or any other document) and technical approval by Railways to be submitted.
5.	Production capacity of the firm for Underslung Diesel Engine per month/annum to be submitted.		Proof of dispatch of diesel engines per annum to be submitted for preceding 3 years.
6.	All documents should be in English or its translation thereof.	Yes/No	

Prepared By:	Checked By:	Approved by:
13/06/25	13/06/25	13.6.25
(Sanjay Bhengra) Dy.Mgr. /CET	(Abhideep Choudhury) Mgr (CET)	J.Chattopadhyay AGM (CET)

BHARAT HEAVY ELECTRICAL LIMITED
TRANSPORTATION SYSTEMS GROUP & CENTRE FOR ELECTRIC TRANSPORTATION
UNIT'S ADDRESS: PIPLANI, BHOPAL

SPECIFICATION CUM COMPLIANCE CERTIFICATION

FOR

DIESEL ENGINE AND POWERPACK ACCESSORIES FOR UNDERSLUNG APPLICATION IN 700HP TWIN POWER PACK DIESEL ELECTRIC TOWER CAR (DETC)

SPECIFICATION NO: CET/3.4/SP0020/T07 (Rev.04)

REVISION	DATE	PREPARED BY	CHECKED BY	APPROVED BY
04	28/08/2024	28/8/24 SANJAY BHENGRA	28/08/24 ABHIDEEP CHOUDHURY	28.8.24 I CHATTOPADHYAY

SNO	DESCRIPTION			Supplier to Confirm or Provide any deviations
1.0	**PURPOSE :**			
1.1	The proposed Diesel Engine shall be utilized for 700hp under slung twin power pack Diesel Electric Tower Car (DETC) for Indian Railways.		Supplier to confirm	
2.0	**SCOPE OF SUPPLY:**			
2.1	Set of Diesel Engine of proven design Cummins make NTA 855R or similar other reputed make and all items required for powerpack assembly consisting of:	**01 Set**	Supplier to confirm	
2.1.1	Diesel engine as per clause no. 3.3 of BHEL specification no. CET/3.4/SP0020/T07 (REV.04). Qty.- 2nos			
2.1.2	Shipping skid for mounting of above diesel engine and BHEL alternator. Qty.- 2nos.			
2.1.3	Set of hardware for mounting of above diesel engine and BHEL Alternator. Qty: 2nos			
2.1.4	Set of brackets for mounting of above 2nos power-pack in the underframe. Qty: 2nos.			
2.2	Set of accessories for complete assembly and operation of 2nos. power pack per DETC consisting of diesel engine as per clause 2.1 of this specification.	**01 Set**	Supplier to confirm	
2.3	Assembly and alignment of 2nos. power pack at BHEL premises as per clause 7.1 of BHEL specification no: CET/3.4/SP0020/T07 (Rev.04) consisting of diesel engine as per clause 2.1 of this specification.	**01 Set**	Supplier to confirm	
2.4	**Installation and Commissioning of powerpack consisting of diesel engine as per clause 2.1 of this specification.** a) Installation of 2nos. power pack per DETC with all engine accessories including installation of BHEL supplied auxiliary alternator and other activities mentioned in clause 7.2 of BHEL specification no. CET/3.4/SP0020/T07 (REV.04) will be in the scope of engine supplier.	**01 Set**	Supplier to confirm	

	b) Commissioning of 2nos. diesel engines and associated accessories shall be done by engine supplier as per clause 7.2 of BHEL specification no. CET/3.4/SP0020/T07(REV.04)			
2.5	**Supervision of Installation and Commissioning of powerpack consisting of diesel engine as per clause 2.1 of this specification.** a) Instead of clause no. 2.4 (a) of BHEL specification, in case Railways undertakes the installation work themselves and wants only Supervision of Installation of 2nos. power pack per DETC with all engine accessories including BHEL supplied auxiliary alternator and other activities mentioned in clause 7.2 of BHEL specification no. CET/3.4/SP0020/T07 (REV.04), same is to be done by Engine supplier. b) Commissioning of 2nos. diesel engines and associated accessories shall be done by engine supplier as per clause 7.2 of BHEL specification no. CET/3.4/SP0020/T07 (REV.04).	**01 Set**	Supplier to confirm	
2.6	Any other items, tools, equipment, consumable etc. which are not covered in the scope of supply and essential for satisfactory operation of power pack shall be in scope of supplier.		Supplier to confirm	
3.0	**TECHNICAL DETAILS:**			
3.1	**General Details:**			
3.1.1	The supplier is required to furnish clause by clause comments to this specification, either confirming acceptance of the clause or indicating deviation therefrom. In the event a supplier is unable to comply, either partially or fully, to any of the stipulations made in this specification, it must be brought to the notice of purchaser with full particulars of the deviations, technical details, cost implications and past service performance, etc.		Supplier to confirm	
3.1.2	The supplier shall submit detailed scope of supply duly covering all technical requirements covered in this specification with quantity.		Supplier to confirm	

3.1.3	The supplier shall develop the design based on the details given in this specification and sound engineering practices. The entire design & technical data along with calculations shall be submitted to BHEL for onward approval of Railway before commencing manufacturing of engine.	Supplier to confirm	
3.1.4	The design shall be based on S.I. Units.	Supplier to confirm	
3.1.5	From the information given in this specification and instructions of RDSO/ Indian Railway Production units, the supplier shall prepare a full set of engineering drawings and submit to BHEL for onward approval of Railway.	Supplier to confirm	
3.1.6	When submitting drawings of a particular detail, other details depending on it shall be shown in juxtaposition	Supplier to confirm	
3.1.7	Material specifications, manufacturing tolerances and other details, which are necessary for manufacture for each component shall be indicated on the drawings.	Supplier to confirm	
3.1.8	Drawing for approval shall be submitted in standard size (s) as per IS: 696 along with main calculation details in triplicate. List of drawings/calculations shall be submitted to BHEL for onward approval of Railway before undertaking manufacture of prototype. Any other drawings of which manufacturer desire to obtain approval of RDSO/ Indian Railway Production units shall also be submitted to BHEL.	Supplier to confirm	
3.1.9	**Supplier's responsibility:** The supplier shall be entirely responsible for the execution of the works strictly in accordance with the terms of this specification and the conditions of contract, notwithstanding any approval which RDSO/ Indian Railway Production units or the Inspecting officer may have given: (a) Of the detailed drawing prepared by the supplier. (b) Of other parts of the work involved by the supplier.	Supplier to confirm	
3.1.10	**Exhibited Drawings and standard Specifications:**		
3.1.10.1	"Exhibited Drawings" means the drawings which are exhibited or provided by RDSO/ Indian Railway Production units for the guidance of the supplier.	Supplier to confirm	
3.1.10.2	The design of the engine must comply with the dimensions, and fittings included in the exhibited drawings as far as possible. Any deviation therefore shall be clearly mentioned in the form of a table on the drawing.	Supplier to confirm	
3.1.10.3	The exhibited drawings are not guaranteed to be free from discrepancies. The supplier while preparing the engineering drawings shall ensure that these are free from discrepancies. He shall also incorporate all modifications desired by the	Supplier to confirm	

