

# 1500hp Diesel Engine Component Design Concept Sheet

Please complete GREEN shaded areas and return with any additional materials  
(.pdfs, .ppts, drawings or other supporting materials) to:


**Ricardo India representative (Shashank Jain/Raghav Kulkarni)**

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Systems Owner

BEML Engine Design Programme

Plaza M6, District Centre, Jasola, Mathura Road, New Delhi, 110076, India

Title		DCS Number	
Display Unit		DCS.029.2	
<A> Component Image		<B> Project Description	
		Design & development of a V12 1500hp, 4-Stroke, turbocharged & intercooled DI Diesel engine for <b>Indian military market</b> to be manufactured exclusively in India at a production volume of 75 units annually for 40 years. SoP 2025 20 prototype engines will be manufactured during the design and development phase	
		Swept volume	≥ 25 Litres (Bore 138mm, Stroke 140mm)
		Rated power	1100 kW @ 2600rpm
		Minimum power at idling speed	140 kW
		Maximum torque	4780 Nm @ 1560rpm
		Continuous over speed	110% of rated speed (2860rpm)
		Instantaneous over speed	125% of rated speed (3250rpm for 2secs)
		Max Peak Firing Pressure (design)	190 bar
		BSFC @ Maximum torque	≤210g/kWh
		Minimum ambient temperature at which the engine must be able to start with a starting aid	-40°C
		Maximum ambient temperature before engine de-rate	55°C
		Engine compartment temperature	-40 to +100°C
		Maximum operating altitude	5000 m
		Allowable altitude range for engine de-rate	1000-5000 m
		Maximum relative humidity	100%
		Fuel specification	Diesel DHPP-A and DHPP-A Winter Grade
		Oil specification	5W50
<C> COMPONENT REQUIREMENTS		Engine Life (qualification)	400 hrs per CVRDE driving cycle
		Engine Life (overhauls in service)	3 overhauls, 1200 hrs (MTBO), 1080 hrs (min)
Description		Value	
Flat Panel Display Type		10.4", 1024x768, TFT LCD display, XGA resolution	
Backlight		LED (automatic backlight control)	
Brightness		1000cd/m <sup>2</sup> min	
Contrast ratio		800:1 min	
Viewing angle (typ. Val.)		Horizontal -80° to +80° Vertical -80° to +80°	
System Processor and Onboard Features		Intel Processor - conduction cooled with graphics	
Description		Value	
Master Key Switch (MKS) for Powering ON the complete electrical system		3 position rotary 0 I-II, rated at 24V	
Pre-Glow pushbutton		Push-button (momentary)	
Engine Stop Pushbutton		ON/OFF push button, rated at 28V	
Emergency Start Switch		ON/OFF Momentary toggle, rated at 28V	
Start-Lock-Transmission Switch		ON/OFF toggle, rated at 28V	
Fording Switch		ON/OFF toggle, rated at 28V	
APU ON Switch		ON/OFF toggle, rated at 28V	

System Processor and Onboard Features	chipset or equivalent	Transmission Override Switch	ON/OFF toggle, rated at 28V	
System Memory	Minimum 8GB (DDR RAM), Video memory (1GB min)	Spare	ON-OFF-ON toggle, rated at 28V	
	Minimum 256 GB SSD Flash device along with 1TB SATA Hard disk	Video Inputs	VGA Interface - D38999 connector	
System I/O	Can 2.0B	Controls	Display control serial link	
	Ethernet		Push button switches for manual interface	
	USB 2.0		Circuit breaker at power input side	
	serial interface RS232 / RS422 / RS485	Connectors	Key status indicators	
Touch Screen	Required (resistive or capacitive)	Coolant Low Indication	Mil grade for power and signals (38999 series)	
Power Supply	18V to 32V DC	Coolant Flow Failure Indication	LED Indicator (constant) - RED	
Electrical supply	Compliant to MIL-STD-1275E	NBC Attack Indication	LED Indicator (constant) - RED	
Environmental	Operating temp: -20degC to +70degC	Transmission Override Condition	LED Indicator (constant) - RED	
	Storage temp: -40degC to +80degC	Transmission Oil Temperature	LED Indicator (constant) - RED	
Software Support	Windows Embedded, Windows 10 & Linux®	Lockup Activation/Torque	LED Indicator (constant) - RED. GREEN BICOLOR	
	BSP drivers for touch screens and hard buttons	Engine OFF Indication	LED Indicator (constant) - YELLOW	
External memory and digital interface	SD-card socket	Throttle Position Actuator Failure Indication	LED Indicator (constant) - RED	
	Isolated digital IO	Stand by Indication	LED Indicator (constant) - RED	
Power Connector	D38999 / 20WC4PN	Spare	LED Indicator (constant) - RED	
	D38999 / 26WC4SN (mating)	Spare	LED Indicator (constant) - RED	
Enclosure	Rugged Aluminium enclosure and EMI filters and gaskets	Unit Dimensions	400mm (W) x 250mm (H) x 130mm (D) (without shock mounts, connectors, key protrusion)	
		Weight	Not exceeding 15kgs	
Hard Buttons	Buttons to be provided in left and right to access the different pages in the display and display adjustments	Circuit Breaker for Power	As required by the circuits	
		Environmental	Compliance with "Environmental Tests" worksheet	
		EMC/EMI	Compliance with MIL-STD-461G	
Hard Switches for Vehicle control	8 Nos (rugged) - min			
<D> DESIGN REMARKS				
1. All parts or materials shipped must be compliant to current local environmental and Health & Safety regulations (Including End Of Life recyclability)				
2. Assume that current 'catalogue parts' for the assembly be used where possible				
3. Assume that supplier design guidelines are met with regards installation and environmental requirements. Please advise of these requirements				
4. Supplier to advise of proposed 3D CAD models to allow package studies to be completed				
5. A supplementary document is provided with this DCS, to give more information on the requirements in section <C>				
<E> Design & Development Responsibility				
	Display Unit	Component Design	Component Functional & Durability Analysis	Manufacturing Process Design, Analysis & Development
	Ricardo	Support	Support	Support
	Vendor	Responsible	Responsible	Responsible
<F> Validation Tests				
Component Specific Tests (Completed by Supplier)			To be completed by BEML	
1) Functional test on Hardware-in-Loop test facility, to demonstrate compliance to functional and diagnostic requirements.				
2) Physical testing (EMC/EMI, environmental, etc) to demonstrate compliance to Component Requirements <C>.				
<G> Quality				

