



LME:009C

LOCOMOTIVE ENGINEERING DEPTT.

PURCHASE SPECIFICATION

LME/ PUR/340

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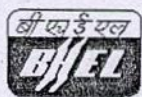
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SPECIFICATION**FOR****CAB AIR CONDITIONING UNIT(AC)****FOR****DIESEL ELECTRIC LOCOMOTIVES****NOTE:-****Enclosures** : - Locomotive cab layout :-

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**LOCOMOTIVE ENGINEERING DEPTT.
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BHEL has been manufacturing different types of Diesel electric (DE) shunting locomotives in the range of 350hp to 1400hp. The source of power in these locomotives is diesel engine, which is coupled with a traction generator/alternator to convert the power into the electrical power. The Power from alternator/generator with help of various electrical control gear is fed to the axle suspended traction motor for transmitting it to the Rail/wheel. The control voltage of these locomotives is either 24V dc or 72V dc.

Presently the cab of locomotive is equipped with 2 nos. of cab fan. In extreme summer condition, the existing system is inadequate for reasonable level of comfort of crew. This specification shall establish the minimum the basis and minimum criteria of design, manufacturing, performance, reliability and maintainability of air conditioning system and its components.

This document is for basic guideline to the suppliers. However, suppliers are also allowed to give their design and layout arrangement independently.

This specification is prepared for development of air conditioning unit for diesel electric locomotives. Necessary corrective actions and modifications would be undertaken after fitment and commissioning of 1 unit of air conditioning system before regular and large fitment in locomotive. The review will be done based on feedback from crew, maintainability and overall performance.

1.2. Supplier's Responsibility:

The supplier's responsibility will extend to the following:-

- Supply of detailed instructions for installation of the equipment on the locomotive. Supplier shall also depute his representative for ensuring correct Installation of first two equipments at BHEL works.
- Supplier shall submit the detail schedule of maintenance of various sub assembly of air conditioning unit.
- Supplier shall arrange Commissioning, testing & field trials of the prototype equipment in service jointly with BHEL.
- The Supplier shall clearly mention the minimum service life of major equipments of air conditioning system.
- The design shall be developed as per requirement given in the specification. Detailed design and OGA drgs shall be submitted to BHEL for scrutiny and approval, before commissioning of the

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equipment. BHEL approval of the design does not absolve supplier's responsibility for satisfactory performance of complete system.

- f) The supplier shall be responsible for carrying out all the modifications at his own cost on any part of the equipment during the period of warranty required for satisfactory operation of the equipment as per technical specification. For any technical matter the final authority is BHEL. Modification, if any required on the basis of the experience gained during the field trials of prototype equipment, shall be incorporated by the suppliers without any extra cost. Such modification shall be finalized in consultation with BHEL.
- g) Any deviations to this specification considered necessary to improve performance reliability of the unit or for any other reason, should be furnished by tenderer with details and fill particulars for consideration of purchaser. Unless such deviations are accepted in final contract, the provision of this specification will be binding on the contractor.

1.3. Warranty: The supplier shall be responsible for any damage to equipment provided in the locomotive due to defective design, materials, and workmanship up to a period of 12 months after commissioning on the locomotive or 18 months from the date of supply, whichever is earlier. The supplier shall replace within one month, such equipment during the warranty period at his cost. The period of warranty will be extendable in case of recurring problems attributable to defective design, material or manufacturing. The supplier's liability in this respect of any complaints, defects and /or claim shall be limited to the furnishing and installation of replacement parts free of any charge.

1.4. BHEL Responsibility:

The Assist in installation of equipment on locomotives and connections.

1.5. Documents to be submitted after getting Order:

- a) Electrical scheme/ wiring and data sheets
- b) OGA drg of the unit with mounting details
- c) Operation and Maintenance manual.
- d) Spares catalogue

CHAPTER 2 – TECHNICAL REQUIREMENTS

All types of diesel electric locomotive manufactured in the range of 350hp to 1400hp is having only one cab. The Auxiliary electrical power source available for these locomotives are at 24V/72V dc. No source (Inverter/converter) of three-phase power is available in these locomotives.