	RDSO/ Indian Railway Production units, subsequently, without prejudice to the date of delivery or contracted price, except as provided for under the conditions of contract.		
3.1.10.4	To improve upon the performance, modifications and corrections are made in the specification and drawings from time to time. The supplier must, therefore, satisfy himself that the drawings being used by him are of the latest version. In case of any doubt, he must get it clarified from RDSO/ Indian Railway Production units.	Supplier to confirm	
3.1.10.5	The supplier shall procure at his own expense all the drawings and specifications required for the engine.	Supplier to confirm	
3.1.10.6	Copies of drawing referred to in this specification may be obtained from RDSO/ Indian Railway Production units on payment.	Supplier to confirm	
3.1.11	**Quality Assurance Plan**		
3.1.11.1	The supplier should possess valid ISO-9001:2000 certificate for his work's address, covering the items for which he is participating in the contract. The supplier shall formulate Quality Assurance program (QAP) detailing the methodology proposed to be followed to ensure a quality product. QAP shall cover quality assurance procedures and procedures to be followed during all stages of design, manufacture, testing and commissioning of the equipment. The supplier shall define the role of each functional group in the organisation for achieving the required quality of the product and submit a comprehensive document "Quality assurance manual" in accordance with IS 102011982 as the basic guideline. The preparation of necessary charts and proforma shall be to IS: 7200 (Part- III)-82.	Supplier to confirm	
3.1.11.2	The supplier, whose bid is accepted, shall be required to submit a "Quality Assurance Manual" by giving details as to how the quality of specific product is proposed to be assured. Supply of the equipment shall commence only after "Quality Assurance Plan" has been approved by RDSO/ Indian Railway Production units. The above shall apply to the main supplier as well as sub-suppliers.	Supplier to confirm	
3.2	**CLIMATIC CONDITIONS:**		
3.2.1	The Engine shall be in continuous operation under the following atmospheric and climatic conditions:	Supplier to confirm	
	1 Atmospheric temperature — Metallic surface temperature under Sun: 75° C max. and in shade: 55 °C max. Minimum temperature: -		

			10°C (Also snow fall in certain areas during winter season).		
	2	Humidity	100% saturation during rainy season		
	3	Reference site conditions	i) Ambient Temp. : 50° C ii) Humidity: 100% iii) Altitude: 1000m above mean sea level.		
	4	Rain fall	i) Ranging from 1750 mm to 6250 mm. ii) Number of rainy days/annum 120.		
	5	Atmosphere during hot weather	Extremely dusty and desert terrain in certain areas. The dust concentration in air may reach a high value of 1.6 mg/m3. In many iron ore and coalmine areas, the dust concentration is very high affecting the filter and air ventilation system.		
	6	Coastal area	OHE Car and its equipment shall be designed to work in coastal areas in humid and salt laden atmosphere with maximum. pH value of 8.5, sulphate of 7mg per liter, max. concentration of chlorine 6 mg per liter and maximum conductivity of 130 micro siemens/cm.		
	7	Vibration	The equipment and their arrangement shall withstand satisfactorily, the vibration and shocks normally encountered in service which are as below:- (a) Maximum vertical acceleration 3.0g (b) Maximum longitudinal acceleration 5.0g (c) Maximum train acceleration 2.0g (g – acceleration gravity) High level of 50g vibration and shocks. Accelerations over 500 m/s2 have been recorded at axle box levels for long periods during run. Vibrations during wheel slips are of even higher magnitude.		
	8	Wind speed	High wind speed in certain areas, with wind pressure reaching 200kg/m2.		
3.2.2	The engine shall be able to negotiate water logged tracks at 10 kmph, with water level of 102 mm above the rail top, for which the equipment shall be suitably designed.			Supplier to confirm	

<table>
<tr><td>3.2.3</td><td>The engine and its assemblies/accessories shall be designed and manufactured to give satisfactory performance in the tropical climate, having very dry & dusty regions in arid zones of the country, to humid coastal areas and extreme cold climate of the northern region.</td><td>Supplier to confirm</td><td></td></tr>
<tr><td>3.2.4</td><td>In addition to above the Engine has to be complied with climatic condition as per RDSO spec no. TI/SPC/OHE/8WDETC/0092 (02/09) of Aug'2015</td><td>Supplier to confirm</td><td></td></tr>
<tr><td>3.3</td><td>TECHNICAL REQUIREMENTS OF ENGINE:</td><td></td><td></td></tr>
<tr><td>3.3.1</td><td>The different speeds of the engine from idle to maximum speed and the corresponding power developed should be so selected that the number of speeds and power levels chosen should not be less than 8 (herein after referred to as notch positions) in addition to the idle position. The performance of the engine shall be optimum in each notch position in addition to being able to meet the traction load and demand by the auxiliaries. The power at each notch should not be inferior to as mentioned below(excluding engine auxiliaries):
<table>
<tr><th>Notch</th><th>RPM</th><th>HP</th></tr>
<tr><td>1</td><td>700</td><td>33</td></tr>
<tr><td>2</td><td>1000</td><td>55</td></tr>
<tr><td>3</td><td>1200</td><td>118</td></tr>
<tr><td>4</td><td>1300</td><td>156</td></tr>
<tr><td>5</td><td>1400</td><td>205</td></tr>
<tr><td>6</td><td>1500</td><td>252</td></tr>
<tr><td>7</td><td>1650</td><td>292</td></tr>
<tr><td>8</td><td>1800</td><td>320</td></tr>
</table></td><td>Supplier to confirm</td><td></td></tr>
<tr><td>3.3.2</td><td>Under-slung naturally aspirated, turbo-charged and after cooled diesel engines of proven design of Cummins make NTA 855R or similar other reputed make suitable for 8-W diesel electric tower car, complete with all accessories, suitable for traction service under the climatic and operating conditions obtained in India, shall be provided.

