भारत सरकार
रेल मंत्रालय

GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

बिना माइक्रोप्रोसेसर डीजल इलेक्ट्रिक लोकोमोटिव में इन्टेलिजेन्ट लो आइडिल के साथ स्वतः इंजन चालू और बंद के लिए विशिष्टि

Specification for Auto Engine Start Stop system with Intelligent Low Idle System(AESS with ILI) for Non Microprocessor Diesel Electric locomotives

विशिष्ट संख्या चा0श0.2400.68(संसो0.00)
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SPECIFICATION FOR AUTO ENGINE START STOP SYSTEM WITH INTELLIGENT LOW IDLING SYSTEM (AESS WITH ILI) FOR NON MICROPROCESSOR DIESEL ELECTRIC LOCOMOTIVES

1.0 INTRODUCTION

1.1 Analysis of the locomotive data has shown that 50% of the run time of the locomotive is spent in IDLING hours only. This is specially true for the goods trains that are awaiting signals in the station & yards for prolonged periods of time.

While a diesel engine is idling at 400 RPM, the diesel engine consumes roughly 25 to 30 litres of diesel oil per hour. The diesel locomotive performs two functions while idling at stand still; the compressor maintains Main Reservoir pressure between 8 to 10 kg/cm² and charges the locomotive batteries. However, at stand still with brakes applied, the requirement of air from compressor is less and it is required only to compensate leakage. These two functions do not require much power; however as the full diesel engine runs to cater this requirement, the energy consumed is very large.

Instructions exist for shutting down the engine to avoid unnecessary idling. However, drivers generally avoid shutting down to avoid difficulty in re-starting the engine.

1.2 The diesel locomotive normally idles at 400 rpm. There exists a scope to decrease this idling rpm further and thereby save fuel. Attempts made in the past to do so have not yielded satisfactory results. With adoption of microprocessor on locomotives, it has been possible to implement this feature by monitoring critical parameters of locomotive with the low idling rpm kept at 350 rpm. Implementation of this feature on non-microprocessor locomotive shall require additional hardware (and software) to enable this feature satisfactorily.

2.0 DEFINITION OF TERMS

The following terms and abbreviations are used throughout the specification.

ILI	Intelligent Low Idling System
IEC	International Electro-Technical Commission
IR	Indian Railways
UIC	International Union of Railways
IS	Indian Standard
AAR	Association of American Rail-Road
RDSO	Research Design and Standards Organisation
BOM	Bill of Material
AESS	Auto Engine Start Stop System
LOPS	Low Lube Oil Pressure Shutdown
LOP	Lube Oil Pressure
EMI	Electro Magnetic Induction

3.0 SCOPE

3.1 This specification covers the design requirements of a system (Automatic engine start and stop-AESS) for shutting down the idle engine to reduce emissions, noise, wasteful burning of fuel, wear and tear & maintain all the critical parameters of the locomotive that will keep the locomotive in a state of readiness for operation at very short notice. The current design is for implementation on locomotives involved for *shunting operations only*. The system is not to be fitted on locomotives working freight/ mail express trains.

3.2 Specification also covers design and manufacturing of Intelligent Low Idling (ILI) Equipment for 2600/3100 HP non-microprocessor diesel electric locomotives fitted with woodward governor.

3.3 The locomotive shall automatically go into low idling mode whenever the loco is set for idling. The AESS shall shut down the locomotive thereafter (after nominated time) if the AESS is enabled. If for some reason the AESS is disabled/bypassed, the locomotive shall continue in low idle mode. There will be no option for the driver/crew to isolate the ILI system. The AESS system shall be provided with a bypass switch.

3.4 The cost of the equipment should be inclusive of the cost of hosting data on a remote server as well as the cost of the data plan for data transmission (GPRS/CDMA) for period of 2 years. The data plan should be taken from a service provider that has pan India presence. The supplier shall bear the cost for a period of 2 years (till warranty on equipment). After expiry of two years, the cost shall be borne by Railways.

