EXPRESSION OF INTEREST FOR SUPPLY OF DIESEL ENGINE AND ALTERNATOR

A. GENERAL

BHEL Jhansi is manufacturing diesel electrical locomotive up to the rating of 1400 hp at present. Based on market demand we plan to manufacture diesel electric locomotives of 3000 HP catering to demand from domestic as well as export market. To manufacture diesel electric locomotive we need diesel engine along with accessories and alternator. An expression of Interest is being floated for the same. Interested reputed engine manufacturers with the capability of manufacturing diesel engines are requested to participate.

B	**DIESEL ENGINE (with accessories) and suitable alternator**	
1	Diesel Engine	3000 HP @ 1800 rpm ,Electronically controlled fuel injection, **(other accessories refer Clause 'C')**
2	Governor	Electronic Governor Unit (for engine and loco control)
3	Cranking equipment	Cranking by 2 nos. 64 VDC starter motor
4	Traction alternator	• Suitable traction alternator with self cooled rectifier unit and 175 KW companion alternator shall be in engine supplier scope. • Alternator shall have extended PTO shaft for driving 12 KW battery charging auxiliary generator. Battery charging auxiliary generator along with its control unit shall be in BHEL Scope.
5	Gear box for Expressor drive	Suitable gear box with suitable coupling arrangements / cardan shafts shall be provided by supplier for driving expressor (95 KW) from engine front.
6	Static Battery charger (74 V)	Optional.
7	Silencer	Optional.
8	Dynamic Braking Grid & Fan	BHEL Scope.
9	TVA	TVA for the complete driveline shall be in engine supplier scope.
C	**Engine Accessories**	
1	Engine Intake Air	Party to supply secondary engine air filtration system. Primary air filtration shall be in BHEL Scope.
2	Radiators	2 nos. suitable roof mounted radiators and expansion tank shall be in engine supplier scope. Radiator Pipes shall be in engine supplier scope. Piping shall be in BHEL scope.
3	Radiator Fan	2 nos. Radiator fan with suitable rated power contactor shall be in engine supplier scope.
4	Radiator Fan Drive (Electrical)	Engine Supplier scope.
5	Lube Oil filter	Engine Supplier scope.
6	Lube Oil Cooler	Engine Supplier scope.
7	Fuel Transfer pump	Engine Supplier scope. (if required)

9	Metering and safety devices	All metering and safety devices shall be in scope of engine supplier. party to submit list of all safety and metering devices.
10	Control System	Microprocessor based engine control panel and load governing shall be in engine supplier scope. This will include features of Propulsion & excitation control, diesel engine speeds and load control, radiator fan control, dynamic braking control, directional control, various protection strategies, adhesion regulation, self load test using DBR grid and diagnostic features etc . The traction excitation control should maintain a constant engine gross horsepower, and allow power for traction to 'float' with auxiliary load, thereby delivering the maximum traction power available at any time. Alternator current and voltage limits shall be enforced to assure the traction motors operate within specified ratings. Malfunctions and abnormal conditions should be recorded as 'Faults' in the Electronic governor. Maintenance personnel can view these 'Faults' for diagnosis. The resulting 'fault log' is a valuable tool in the diagnosis of problems. Conditions that cause a loss of performance or functionality are displayed to the operating crew on the Diagnostic Information Display panel (DID) (optional). This panel also allows maintenance personnel to view various parameters throughout the locomotive, and to initiate various self-test procedures.
11	Duty Cycle/ Notch Power	The engine speed /power shall be controlled through master controller in 8 notches, party to specify notch wise speed and power starting from Idle to 8th notch along with tolerances.
12	Exhaust system/ Emissions	Suitable exhaust system shall be supplied by engine supplier. Engines shall be UIC 2 emission compliant or better.
13	Fuel Efficiency	Party to specify specific engine brake fuel consumption in gram per hp-hour and also Engine Idle Fuel Consumption in Kg/hour. Party to offer auto engine start system to minimize idle fuel consumption and to eliminate pre-heating for operation in very low temperature zone as optional feature. However, the engine should be capable of starting in low temperature climatic conditions as per UIC norms.