The continuous traction rating of each engine shall be 340 hp (approx.) or higher at 1800 rpm after due de-rating for environmental temperature of 55^0 C. It shall be battery started. Specific Fuel Consumption (SFC) shall be low. Robust construction, low maintenance and satisfactory record of past performance are of</td><td>Supplier to confirm</td><td></td></tr>
</table>

	paramount importance. Supplier shall furnish full particulars of the engine with the offer. Adequate allowance shall be made in the power of the diesel engine for the de-rating under most adverse climatic conditions stated in Clause-3.2 of this specification. Supplier shall give detailed calculations for engine's suitability and its rating.		
3.3.3	The supplier shall indicate the total horse power required for the auxiliaries with the break up power for each of the auxiliary machines at rated output. Power consumed by BHEL supplied Auxiliary Alternator is 8 KW.	Supplier to confirm	
3.3.4	The supplier shall indicate the net horse power available for input to traction under the conditions mentioned under Clause-3.2 of this specification.	Supplier to confirm	
3.3.5	The idling speed of the diesel engine shall be such so as to match the requirement of various auxiliary machines driven by the engine. Power consumed by BHEL supplied Auxiliary Alternator is 8 KW.	Supplier to confirm	
3.3.6	The mounting arrangement for power pack and auxiliary alternator will be provided by Railway. Details of mounting arrangement is given in ICF drg no. DETC/US (231)-1-1-022 & DETC/US (231)-1-1-024 (enclosed). The supplier has to ensure interfacing of the power pack as per these drawings and submit Indian Railways' approved drawing to BHEL for use in the Underslung DETC.	Supplier to confirm	
3.3.7	The diesel engine shall work satisfactorily with fuel oil to Indian Standard Specification no.1460-grade A, but shall also be able to function in a trouble free manner even with Grade B fuel oil to the same specification.	Supplier to confirm	
3.3.8	Suitable hand priming pump shall be provided to avoid air lock in the fuel system.	Supplier to confirm	
3.3.9	The engine shall be provided with suitable end on mounting arrangement to SAE-O dimensions for coupling with and driving the traction alternator. The mounting and coupling arrangement shall be of adequate capacity to withstand high deflection and torque (at starting, stopping and due to misfiring of cylinders) so that no damage is caused to the alternator and engine components in service.	Supplier to confirm	
3.3.10	The drive gear for driving compressor, auxiliary alternator and fan drive for the radiator shall also be in the scope of supplier.	Supplier to confirm	
3.3.11	Detailed torsional vibration analysis of the complete system under normal engine working as well as under conditions of one cylinder misfiring for the complete operating range including 10% over speed shall be furnished.	Supplier to confirm	

3.3.12	Air inlet to the engine shall be from inside the Car with proper ducting arrangement from the filters.	Supplier to confirm	
3.3.13	Piping from the air cleaner to the turbo-driven air handling unit shall be in the scope of supply.	Supplier to confirm	
3.3.14	The exhaust pipe shall not leave carbon soot on important assemblies like traction motors, axle drive etc. The exhaust pipe shall be taken horizontally and located under floor avoiding the position near footsteps of the vehicle with adequate insulation to withstand 700^0C.	Supplier to confirm	
3.3.15	Filters shall be of adequate air flow capacity/filtering efficiency to ensure satisfactory performance under dusty environment.	Supplier to confirm	
3.3.16	The supplier shall submit graphs showing the BMEP/engine output torque and SFC at all notch positions from idling speed to rated speed.	Supplier to confirm	
3.3.17	Lube oil consumption at rated output as a percentage of the fuel oil consumption should also be indicated.	Supplier to confirm	
3.3.18	The supplier shall furnish a copy of the Type Test report of the engine by a statutory body in support of their claim regarding performance, reliability and specific fuel consumption. In case the engine offered is not type tested earlier, the testing shall be done in the presence of RDSO's representative. In case engine is already type tested and found satisfactory then routine test report is to be submitted for all the engines by the firm to the purchaser. RDSO may like to conduct acceptance test, if required.	Supplier to confirm	
3.3.19	The noise level in the driver's cabin with the doors and windows in closed condition shall be less than 75 db (A) and in the inside of the coach shall not exceed 80 db (A) at maximum output and speed of the engine.	Supplier to confirm	
3.3.20	The exhaust emission shall be below the limit laid down in UIC/ORE no. B13/RP22/E Clause-4 of the entire engine range of operation from idle to full power and shall be measured as per UIC/ORE/B13/RP21E. The exhaust opacity shall not exceed 20 as measured by Hartridge smoke Meter, under all conditions including acceleration of the engine. A suitable catalytic converter shall be connected in exhaust pipe to limit the emission.	Supplier to confirm	
3.3.21	The supplier shall supply the complete system including engine starter, battery charging arrangement from engine and additional battery charger from external source of 230V AC supply for charging of 24 V, 290 Ah battery (battery is not in supplier's scope).	Supplier to confirm	

3.3.12	Air inlet to the engine shall be from inside the Car with proper ducting arrangement from the filters.	Supplier to confirm	
3.3.13	Piping from the air cleaner to the turbo-driven air handling unit shall be in the scope of supply.	Supplier to confirm	
3.3.14	The exhaust pipe shall not leave carbon soot on important assemblies like traction motors, axle drive etc. The exhaust pipe shall be taken horizontally and located under floor avoiding the position near footsteps of the vehicle with adequate insulation to withstand 700^0C.	Supplier to confirm	
3.3.15	Filters shall be of adequate air flow capacity/filtering efficiency to ensure satisfactory performance under dusty environment.	Supplier to confirm	
3.3.16	The supplier shall submit graphs showing the BMEP/engine output torque and SFC at all notch positions from idling speed to rated speed.	Supplier to confirm	
3.3.17	Lube oil consumption at rated output as a percentage of the fuel oil consumption should also be indicated.	Supplier to confirm	
3.3.18	The supplier shall furnish a copy of the Type Test report of the engine by a statutory body in support of their claim regarding performance, reliability and specific fuel consumption. In case the engine offered is not type tested earlier, the testing shall be done in the presence of RDSO's representative. In case engine is already type tested and found satisfactory then routine test report is to be submitted for all the engines by the firm to the purchaser. RDSO may like to conduct acceptance test, if required.	Supplier to confirm	
3.3.19	The noise level in the driver's cabin with the doors and windows in closed condition shall be less than 75 db (A) and in the inside of the coach shall not exceed 80 db (A) at maximum output and speed of the engine.	Supplier to confirm	
3.3.20	The exhaust emission shall be below the limit laid down in UIC/ORE no. B13/RP22/E Clause-4 of the entire engine range of operation from idle to full power and shall be measured as per UIC/ORE/B13/RP21E. The exhaust opacity shall not exceed 20 as measured by Hartridge smoke Meter, under all conditions including acceleration of the engine. A suitable catalytic converter shall be connected in exhaust pipe to limit the emission.	Supplier to confirm	
3.3.21	The supplier shall supply the complete system including engine starter, battery charging arrangement from engine and additional battery charger from external source of 230V AC supply for charging of 24 V, 290 Ah battery (battery is not in supplier's scope).	Supplier to confirm	