4.0 PRINCIPLE OF OPERATION/ TECHNICAL REQUIREMENTS OF AESS

4.1 AESS system addresses this situation of unwanted idling of locomotives by automatically controlling the engine shut down and restart operations at the same time continuously monitoring the existing condition of various parameters vis-à-vis preprogrammed set values.

The AESS should monitor the critical locomotive parameters that are required either to restart the locomotive or to keep the locomotive in state of readiness for movement at a short notice. These parameters are given in para 6.6 of the specification. Once these parameters are stabilized at engine idle, the AESS will automatically shut down the engine. In shut down condition also, the AESS will keep on monitoring these parameters; in case any of these parameters values fall below preset values, the AESS will restart the engine. This cycle will repeat as long as the AESS is enabled and the engine is not shut down manually (in this case the AESS gets disabled). It also monitors and follows to various safety features of engine operation as described in later part of the specification.

5.0 BENEFITS

- Reduced Consumption of fuel and other lubricants.
- Reduced wear and tear of Engine due to unnecessary idling.
- Reduced NOX emissions and noise pollution with a potential to earn carbon credits.

- The facility of loco monitoring from a remote location using GPRS based interface with a ftp protocol based front end software.

6.0 FUNCTIONAL REQUIREMENTS FOR AESS

6.1 The functional requirements of this system is to automatically shut down idle engine when, zero speed and other automatic stop condition are met to save fuel, reduce emissions & noise and restart when the engine conditions are changed or power is called for. In addition, AESS should have an audio visual warning feature to alert operators that the engine is shutting down or starting back up. There should have manual activation and deactivation switch for this system and also it should be possible to shut down the loco manually. The system should have fail safe feature i.e. if for some reason AESS is malfunctioning or loses power, the AESS system should provide audio visual warning for the crew to take over manual control.

6.2 The AESS system should have a microprocessor to capture/process data sensed by the various temperature/pressure/current sensors. The microprocessor should be 16-bit industrial standard micro controller. The microprocessor should be interfaced with a 16x2 LCD display screen with required functional keys. Suitable sensors shall be provided to monitor pressure temperature and current at desired locations on the locomotive.

6.3 The system should have a data storage capacity of past 6 months of data. The data should be stored every minute in the internal memory during idling. Down loading of data from the system memory should be possible through a standard pen drive (plug and play).
The data should be in the following format:

Date	Time	AESS Auto/ Manual	Engine start/ stop	Status of Lube Oil Pressure	Status of Water Temp.	Status Of BCP	Status of Battery Voltage	Status of battery Charging current	Status of Ambient temperature

6.4 The system should have capability of transmitting data to a remote server through a GPRS connection. The information to be transmitted is furnished at para 9.0 of this specification.

6.5 **The conditions for shutting down loco are:**

a. AESS is enabled.
b. No direction signal during idle time i.e. reverser in neutral.
c. Both the throttle handles in Idle position.
d. Battery charging current below 10 Amps.
e. Battery voltage between 67 and 72 volts
f. MR air pressure> 6.5 Kg/cm^2/ BC pressure > 2.3 kg/cm^2
g. Locomotive is not moving (logical zero speed =0 kmph), (to be sensed with the spare potential free speed dependent contacts available in locomotive).
h. Engine idling for more than 10 mins.
i. At all times, it should be possible to shut down the engine manually. Manual shut down will always override the AESS and disable its functioning i.e. the

AESS shall never start an engine that has been shut down manually or through operation of any safety feature such as low water etc.

6.5.1 The parameters mentioned from d to h should be user settable and password protected.

6.5.2 The AESS system will not shut down the engine in case the water temperature is above 68 ºC any of following cases:

6.6 Conditions for automatic start of loco:

a. AESS is enabled.
b. Engine was shutdown by AESS system (No manual shut down or any of the safety trip operated by any of the engine safety device).
c. Both the throttle handles in Idle position.
d. Reverser in neutral position.

6.6.1 Trigger for automatic start is provided by one of the following events:

a. Brake Cylinder Air Pressure <2.0 kg/cm²
b. Shut down for 2 hours
c. Battery Voltage less than 62 Volts
d. Main reservoir air pressure is less than 2.5 kg/cm².