Key Characteristics	Targets
<p>1) No sharp edges, its detrimental to safe handling</p> <p>2) Technical support during project, including: system commissioning support, testing support, fault resolution support</p> <p>3) Documentation pack, including: hardware technical specifications, component drawings, software functional description, test reports, user manual.</p> <ul style="list-style-type: none"> <li>• The display should work in harsh environmental conditions, as per 'Environmental' requirements.</li> <li>• The display is to be with latest Electronic technology&amp; tools /systems/components.</li> <li>• Window based PC software for calibration, configuration and diagnosis of Display.</li> <li>• The display should be compatible for GPS/GPRS/GSM system for remote data transfer</li> <li>• The provision in the display for <ul style="list-style-type: none"> <li><input type="checkbox"/> Adjust brightness /contrast and also to change the units of measurement parameters.</li> <li><input type="checkbox"/> Additional analog /digital pages for easy troubleshooting (Display unit).</li> <li><input type="checkbox"/> Configuration of parameters in required format(Gauge, Bar graph, digital etc).</li> <li><input type="checkbox"/> Future expansion(Enhance the features).</li> <li><input type="checkbox"/> The data logging and trend analysis for all parameters.</li> </ul> </li> <li>• Window based software to configure analogue&amp; digital parameters, uploading software, Simulator, Virtual panel, enable and disable of analog and digital parameters etc.</li> <li>• The system should work on Standard SAE J1939 / MILCAN/ RS485 Protocol.</li> </ul> <p>General Notes :</p> <p>1. The system should be customized by the prospective firm for specific application for which details of I/O and logic required and other interface details will be provided during development stage.</p> <p>2. The firm to support for satisfactory development and performance trials at factory followed by field trials.</p> <p>3. Any calibration tools required for programming and making adjustments during usage of the offered products should be offered separately.</p> <p>4. Training programmes for BEML and CVRDE engineers to comprehensively transfer knowledge required for operating and maintaining the system needs to be offered by the firm.</p> <p>5. Firm to indicate the local technical support infrastructure they have in India which can offer technical, and service support for the offered products.</p> <p>6. Spare parts and support should be guaranteed for a minimum period of 30years beyond the warranty period for which, replacements compatible with offered system should be available.</p>	<p>1) Quality system - ISO9001. For supplier who do not have this accreditation, a plan must be presented to achieve this before production</p> <p>2) Software development in adherence to Software development life cycle standard IEEE 12207</p> <p>3) DV shall be completed before PO (Hard tooling)</p>

#### <H> VENDOR COST AND MASS TARGETS

Item N <sup>o</sup>	Part N <sup>o</sup>	Part Name	Quantity (per engine)	Unit Mass (kg)	Vendor Pricing (approximate)		Comments
					Unit Price (value)	Pricing Currency (specify)	
1	TBD	Display unit	1	<15		INR	

#### <I>VENDOR COST AND MASS REMARKS

1. All parts of materials to be costed assuming FDD (Free door delivery)





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<J> ADDITIONAL VENDOR INPUTS & PRODUCT RECOMMENDATIONS	
VENDOR INPUT REQUESTED	VENDOR INPUT
This document reflects the initial requirements expected by Ricardo, based on preliminary concept data (Sept 2020). <b>The vendor should provide a quotation, including an estimate of all elements that would reasonably be expected for this component. This may include: design features, processes, testing, quality checks. Give details of which elements are included and/or excluded.</b>	
Please describe local technical support available within India.	
Please advise what end of line testing (production) has been assumed in the costing analysis you have undertaken	
If the project description or product requirements are driving cost into the component(s) then please advise which requirement, what the reduced content requirement would need to be to achieve a reduction in cost AND estimate the cost delta should the requirement be relaxed. For example does ambient temperature range affects your selection, if so how and by what cost.	

<J> VENDOR REMARKS		
Prepared	Checked	Revision
NW13	HWTh	2
09 October 2020	09 October 2020	09 October 2020