3.3.22	Suitable anti-vibration mountings for the engine, alternator, auxiliary alternator, and compressor shall be used. The anti-vibration mountings (AVMs) shall be of approved make. The type and number of AVMs offered shall be specified. To meet the vibration limit, any increased numbers if required shall be to the supplier account. The deflection characteristics of the AVMs shall be submitted.	Supplier to confirm	
3.3.23	All threaded fasteners shall be of RDSO approved make.	Supplier to confirm	
3.3.24	The engine manufacturer shall provide necessary safety devices to protect the engine against hot engine, low lube oil pressure, engine over speed and low water levels etc. two high water temperature thermostats with 5^0C difference in setting shall be provided.	Supplier to confirm	
3.3.25	List of all accessories that are offered with the diesel engine, clearly indicating those mounted on the engine and those supplied loose shall be furnished by the supplier.	Supplier to confirm	
3.3.26	Electrically operated gauges for the various indication requirements and fault indication lamps shall be provided in each driving cab.	Supplier to confirm	
3.3.27	The stopping of the engine shall be by de-energizing a fuel solenoid valve.		
3.3.28	The initial fill of lube oil for the engine as recommended by the engine manufacturer shall be in scope of supplier.	Supplier to confirm	.
3.3.29	The supplier shall submit along with the offer, complete engine data as per Annexure -I, as applicable to the engine offered.	Supplier to confirm	
3.3.30	**Cooling Equipment**		
3.3.30.1	The cooling equipment shall be guaranteed to work efficiently under the climatic conditions specified in clause-3.2 of this spec. The radiator and fan shall be of adequate capacity with 30% choked condition of the radiator used. Air flow required for the radiator fan shall be at least 15% more than that actually required to make up for any reduction in air flow due to train movement. The limited ambient capability of cooling system shall be minimum 55^0C with 30% choked condition.	Supplier to confirm	
3.3.30.2	The complete technical details of the radiator and its fan shall be furnished.	Supplier to confirm	
3.3.30.3	Two independent sets of cooling equipment (i.e. roof mounted radiator, hydraulic tank, hydraulic oil cooler and water pipes) shall be provided. The individual radiator will take care of the cooling requirements of respective engines and the hydraulic cooler.	Supplier to confirm	

3.3.30.4	The maximum operating water temperature shall normally not exceed 95^0C. There should be provision of alarm and shut off at higher temperature.	Supplier to confirm	
3.3.30.5	The radiator shall be roof mounted with proven electric fan drive system or hydraulic fan drive arrangement which shall have thermostatic control to regulate the fan speed depending upon the water temperature. Complete technical details of the radiator and its fan & drive shall be furnished to RDSO/ Indian Railway Production unit. The most suitable and reliable design and type of fan & drive shall be selected at the design approval stage. If there is any cost differential for electric driven radiator cooling and hydraulic driven radiator cooling fan shall be clearly indicated by the supplier.	Supplier to confirm	
3.3.30.6	Suitable water raising apparatus, using mono block pumps for topping up the water in the radiator shall be in the scope of supply. A stainless steel tank for the radiator of not less than 100 liters capacity shall also be provided.	Supplier to confirm	
3.3.30.7	The installation drawings of the radiator and fan with details of fan drive shall be supplied by the supplier.	Supplier to confirm	
3.3.30.8	Cooling Proving trials shall be carried out in a test bed at the firm's premises (OEM) to prove the adequacy of the cooling system comprising of radiator and hydraulic oil cooler for the prototype in the presence of RDSO/ Indian Railway Production unit representative. The procedure for such testing shall be submitted and got approved from RDSO/ Indian Railway Production unit.	Supplier to confirm	
3.3.30.9	The following calculations in support of offered cooling system shall be submitted: □ Cooling requirement for all sources of heat (with break up) □ Heat dissipation characteristics of the radiator and its resistance characteristics □ Radiator fan characteristics showing the air flow vs total heat at different speeds. □ Cooling system-matching calculations.	Supplier to confirm	
	□ Schematic cooling circuit diagram showing water, oil and air flow through each equipment.		
3.3.30.10	The supplier shall submit RDSO/ Indian Railway production unit approved drawing for mounting details of radiator assembly, fan drive arrangement and ensure that these fit completely within the overall dimensions of OHE car.	Supplier to confirm	

3.3.31	**Compressor:** Engine driven air-cooled compressors of adequate capacity and complete with all accessories suitable for continuous operation at a nominal maximum pressure of 8 kg/sq.cm shall be offered. The capacity of the air compressor shall not be less than 10 cfm at engine low idling speed. The essential accessories as under shall also be in scope of supplier:- i. Suitable after cooler and air dryer. ii. The compressor shall be provided with suitable governor to cut in and cut out at 7 Kg/cm2 and 8 Kg/cm2 respectively and a safety valve set at 8.5 Kg/cm2 iii. Main compressor hose with adapter suitable for 1"BPST male fitting (S.S. double ferrule) iv. Unloader hose with adapter suitable for 3/8"BPST male fitting (S.S. double ferrule) Note: i. The compressor capacity and expected power consumption shall be specified at low idle and max operating speed of the engine. The compressor offered shall be of proven capability in Railway Rolling stock application.	Supplier to confirm	
3.3.32	**Engine Control**		16
3.3.32.1	The engine control system should return the engine to idling (no traction load) position in case of emergency brake application.	Supplier to confirm	
3.3.32.2	Engine should be electronically controlled using suitable and proven ECUs. Electronic Governing system for engine control (LCC) as well as main traction alternator excitation control shall be provided.	Supplier to confirm	
3.3.32.3	Supplier shall indicate notch wise speed and power of the engine offered.	Supplier to confirm	
3.3.33	**Instruments and Safety Devices:**		
3.3.33.1	The following instruments & safety devices shall be part of supply for safe and satisfactory operation of the Car. The equipment and controls shall be arranged in both the driving cabs of the Car so that the car can be worked from any one of the driving cabs. Adequate Control Equipment including gauges, instruments and cab safety devices shall be provided for safe and satisfactory operation of the DETC. The controls shall be so arranged in the driver's cab that it will be within easy reach	Supplier to confirm	

	vii) Radiator water temperature too high viii) Engine 1 ON ix) Engine 2 ON x) Engine shut-down xi) Wheel slip indication xii) Battery discharge indication xiii) Low idle rpm indication xiv) Power ground xv) Alternator 1 Excitation ON xvi) Alternator 2 Excitation ON xvii) Alternator overload xviii) Engine 1 Trip xix) Engine 2 Trip xx) HCWT engine-1 xxi) HCWT engine-2 xxii) Gov-1 supply fail xxiii) Gov-2 supply fail xxiv) Engine idle-1 xxv) Engine idle-2		
4.0	**COMPLIANCE WITH NATIONAL / INTERNATIONAL STANDARD:**		
4.1	Diesel Engine shall comply with relevant standard as mentioned in this specification.	Supplier to confirm	
5.0	**TOOLS & TESTING KIT:**		
5.1	The supplier shall supply testing equipment with each engine required for ensuring optimum performance and trouble-free service of the equipment & accessories provided with engine. The cost of testing equipment shall be quoted separately.	Supplier to confirm	
5.2	The supplier shall also offer separately special jigs, tools and instruments, which shall essentially be required for maintenance of engine and shall demonstrate to the IR, the satisfactory functioning of the tools, jigs & instruments supplied by him. The specification of testing equipments shall be provided by supplier.	Supplier to confirm	
6.0	**QUALIFYING CRITERIA:**		