6.6.2 The parameters mentioned from a to d should be user Settable and password protected.

6.6.3 The AESS should start the engine (as in para 6.6) and keep the engine started till such time the parameters as in para 6.5 are stabilised to the threshold value. The parameters should remain stable for at least 5 minutes before the AESS shut down the loco again.

6.6.4 A comprehensive table for shut down and restart trigger are given in the table below;

Shut down trigger	**Restart trigger**
AESS is enabled.	AESS is enabled.
No direction signal during idle time i.e. reverser in neutral.	Reverser in neutral position.
Both the throttle handles in Idle position.	Both the throttle handles in Idle position.
Battery charging current below10 Amps. Battery voltage between 67 and 72 volts	Battery Voltage less than 62 Volts
MR air pressure> 6.5 Kg/cm²	MR air pressure <2.5 kg/cm²
BC pressure > 2.3 kg/cm²	BC pressure < 2.0 kg/cm²
Locomotive is not moving (logical speed =0 kmph)	Locomotive is not moving (logical speed =0 kmph)
Engine idling for more than 10 mins.	Engine was shut down by AESS system (No manual shut down or any of the safety trip operated by any of the engine safety device).
The eco smart system will not shut down the engine in case the water temperature is above 68 ºC.	-

7.0 Offered system should have following features:

- A 16x2 self illuminated LCD display with minimum four functional keys.
- Self Diagnostic feature.
- Engine should not start automatically, if it has got shut down due to any safety trip or by manual operation.
- A reset button should be provided.
- Energy saver Timer to calculate the amount of diesel saved (consumption pattern of diesel at idle is user settable).
- Total Loco/engine Monitoring Timer.
- Total Time the AESS system was put in Active Mode.
- Total Time the AESS system was put in Bypass Mode.
- Total Engine Start Timer.
- Total Engine Stop Timer.
- Total Idling Time with engine in start condition**.
- Total number of times loco shut down by the AESS System.
- Total number of times loco restarted by the AESS System.
- Number of times loco restarted due to low air pressure and its mean time of restart.
- Number of times loco restarted due to water temperature and its mean time of restart.
- Number of times loco restarted due to low battery voltage and its mean time of restart.
- Fuel saving reporting; *this will be in terms of total idle hours saved by the system by shutting down the engine and saving in terms of diesel oil*.
- Engine status indicator and alarm bell to alert operator etc.
- Alarm bell to ring for 15 seconds during automatic start or automatic shut down, preferably system should be integrated to Indian Railways Alarm Gong provided on locomotive for the loco start warning.
- Sensing Arrangement: Suitable pressure and temperature switches/sensors shall be provided for sensing Lube Oil Pressure, MR Pressure, Brake Cylinder Pressure, Ambient temperature etc.
- The system should be equipped with a minimum of 16-bit industrial Microcontroller/Microprocessor.
- Onboard data storage device of adequate capacity to record data for storing all data for at least 45 days and the data for engine idle time and fuel saving report for at least 6 years.

**

I. **Idle-A:** Idling time of the engine should be determined by both the throttles in idle position irrespective of reverser position.
II. **Idle-B:** Idling time of the engine should be determined by both the throttles in idle position as well as reverser in neutral position.
III. The system should record and display both the above parameters.

8.0 Data Logging Features:

The data should be logged at an interval of one minute and should store the status of all the inputs to the Auto Engine Start Stop system. A suitable graphical user interface (PC Based software with print facility) shall be provided for the analysis of the logged data.

It should be possible to download the recorded data from the memory of AESS system by using any commercially available USB pen drive.