15	Adhesion Control	Adhesion control system shall also be provided by the party and it should be operative during dynamic braking. Any relative change in wheel speed shall initiate a correction. Correction may be made by application of sand or automatic reduction in braking until the affected wheel(s) is operating at the same speed as the other wheels. Adhesion control should be maintained by constantly comparing motor speed (using voltage and current readings) against the system's best estimate of true ground speed to detect wheel slip. Slip is corrected by automatic application of sand and modulation of power. Various protective strategies are provided. Motor thermal protection uses measured inputs to model traction motor temperature and prevent equipment damage by limiting motor current when estimated temperatures hit preset limits. Oil and water temperatures are measured, and horsepower is gradually de-rated when overheating is sensed. This allows continues operation at a reduced power level in case of cooling system malfunction or at extremes of ambient conditions. These shall be part of control systems in engine supplier scope.
16	Battery Charging Control	Same as Clause B-4 above.
17	Engine Cranking Control	Cranking by 2 nos. 64 VDC starter motor. Cranking should not be possible while the engine is running. Also successive cranking shall be possible (once attempt to crank fails) only when the engine RPM is zero. This control shall be part of control system in engine supplier scope.
18	Radiator Fan Speed Control	Should be provided by party.
18	Electrical Schematics, Wire and Cable	Party shall provide the schematic and wiring harness of the engine and the governing unit. Party shall also provide complete details of terminations, internal scheme/ logic chart, operation &trouble shooting manuals, do's and don't etc. BHEL shall provide the remainder of wires and cables, and shall complete terminations on engine panel and governor panel as per wiring scheme suggested by engine supplier..
19	Schematic drawings	Engine supplier to furnish the BOM of engine mounted and loose supplied items including control system , lube oil circuit, cooling water circuit, fuel oil circuit, ,air inlet and exhaust circuit etc.
20	Qualifying criteria	Party shall submit the qualifying criteria (Annexure-1) duly filled in with all the supporting documents.
21	Demand projection / year	Initially one no. prototype loco shall be manufactured . Demand exists in export and domestic market.
22	Erection and commissioning	• Supplier representative shall be present during final assembly and testing of diesel engine with sub-systems and alternator for prototype loco. • For subsequent loco supplier representative shall be required during locomotive testing.
23	After sales service	Engine manufactures should have good network for after sales services in India and abroad.

ANNEXURE-1

Qualifying Criteria

SL. NO	***Question***	***Response***	***Remarks***
1	Party shall be a reputed diesel engine manufacturer		***Mandatory***
2	**TECHNICAL SUPPORT:** Party shall indicate willingness to provide technical support in following areas for prototype unit: • Loco layout: The layout shall be prepared by BHEL based on engine and sub-system details given by party. The layout shall be sent to engine manufacturer for checking suitability. • Selection of coupling between engine and alternator. • Engine to auxiliary drive coupling and assembly • Engine / Load governor unit: Technical details of the unit, interface scheme / wiring, Control algorithms and verification of electrical scheme prepared by BHEL. • Locomotive functional / sequence and load test • Training to BHEL staff for operation and maintenance for their scope of supply.		***Mandatory***
3	**Control System** as per Sl. no-C.10		***Mandatory.***
4	**Party shall provide with detailed spec for following:** a.) Engine inlet secondary air filtration system b.) Radiator, radiator fan, radiator fan drive system c.) lube oil filter d.) Lube oil Cooler e.)Fuel transfer pump f.) Coupling arrangement between engine and alternator g.) TVA of driveline h) AVM pads		***Mandatory.***
5	**Service after sale support:** Please indicate service network available in India and abroad for maintaining the equipments in their scope of supply and to ensure timely supply of spares during and after warranty period.		***Mandatory.***