6.1	**SERVICE NETWORK:** The supplier shall provide and ensure servicing facilities in India throughout the warranty period. After the warranty period is over he shall, on call, give service support for troubleshooting and for obtaining spares parts. A well designed and informative electronic portal for lodging of complains and action taken by supplier shall made operative before dispatch of first prototype vehicle.	Supplier to confirm	
6.2	The offered engine should be duly type tested and approved by RDSO/ Indian Railway Production unit for use in underslung Diesel Electric Tower Car (DETC). Documentary evidence of the same is to be submitted with the offer.	Supplier to confirm	
6.3	In the Indian Railway Production unit/work shop anywhere in India where DETC will be manufactured with the offered engine, supplier team has to be posted for installation, commissioning and technical support.	Supplier to confirm	
7.0	**ASSEMBLY AND INSTALLATION & COMMISSIONING (I&C):**		
7.1	**Assembly and alignment of Power pack**		
7.1.1	Assembly and alignment of power pack (engine and BHEL supplied traction Alternator) shall be done by engine supplier at BHEL premises. Alternator with flex plate shall be supplied by BHEL.	Supplier to confirm	
7.1.2	Suitable skid and hardware required for assembly and alignment of power pack shall be supplied by supplier.	Supplier to confirm	
7.2	**Installation & Commissioning**		
7.2.1	Installation and commissioning of complete power pack (engine & traction alternator assembled), engine accessories, piping etc. required for successful operation of power pack and BHEL supplied auxiliary alternator on a shell provided by Indian Railways at their premises (anywhere in India). Following items required for installation to be supplied by supplier: 1. For aux alternator a) Flexible coupling b) Cardan shaft c) Frame and fixture for auxiliary alternator 2. All mounting hardware required All hardware shall be railway approved make.	Supplier to confirm	

7.2.2	Radiator loading and fixing on DETC shell (including unpacking, minor rework/grinding if any)	Supplier to confirm	
7.2.3	Installation of pipeline supplied with engine i.e. hydraulic, coolant etc.	Supplier to confirm	
7.2.4	Battery charger loading and fixing (including unpacking, minor rework/grinding if any)	Supplier to confirm	
7.2.5	Wiring termination of Engine gauges, meters and for offered governing system for engine control.	Supplier to confirm	
7.2.6	Cranking preparation and cranking of diesel engine, hydraulic pressure setting and safety checks of engine related items.	Supplier to confirm	
7.2.7	Internal and External Load test & Engine commissioning including setting of offered governing system for engine control shall be jointly done by BHEL and engine supplier. (However, engine supplier to do the setting of offered governing system for engine control and attend the engine related issues if any).	Supplier to confirm.	
7.2.8	Hydraulic performance, Engine starting and setting of MR governor, safety valve etc. shall be done by engine supplier.	Supplier to confirm	
7.2.9	Engine supplier will provide load test report and attend engine related issues during movement test and attend all despatch points related to Engine scope of supply.	Supplier to confirm	
7.2.10	The supplier shall depute engineer for the commissioning and successful operation of engine in DETC after receipt at ultimate destination i.e. at end user within a week time on intimation from BHEL/railways. He shall also carry out joint check of the receipt of components regarding short shipment or transit damages.	Supplier to confirm	
7.2.11	The supplier shall ensure commissioning of the car within period as agreed by supplier in tender from date of intimation/coach issued by the Indian Railway Production Unit/Shed.	Supplier to confirm	
7.2.12	The performance of Engine shall be demonstrated by the supplier after its successful commissioning at the consignee's works.	Supplier to confirm	
7.2.13	It is responsibility of the supplier to obtain commissioning completion certificate report in association with BHEL & Railway staff from relevant loco sheds and submit it to BHEL.	Supplier to confirm	
8.0	**INSPECTION AND TESTING:**		
8.1	**Test on Diesel Engine:** Type /Routine test procedure has to be RDSO/ Indian Railway Production unit approved. Followings points should be included in test procedure:	Supplier to confirm	

19

	i) Type, Routine and acceptance tests on the Diesel Engine should be performed in accordance with UIC 623-OR ii) The type test should comprise of 12 hours running of engine with Load Cycle 100%, 110%, 75% and 50%. iii) At the end of run, the parameters like high idle rpm, low idle rpm and lube oil pressure at high and low idle rpm should be recorded. iv) The Oil consumption test and Exhaust smoke should be measured in accordance with BS standards. v) All the performance parameters should be recorded measured in accordance with UIC 623 – OR with latest edition vi) The type test/routine test schedule should be carried out in presence of RDSO/ Indian Railway Production unit representative.		
8.2	**Test on Power pack:** The type test procedure for prototype power pack (engine plus alternator) testing shall be submitted and got approved from RDSO/ Indian Railway Production unit. Type testing of prototype power pack shall be carried out in the presence of RDSO/ Indian Railway Production unit representative. If already type testing is done for the power pack, routine/acceptance tests shall be done in the presence of RDSO/ Indian Railway Production unit representative after getting the procedure approved from RDSO/ Indian Railway Production unit by the supplier. Note: i. The excitation system adopted shall be explained in detail giving all relevant characteristics for different notch positions of the engine and their matching with engine characteristics. ii. Any special item (for e.g. Screened cables) required for any signal/ control feed between engine, alternator and electronic governor shall be in the scope of supplier.	Supplier to confirm	
9.0	**APPROVALS FOR DESPATCH CLEARANCE:**		
9.1	Material as per BHEL specification clause no. 2.1 and 2.2 shall be dispatched from supplier works only after dispatch clearance from BHEL.	Supplier to confirm	
10.0	**MARKING:**		