9.0 GPRS Features:

The Auto Engine Start Stop system should have the provision of built in GPRS interface for remote monitoring of the locomotive through the online and cumulative parameters stored by the system as listed below:

- Fuel saving reporting; *this will be in terms of total idle hours saved by the system by shutting down the engine and saving in terms of diesel oil.*
- Total Loco/engine Monitoring Timer.
- Total time the system was put in Active Mode.
- Total Time the system was put in Bypass Mode.
- Total engine Start Timer.
- Total engine Stop Timer.
- Total Idling Time with engine in start condition.
- Total number of times loco shut down by the AESS System.
- Total number of times loco restarted by the AESS System.
- Number of times loco restarted due to low air pressure and its mean time of restart.
- Number of times loco restarted due to water temperature and its mean time of restart.
- Number of times loco restarted due to ambient temperature and its mean time of restart.
- Number of times loco restarted due to low battery voltage and its mean time of restart.
- Image of last event by eco smart system w.r.t. time stamp and reason.
- Online status of the following parameters should be available on real time basis.
  - Currently AESS- Active/Bypass mode.
  - Currently Engine- Start/Stop
  - Lube Oil Pressure- High/Low
  - B C Pressure- OK/Not OK
  - M R Pressure- OK/Not OK
  - Battery Voltage- OK/Not OK
  - Throttle Position- Idle/Non Idle
  - Reverser Position- working/neutral
  - Water Temperature OK/Not OK
  - Ambient Temperature OK/Not OK

10.0 FAIL SAFE FEATURES

- If for some reason AESS malfunctions or loses power, the AESS system should become disabled and the locomotive should operate as if AESS was not installed.
- It should be possible to shut down the engine manually that has been automatically started by the AESS through engine stop button. When stop button is pressed or one of the locomotive protective systems causes a shut down, AESS should disable itself. To enable AESS, the engine should be started manually by the driver.

The Warning bell sequence & their descriptive meaning should be as under:

Bell Rings	**Description**
Rings for 2 sec every 5 minutes when engine is not running	Engine is in automatic shut down period
Continuous ringing for 15 seconds while engine is running	An automatic shut down is about to occur.
Continuous ringing for 15 seconds while engine is not running	An automatic start is about to occur,

The above details of AESS should be taken as guidelines. The design and parameters of AESS shall be finalized by successful tenderer in consultation with RDSO.

11.0 PRINCIPLE OF OPERATION/ TECHNICAL REQUIREMENTS OF ILI:

11.1 Tecnical Requirements:

- The ILI systems are intended to be installed on diesel electric locomotives fitted with E-type excitation system and woodward governor to decease fuel consumption during idle running of the locomotives. This system will bring the locomotive to low idle rpm of 350 after ensuring that-
  a) Locomotive starts at normal idle rpm of 400 (idle notch) and runs at this RPM.
  b) Lube oil pressure is 1.7 kg/cm² or more.
  c) These conditions remain stable for 5 minutes.
- LOPS setting at idle (400 rpm) shall be 1.7 kg/cm². During low idling if LOP reduces below 1.2 kg/cm², system will revert back to 400 RPM idle speed. The LOPS setting at low idle (350 rpm) shall be 1.1 kg/cm².
- The proposed low idling system should be reliable & proven for the intended application.
- The function of this system shall automatically get bypassed in conditions such as notching up, switch on GF and dynamic braking. One isolation switch should be provided in ILI control unit to isolate the low idle RPM feature in case of any trouble experienced in the circuit.
- When the engine is at low idle RPM, pressing the "stop button" should stop the engine.
- This system should execute all the functions, even when locomotives are running in MU.
- The LED indications for "status of low idle" and "power supply" shall be provided.
- There should be facility of downloading data of low idling equipment with the help of lap top or by a hand held battery operated portable device (optional). The data will include total nos. of low idling counts and total idling time along with date and time stamp. It should be possible to view entire log of low idle events with date and time stamp on a standard PC or laptop.
- The system should not require any changes in wiring/schematic of the locomotive.
- The LOP setting, LOPS setting, low idle delay time and real time clock setting should be user settable and password protected.

- Data downloading from the ILI unit should be password protected to avoid erasing of data by an unauthorised person.

11.2 **Control Unit:**

- Storage of minimum 1000 low idle events with date and time stamp.
- Fail safe design with feature of self isolation in case of malfunctioning.
- Should be of cast aluminium or equivalent material coated with chromate for EMI shield.
- Modular system.

11.3 **Out Put:**

- High rated contacts for digital output (2 Amps 72V DC) continuous.
- Visual indication of self-status.