10.1	Proper marking shall be provided indicating technical details, supplier name, year of manufacturing, serial number etc.	Supplier to confirm	
11.0	**DOCUMENTATION:**		
11.1	**Prints**		
11.1.1	One set of tracing, two sets of their prints & two DVD of the RDSO/ Indian Railway Production unit approved drawings/ calculations and six sets of their prints shall be supplied by the successful supplier. The tracings shall be on RTF of durable quality. Drawings shall be made on Auto CAD. Two sets of tracing, two sets of prints & two copies of approved drawings & calculations along with 3 DVD's shall be supplied to RDSO/ Indian Railway Production unit.	Supplier to confirm	
11.1.2	Each set of tracings shall form a complete set of working drawings, the first sheet being the index and the following sheets being arranged properly to show the various assemblies, sub- assemblies and components of complete works in the following sequence:- (a) Diagram sheets show the overall dimensions of the equipment, weights and the relation of overall dimensions to the space in the car. (b) Lists of all parts grouped in to major assembly with details of numbers per set, weight, specification material and drawing reference against each item. (c) General arrangement drawings of complete equipment sets. Diagram of lubrication points indication type of lubricant. Sub-assembly arrangement, drawing in proper and logical sequence. (d) Detailed drawings:- On detailed drawing sheets, each part shall be identified by an alphabetic letter and the list of all parts forming the sub-assembly shall be tabulated just above the title block on the same sheet giving details against each alphabetic letter.	Supplier to confirm	
11.2	**Service manual and spare parts catalogues:**		
11.2.1	Detailed Maintenance & Service Manuals including the manual for trouble shooting & operational requirement for the driver and maintenance staff for the OHE car shall be prepared and three copies supplied free of charge, per OHE car, to the consignee. Before printing the final version of the manual, the draft of the Manuals shall be got approved from RDSO/ Indian Railway Production unit	Supplier to confirm	
11.2.2	Three copies per OHE cars of Spare Parts Catalogues shall also be supplied to the consignee.	Supplier to confirm	

11.2.3	In addition, three copies each of the Maintenance/Service and troubleshooting manual along with Spare Parts Catalogue and list of must change items with periodicity shall be supplied to RDSO/ Indian Railway Production unit	Supplier to confirm	
12.0	**TRAINING:**		
12.1	The supplier shall arrange to provide training in operation & maintenance of the Engine at their manufacturing works for eight persons for a period of two weeks. The charges for providing these facilities (excluding travel, boarding and lodging) should be indicated separately. The charges for travel, boarding and lodging shall be borne by the Railways.	Supplier to confirm	
12.2	Technical experts of the manufacturer during commissioning of OHE car shall also adequately train operators/ maintenance staff nominated by the consignee.	Supplier to confirm.	
13.0	**SPARES:**		
13.1	Supplier shall offer list of unit exchange spares, mandatory, maintenance and consumable spares each separately. However, final decision to buy the spares will rest with the Railway.	Supplier to confirm	
13.2	The prices for these spares shall be quoted separately. The prices shall not be used for tender evaluation purpose.	Supplier to confirm	
13.3	The supplier shall be responsible to ensure subsequent availability of the spare parts for the normal life of the equipment.	Supplier to confirm	
14.0	**WARRANTY/GUARANTEE :**		
14.1	Period of Warranty/Guarantee shall be 30 months after the date of delivery as per para 3200 of IRS Conditions of Contract for **supply of all equipment** to Indian Railway Production unit/shed/workshop duly inspected.**For installation, commissioning & supervision**:-For poor workmanship - 24 months from the date of dispatch of DETC from Indian Railway Production unit/shed/workshop. The period of warranty shall stand extended by the duration for which the device remains inoperative under exercise of this clause. Further, should any design modification be made in the equipment as a result of defect/fault/shortcomings in the original design, the period of 24 months would commence from the modified part is commissioned into service.	Supplier to confirm	

15.0	**INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS:**		
15.1	**UNDERTAKING BY EQUIPMENT MANUFACTURE:** All respondents shall provide a signed copy of the undertaking on "INFRINGEMENT OF PATENT RIGHTS". The undertaking shall be as under: *Indian Railways shall not be responsible for infringement of patent rights arising due to similarity in design, manufacturing process, use of similar components in the design & development of this item and any other factor not mentioned herein which may cause such a dispute. The entire responsibility to settle any such disputes/ matters lies with the OEM/ supplier.* *Details/ design/documents given by them are not infringing any IPR and responsible in absolute and full measure instead of railways for any such violations. Data, specifications and other IP as generated out of interaction with railways shall not be unilaterally used without the consent of RDSO and right of Railways/RDSO on such IP is acceptable to them.*	Supplier to confirm	
15.2	**DECLARATION OF CONFIDENTIALITY OF SUBMITTED DOCUMENTS BY OEM:** *While submitting a new proposal /design, OEM must classify their documents confidentiality declaration, such as:* *This document and its contents are the property of M/s XYZ (name of the OEM) or its subsidiaries. This document contains confidential proprietary information. The reproduction, distribution, utilization or the communication of this document or any part thereof, without express authorization is strictly prohibited.* *Offenders will be held liable for the use for the payment of damages. Indian Railways/RDSO is granted right to use, copy and distribute this document for the use of inspection, operation, maintenance and repair etc.*	Supplier to confirm	
16.0	**REVISION HISTORY:**		
16.1			

S.No	Rev.	Date	Reason for Revision
1.	00	24/07/2019	Original Issue
2.	01	29/09/2019	a) Change of title. b) Elimination of development order condition. c) Modification in scope of supply.

3.	02	12/08/2020	Modification in Clause no. 2.0, 3.3.32.2, 6.2, 6.3, 7.2 & 14.1
4.	03	01.03.2022	a) Clause 7.2.5 deleted. b) Modification in approving agency. c) Annexure-I added
5.	04	28.08.2024	a) Modification in clause 14.1, 3.3.32.2 & 7.2.11

ANNEXURE-I

The following details pertaining to electrical equipment shall be submitted by the tenderer :

1. Diesel Engine

1.	Exact description and model of the engine	
2.	Rated output under UIC site conditions	
3.	Site Conditions	
	- Ambient Temperature	55 °C
	- Altitude above mean sea level	1000 m
	- Relative humidity	above 40%
4.	Rated speed at continuous rating	
5.	Type of cycle (two/four stroke)	
6.	Method of pressure charging	
	- Pressure ratio of compressor at the rated output	
	- Single stage/two stage	
	- No. of turbochargers used	
	- Make and model of turbocharger	
7	Type of exhaust system Constant pressure/pulse type/multi pulse type	
8	Method of cooling the charge air	
9	Type of combustion chamber	
10	Fuel injection equipment	
	- Type of injection system	
	- Diameter of pump plunger	
	- Nozzle opening pressure	
	- Maximum duration of injection in degrees of crank	
11.	Number, arrangement and angle of cylinder.	
12.	Cylinder bore	
13.	Piston stroke	
14.	Cubic capacity/cylinder	
15.	Compression ratio	
16.	Firing order	
17.	Mean piston speed at rated speed	
18.	Brake mean effective pressure	
19.	Maximum combustion pressure at no load at minimum idling speed	
20.	Compression pressure at rated output	
21.	Minimum no-load idling speed – whether a low idle feature is provided on the engine	
22.	Minimum no load speed under steady conditions	
23.	Speed ranges which should not be used continuously	
24.	Break away torque when the cooling water temperature is 5 °C	