11.4 **Scope Of Supply:**

- ILI unit 01 No.
- Pressure sensor Input Range (0-10 bar) 01 No.
- Configuration and logger software in CD/Pen Drive 01 No.

12.0 ENVIRONMENTAL CONDITION:

The equipments covered in this specification shall be suitable for operation under following conditions:

Maximum temperature (Atmospheric)	i) 70 ºC (Under sun) ii) 47 ºC (In shade) (Temperature inside locomotive may reach up to 60 ºC)
Minimum temperature (Atmospheric)	-5 ºC
Humidity	90% (Up to 100% during rainy season as per IEC 60721-3-5.
Altitude	Maximum 1200 meter above mean sea level
Reference Site conditions	i) Ambient Temp 47 ºC ii) Temp. inside engine compartment 55 ºC iii) 160 m.
Annual rain fall	Between 1750 mm to 6250 mm. The locomotive shall be designed to permit to its running at 5 km/h in flood water level of 10.2 cm above the rail level.
Dust	Extremely dusty and desert terrain in certain areas. The dust content in air may reach as high a value as 1.6 mg/m^3.
Atmospheric conditions in coastal areas in humidity salt laden and corrosive atmospheric	All the equipment shall be designed to work in coastal areas in humid, salt laden and corrosive atmosphere. a. Maximum PH value : 8.5 b. Sulphate : 7 mg /litre c. Max. Concentration of chlorine : 6 mg/litre d. Max. conductivity : 130 micro Siemens/cm

13.0 RATING

Rated Voltage	72V DC
Nominal operating voltage	50 - 80V DC

14.0 DOCUMENTATION

Documents to be furnished

a. Block diagram of system and its interface circuit with IR locomotive.
b. Circuit description & control logic.
c. Circuit descriptions.
d. Detail specification for the equipment offered.
e. Out line and general arrangement drawing.
f. Maintenance manual with full description of maintenance and repair procedure.
g. Drivers operating instructions and trouble shooting handbook.

15.0 EQUIPMENT FOR TROUBLESHOOTING, MAINTENANCE & TESTING

The firm shall supply special tools along with comprehensive lists for testing, troubleshooting & maintenance of the 'AESS with ILI' system to be supplied by firm. The firm can take the equipment back after completion of field trials and finalisation of control software.

16.0 TRAINING

The contractor shall arrange free of cost training to the personnel of Indian Railways in India and abroad to make them proficient in the operation and maintenance of the system and associated equipment providing adequate guidance to enable them to train their subordinate staff in these functions. The to and fro fare and living expenses shall be borne by Indian Railways. Details of the training requirement shall be indicated by the tenderer in its offer.

17.0 SYSTEM INTEGRATION

The supplier shall be responsible for the complete system integration of the microprocessor based AESS with ILI system with the excitation/propulsion control system of the locomotive.

18.0 ACCEPTANCE TEST

Type and routine test schemes shall be prepared in accordance with the relevant IEC/UIC/IS/AAR specifications and furnished to RDSO for approval. Prototype test shall be conducted on the basis of the approved type test scheme in the presence of the RDSO representative.

The inspection and acceptance norms shall be finalised mutually depending upon the type and routine test requirement otherwise frozen. The acceptance norms proposed shall, however, be submitted along with the offer by the supplier.

A-1. Type and Routine Test

The AESS with ILI shall be tested for functional test and test programme shall be finalized at design approval stage between firm and RDSO.

A-2. Following tests shall be carried out on the prototype unit as per relevant IEC specification or mutually agreed test program. Manufacturer shall bear the expenses of the tests.

SL NO	TEST	CLAUSE	TYPE	ROUT-INE
1.	Visual inspection	As per the approved Drawings	✓	✓
2.	Tolerance & Dimension		✓	✓
3.	Cooling	IEC 60571 clause 10.2.3	✓	
4.	Insulation Resistance	IEC 60571 clause 10.2.9	✓	✓
5.	Di Electric		✓	✓
6.	Vibration and shock	IEC 60571 clause 10.2.11	✓	
7.	Performance test, reverse polarity test, effect of voltage variation test	IEC 60571 clause 10.2.2	✓	✓
8.	Voltage surge	IEC 60571 clause 10.2.6.2	✓	
9.	Electrostatic Discharge test	IEC 60571 clause 10.2.6	✓	
10.	Transient susceptibility test	IEC 60571 clause 10.2.7	✓	
11.	Radio interference test	IEC 60571 clause 10.2.8	✓	
12.	Salt mist test	IEC 60571 clause 10.2.10	✓	
13.	Damp heat	IEC 60571 clause 10.2.5	✓	
14.	Dry heat up to 70 degree C	IEC 60571 clause 10.2.4	✓	
15.	Burn – in	As per Burn-in cycle attached Annexure – 1	✓	
16.	Functional Test	As per test program to be finalized during design approval state	✓	✓

The following clarifications issued on the tests above.

18.1 Visual inspection of Tolerance & Dimension – The object of visual inspection is to check that the equipment is free from defects and the equipment is as per approved drawing. Bill of materials shall be submitted. The make, rating of equipments subassemblies shall be checked with the details as per approved design. If a change is needed in make or rating of important equipments, sub-assemblies, it shall be intimated and shall have approval of RDSO. The equipment with modified subassemblies shall be given separate revision number. All the important dimensions shall be measured and shall be in permissible tolerance.

18.2 Insulation resistance and Dielectric test – The insulation resistance with 500 Volt megger shall not be less than 100 M ohms at 70% relative humidity for all

the circuits. The dielectric test shall be carried out after earthing special cards if necessary before applying Dielectric voltage. The dielectric test to be carried out at a test voltage of 1.5 kV rms for 60 seconds. The leakage current to be less than 5 mA.

18.3 Burn in test – The cards used on the equipment shall be subjected to burn – in as per the temperature cycle in Annexure – 1. The cards shall be kept energized during the test. Functional test of each card shall be carried out after the burn in test. This shall be part of internal test by manufacturer, whose results shall be submitted during routine test.

18.4 Validation test

Validation tests like wiring integrity and installation checks, Hi-pot, insulation resistance and self tests, complete performance establishment, load box examination, parasitic load management verification, track test etc. shall be carried out on the load box at any nominated place mentioned by IR to establish the performance capability and integration of the microprocessor system with other locomotive systems.

19.0 FIELD TRIAL

Extensive field trial shall be carried out on one or two prototypes or as decided by IR. The prototypes shall be subjected to field trial for atleast 3 months before clearance is given for bulk supply. During this period, the performance of the equipment shall be closely monitored and evaluated by RDSO. These trials are intended to prove-

- Reliability under rigorous environmental and operating conditions.
- Advantages for locomotive operation and maintenance.
- Maintainability of the equipment.

Modifications found necessary as a result of the tests/the supplier at his own cost shall carry out trials after the relevant modifications have been approved by RDSO.

20.0 SAFETY RELATED MODIFICATION

During implementation of the system, any safety related modifications issued by IR are to be carried out by the tenderer.

21.0 WARRANTY AND SERVICE SUPPORT

21.1 The contractor shall guarantee the equipment against design and manufacturing defects for a period of two years from the date of commissioning.

21.2 The system reliability of the AESS with ILI microprocessor equipments should be such that the equipment should be available for a minimum of 85%. (This is percent of the total loco availability, i.e. if the loco is available for 100 hours, the AESS-ILI equipment should be available for 85 hours minimum). Availability of the equipment shall be monitored by concerned diesel shed through online

monitoring system. Any deviation in these criteria shall be personally ratified by the shed in charge.

21.3 20% of the total cost of the equipment should be withheld at the time of purchase and released after 2 years only when the criteria for availability is met.

21.4 As shunting locomotives are deployed to work in yards, the supplier shall arrange to attend the locomotive on the site. Diesel shed may have to make the locomotive available in shed if it is not possible to attend the fault on site.

21.5 Notwithstanding anything that may be specified in this specification, the final responsibility for the suitability of the design shall lie with the supplier who shall undertake to carry out all modifications and alterations to equipment supplied by them for satisfactory functioning in accordance with this specification as may be necessary during the period of two years.