25. Minimum firing speed when the cooling water temperature is 5°C or at the lowest possible temperature of air intake air in rev/minute.
26. Torque resistance to the firing speed required to turn the engine when the cooling water temperature is 5 °C at the lowest temperature of intake air.
27. Piston
    i. Type of Piston used – whether single piece or composite
    ii. No. of piston rings used.
    iii. configuration of the rings
    iv. whether all the rings are located above the gudgeon pin
    v. method of cooling required for the piston
    vi. oil flow rate and temperature of oil at the piston oulet
28. Cooling system
    i. Single/double cooling circuit
    ii. Whether cooling system is pressurized
    iii. Coolant temperature at outlet from the engine
    iv. Heat absorbed by the cooling water at the rated output
    v. Rate of flow of water
    vi. Inter cooler coolant temperature at entry to the cooler
    vii. Treatment recommended for water
29. Lube Oil System
    i. Temperature of cooling oil with the indication of the point of measurement
    ii. Maximum permissible temperature of cooling oil
    iii. Heat absorbed by the cooling oil at rated output
    iv. Swamp capacity
    v. Quantity required to commission
    vi. Brand of oil recommended

30. Consumption of lubricating oil at the rated output in litres/hour and as a percentage of fuel consumption.
31. Total capacity of lubricating oil pump (s) at the rated output speed in litres/min
32. Lubricating oil pressure at rated speed on entering the engine and at the normal operating temperature
33. Maximum pressure of charge air in the intake manifold at the rated output.
34. Maximum pressure of gases at the turbo inlet at the rated output
35. Maximum speed of the turbocharger at rated output
36. Maximum permissible speed of the turbocharger.
37. Temperature of exhaust gases at turbo inlet at the rated output under UIC and site conditions.
38. Maximum permissible temperature for which the turbocharger components have been designed
39. Heat balance of the engine
40. Weight of the engine complete with all items excluding water and lubricating oil.
41. Weight of water contained in the engine

42. Weight of oil contained in the engine
43. Weight of major components to be handled during maintenance
    i. Turbocharger
    ii. Inlet cooler
    iii. Crank case bare
    iv. Crank shaft
    v. Piston and connecting rod
    vi. Cylinder liner
    vii. Cylinder head
44. Specific fuel consumption with the tolerance band under UIC and site conditions – indicate the lower heating value of the fuel used in arriving at the specific fuel consumption figures
45. Fuel oil consumption at idle in litres/hour
46. Requirement of fuel specification or any other restriction on the use of duel with different sulphur contents
47. Number of such engines used in rail traction and the period since the engines have been in service and their performance
48. Safety devices provided on the engine
    i. Over speed
    ii. low lube oil pressure
    iii. overload
    iv. high exhaust temperature
    v. high intake temperature
    vi. any other
49. Specification of lube oil suitable for engine
50. Method of starting
51. Governor
    i. Make and type
    ii. Full load speed and drop characteristics
    iii. Torque required at the output shaft
52. Estimated period between top and major overhauls
53. periodicity of overhauling the following critical components
    i. Turbocharger
    ii. Piston and piston rings
    iii. Cylinder liner
    iv. Air and exhaust valves
    v. Fuel pump
    vi. Injector/Nozzle assembly
    vii. Main bearings
    viii. Connecting rod bearings
54. Whether the diesel engine is suitable for satisfactory sustained operation under :
    i. Site conditions mentioned in para 2
    ii. Dusty environment
    iii. Frequent starting and stopping of diesel engine
    iv. Average load factor 60%
55. Inlet and exhaust valve timings

56. Special design features of diesel engine highlighting the measures which have been taken to achieve :
   i. Low specific fuel oil consumption
   ii. Low lubricating oil consumption
   iii. Low idling fuel oil consumption
   iv. High reliability

- Maximum availability

- Reduced level of thermal and mechanical loading of critical components

57. General arrangement and dimensional details.

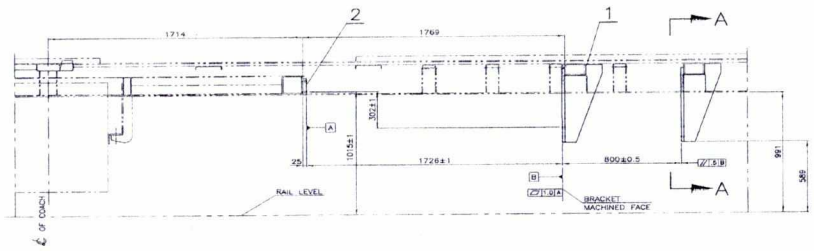
58. Characteristic curves of diesel engine under UIC and site conditions-
   i) Curves for torque, output and specific fuel consumption expressed and guaranteed without upper tolerance for different settings of the injector pump, i.e.
   - Setting at which the engine develops the rated output at its rated speed.
   - Setting at which the engine develops ¾ of the rated output at its rated speed.
   - Setting at which the engine develops ½ of the rated output at its rated speed.
   - Setting at which the engine develops ¼ of the rated output at its rated speed.

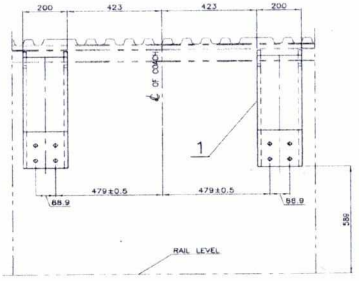
   rated speed.

   ii) The torque speed curve which the manufacturer considers to be the maximum torque that should be used for rail traction. This should cover the range from idling speed to the point corresponding to the international rated output at the rated speed.