21.6 When the equipment is taken in hand for installation at a nominated shed/workshop/production unit, the contractor shall be responsible for providing all necessary service support and guidance for satisfactory installation and commissioning.

22.0 PACKAGING

i) The component packing must be in assembled form of all the subassemblies. The packing list must totally match the complete bill of material (BOM) to be given by the supplier and this match shall be clearly indicated in the documents accompanying the supply.

ii) The above segments shall be suitably packed to prevent any transit damage. It shall be in line with the standard Indian Railways packing instruction.

23.0 INFRASTRUCTURE FOR MANUFACTURE AND QUALITY ASSURANCE

Only those firms shall be considered the developing system that have sufficient experience /expertise in technology related to diesel loco control system. The firm must therefore have through understanding of the system and its functionality .The firm that have already developed system similar to AESS with ILI, but otherwise have no other experience on diesel locomotive can also be considered for placement of order. The firm that neither have AESS with ILI system nor developed any other sub system for diesel locomotive application (related to control electronic) shall not considered for developing the placement of order. The firm shall be having the infrastructure facilities for manufacture and quality assurance as per Annexure – 2 & 3 enclosed.

All the facilities are necessary at the time of development and will be verified by RDSO representative.

24.0 SUBMISSION OF TENDER DOCUMENT & EVALUATION CRITERIA:

The supplier/tenderer offering their standard proven product for similar diesel traction application should submit the following credentials with the tender document:

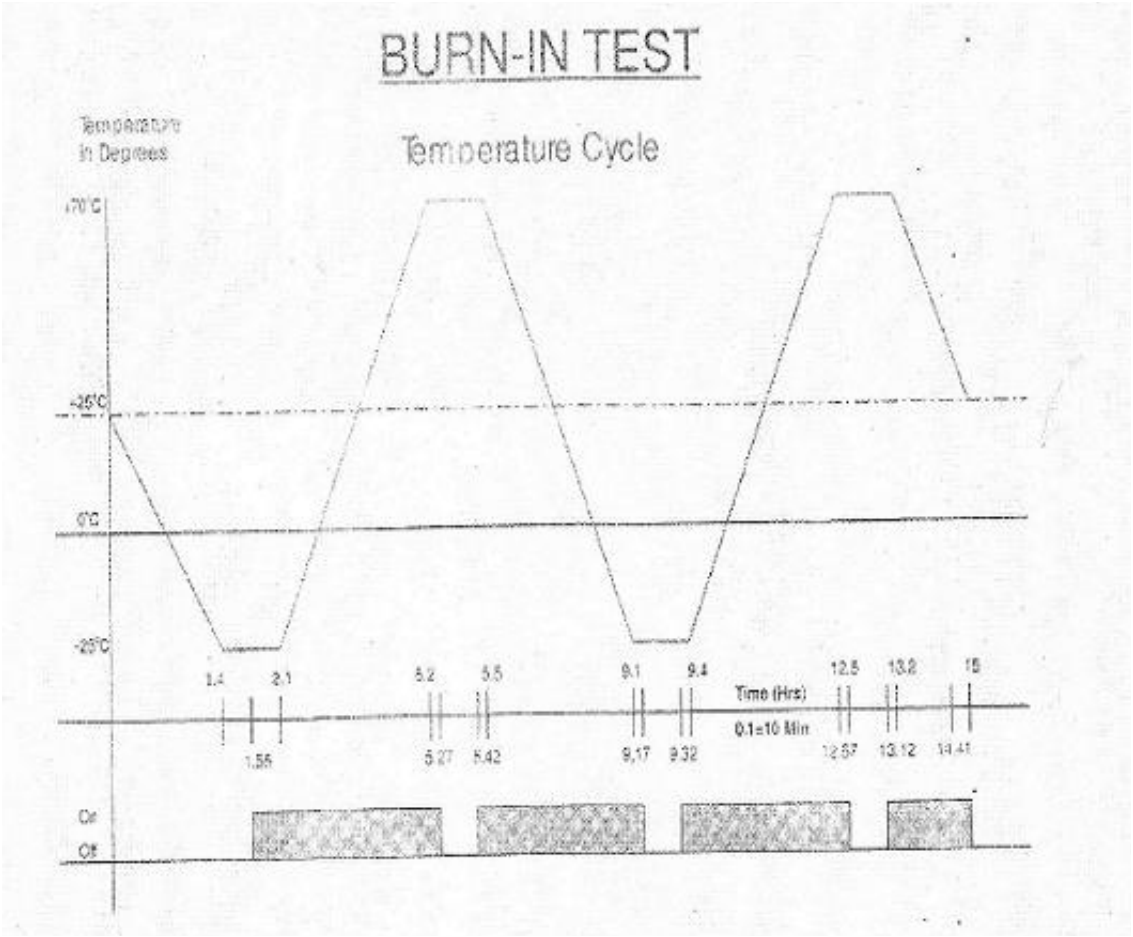
- Printed standard catalogues of the quoted product consisting complete

technical details.

- Credentials of supplying the offered product (against the tender items)
  Reference lists of customer with complete supply and purchase details for the offered product.
- Outline general arrangement (OGA) and mounting drawings of quoted item. It is desirable that the 3D Uni-Graphics (NX3) model on CD may also be submitted along with the offer.
- Deviation in the technical specifications to be clearly brought in the outstation by tenderer.

The supplier/tenderer who has quoted for the development of the tendered product should submit all the above documents of their similar product to establish their credential (capacity & capability) in manufacturing & supplying the similar capacity item for diesel electric traction application for established railways system.

Annexure-1


BURN-IN TEST
Temperature Cycle
Temperature in Degrees
+70°C
-45°C
0°C
-25°C
1.4
2.1
1.55
5.2
5.5
5.27
5.42
9.1
9.4
9.17
9.32
12.5
13.2
15
12.57
13.12
14.41
Time (Hrs)
0.1±10 Min
On
Off

ANNEXURE – 2

IN-HOUSE MANUFACTURING FACILITIES

The following facilities are considered essential for the manufacture of quality and reliability product:

1. Dust free environment for the assembly of PCBs
2. Component lead forming machine/fixture for assembly of PCBs.
3. Testing jigs for the testing of assembled PCBs along with measuring instruments for different parameters.
4. Temperature controlled wave-soldering machine with auto-fluxing facilities.
5. Dry heat test chamber.
6. Functional testing of PCBs preferably with computer.
7. Electro static discharge protection in line with IS: 10087-1981. Work procedure for following ESD practices needs to be submitted.
8. Automatic/light beam guided component insertion machine for PCBs or SMD pick and place machine which ever is applicable.
9. In circuit testing machine for checking the correctness of component inserted in PCBs.
10. SMD Soldering station for soldering surface mounted technology component.
11. ISO Certification from NABCB Accredited agency.

All the above facilities are considered essential at the developmental stage and shall be verified by RDSO before considering the firm as a developmental source.

ANNEXURE – 3

TESTING EQUIPMENT

IN-HOUSE TESTING FACILITIES

The following instruments are considered for testing purpose.

1. Power analyser.
2. Storage type oscilloscope.
3. Power factor meter.
4. H.V. Tester.
5. Humidity Test Chamber (for 55°C & upto 95%Rh).
6. Adequate number of Analog/Digital type meters to measure the current, voltage, power and frequency etc at a particular instant of time.
7. Megger (500Volt).
8. Measuring Gauges such as Vernier Caliper, micrometers, dial gauge, digital stopwatch, Thermometer, thermocouple etc.
9. Digital multimeter.
10. Milivolt meters.
11. Noise/Decibel meter.
12. Testing facility for Water proofness (suitable to dip the entire unit in water) .
13. Multi-channel Temperature Scanner (minimum 12 channels).
14. Complete test bench for measuring the different parameters .
15. ISO Certification from NABCB Accredited agency.

All the above facilities are considered essential at the developmental stage and shall be verified by RDSO before considering the firm as a development.