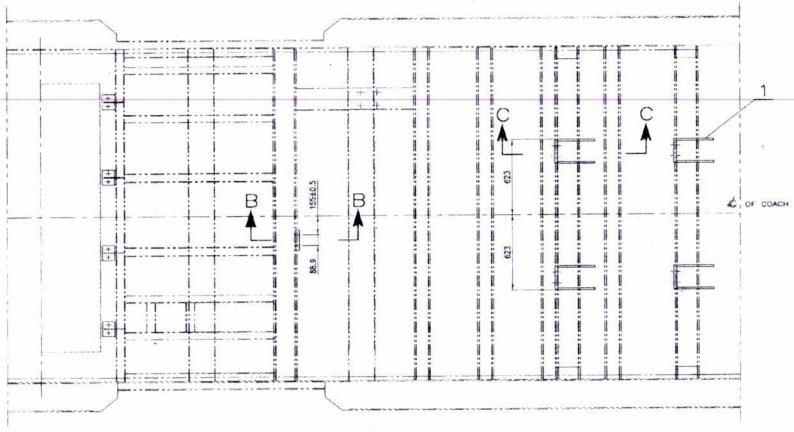
   iii) The curve of fuel consumption for no-load running, commencing from the minimum idling speed, expressed in litre/h

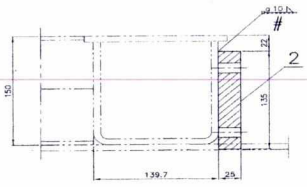
DETC/US-1-1-022



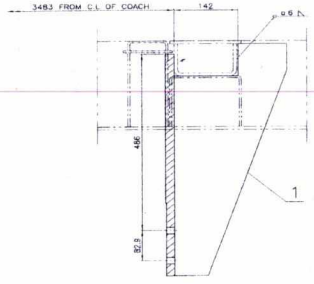


SECTION– AA





SECTION– BB



SECTION– CC

NOTE:

1. THE OTHER SIDE POWER PACK MOUNTING BRACKETS ARE ARRANGED BY ROTATING 180°
2. WELDING SIZE SHALL BE ACHIEVED BY MULTIPLE PASSES OF WELD.

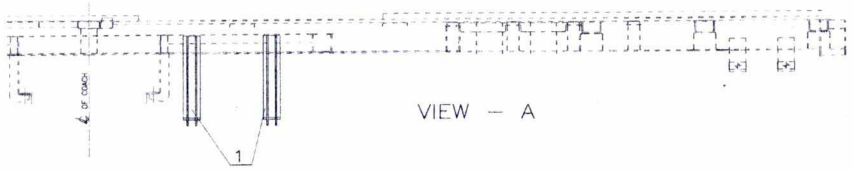
	2	PAD	2	DETC/US 1-1-023			ITEM-3
	8	REAR MOUNTING BRACKET	1	DETC/US 1-1-021			DOL-1
	QTY	DESCRIPTION & DIMENSION	ITEM	REF.DRGS	MAT.SPEC	WEIGHT/UNIT	REMARKS
	2 1	GROUP: 1-1				SUPERSEDED BY:	
						SUPERSEDES	
PER COACH		ARRGT OF MOUNTING BRACKETS FOR POWER PACK ARRGT				SCALE 1:1.5 1:10 1:2.5 1:5	SSE/D CHD ALTD DRN K.SETHURAMAN
						Alpha AE-	
DETC/US	DATA CODE NO 231	INDIAN RAILWAY STANDARDS			SHEET 1 OF 1		INTEGRAL COACH FACTORY CHENNAI-38
							DETC/US-1-1-022

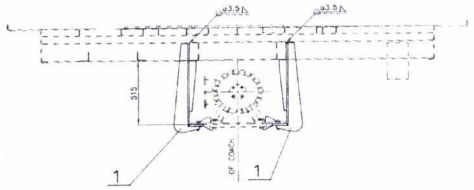
DETC/US-1-1-019 ASSEMBLY DRAWINGS

0 Num. Alt. | 04-11-2017 DATE OF LATEST ALT | DATE OF FIRST ISSUE | AME/SME

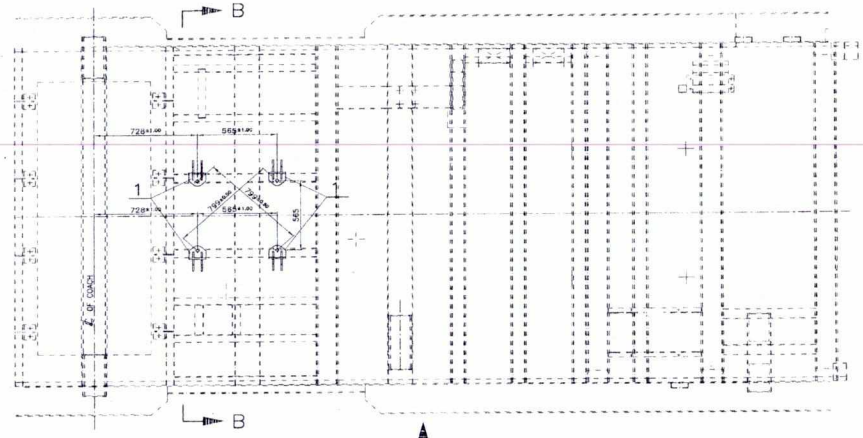
FORM: -IR.A1-840X600

DETC/US-1-1-024





SECTION B–B



NOTE:

1. MOUNTING DIMENSIONS OF ENGINE,ALTERNATOR,AUX. ALTERNATOR ETC. SHALL BE MAINTAINED STRICTLY.
2. ALL THE HOLES TO BE JIG DRILLED.
3. FOR OPEN TOLERANCES REFER DRG. No. ICF/STD-9-0-001.
4. VERTICAL CLEARENCE BETWEEN THE CROSS BEARERS TO BE STRICTLY MAINTAINED AS PER DRAWING SO AS TO FACILITATE PROVISION OF ELECTRICAL CABLE TRAY AT FURNISHING.
5. THE OTHER SIDE POWER PACK MOUNTING BRACKETS ARE ARRANGED BY ROTATING 180°.

QTY	DESCRIPTION & DIMENSION	ITEM	REF.DRGS	MAT.SPEC	WEIGHT/UNIT	REMARKS
2	GROUP: 1-1				SUPERSEDED BY:	
1	VERTICAL BRACKET (MACHINING)	1	DETC/US-1-1-023		SUPERSEDES	

PER COACH / PER COACH

BRACKET
FOR AUX. ALTERNATOR

SCALE 1:15 | SSE/D | CHD | ALTD | DRN TVSSH RAJESH

COL-2

Alpha Alt:--

INTEGRAL COACH FACTORY CHENNAI-38

DETC/US-1-1-019
ASSEMBLY DRAWINGS

0 Num. Alt. | DATE OF LATEST ALT | DATE OF FIRST ISSUE 04-11-2017 | AME/SME

DATA CODE NO. 231

INDIAN RAILWAY STANDARDS

SHEET 1 OF 1

DETC/US-1-1-024

FORM:-IR,A1-840X600