Due to constraints of non-availability of 3-phase power, we prefer compressor of air conditioning unit is to be driven through the belt pulley arrangements from non-driving end of engine. Each cab

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shall have one set of AC unit. The layout of Cab is enclosed herewith may be considered for selecting the size of different components of AC unit.

Major components of air conditioning unit shall be as below :-

- Evaporator assembly suitable for mounting in roof in cabin
- Fan cooled condenser mounted outside the cabin.
- Compressor unit suitable for belt drive from main engine pulley
- Clutch - provide a mechanism for cut in and cut out the compressor unit
- Necessary flexibles hoses for interconnecting the compressor, condenser and evaporator unit.
- Installation bracket, cables and accessories.
- Control Panel with suitable sensor.

The operating power for evaporator, condenser and clutch system shall be at 24V/72V dc.

The refrigerant used shall be eco-friendly R134A or equivalent. The unit shall also have trough arrangements for collection of condensate water. The condensate water collection system shall be foolproof and should allow leakage of water in cab.

The cooling capacity of air conditioning unit shall be sufficient to maintain a temperature between 20-25 deg. C corresponding to 50 deg. C ambient temperature. The minimum Size of cabin to be considered as **2500(H) X1800(L) X3000(W) mm**. The maximum continuous working of compressor unit may be 30-40 minutes followed by 3-4 minutes cutout. This is essential to get the reliable working of compressor unit.

The air conditioning unit shall not have noise in excess 60-65Db (max.) when operating under normal condition.

SAFETY FEATURES:-

The safety requirements are of highest standards being an item of driving cab for comfort of crew. Therefore, tenderers shall take all possible protection against :-

- Malfunctioning by untrained person or tempering. Proper warning level shall be provided.
- Adequate cross covers shall be applied so that it is impossible for human to contact any electrical connection, rotating parts of motors etc.
- No foreign material shall enter in system from the roof of the cab.
- There shall not be any sharp edges, corners, projected parts which may cause injury to crew as well as the maintenance staff.
- In case of failure of refrigerant units or condense unit, all the refrigerant shall be weather out from the top of unit i.e. in no case refrigerant shall enter into the cab.

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Sheet No. : 5 of 6**CHAPTER 3 – CLIMATIC AND ENVIORMENTAL CONDITION**

- 3.1. **Humidity:** The equipment should design to work at relative humidity of 100% (Saturation).
- 3.2. **Altitude:** The locomotive will be working in altitude up to maximum of 1000 meters above sea level.
- 3.3. **Environment:** Extremely dusty and desert terrain in certain areas.
- 3.4. **Shocks and Vibrations:** During normal working of the locomotive the equipment will be subjected to vibration and buffing shocks as indicated below:

Vertical acceleration	-	1.0g	Maximum
Lateral Acceleration	-	0.5g	Maximum
Longitudinal Acceleration	-	3.0g	Maximum

CHAPTER 4 – SCOPE OF SUPPLY

One set of Roof mounted air conditioning suitable locomotive application with refrigerant R134A or equivalent shall system consists of followings:-

- 4.1 Evaporator assembly – 1 No.
- 4.2 Fan cooled condenser – 1 No.
- 4.3 Compressor unit suitable for belt drive from main engine pulley – 1 no.
- 4.4 Clutch Mechanism - Set
- 4.5 Necessary flexibles hoses for interconnecting the compressor, condenser and evaporator unit.
– 1 Set
- 4.6 Installation bracket, cables and accessories. – 1 Set
- 4.7 Control Panel with suitable sensor – 1 Set
- 4.8 Operation & maintenance manual. – 3 Sets
- 4.9 Any other equipments required for satisfactory operation of the system.

Any other items not mentioned above but compulsory for formation of complete system shall also be under the scope of supply.

CHAPTER 5 – INSPECTION

- 5.1. Inspection of Unit shall be conducted by BHEL or it's authorized representative at BHEL Jhansi works or at Supplier's works. The same shall be finalized during procurements.

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- 5.2. All components or fittings used in the construction of the equipment may also be inspected by the BHEL Inspecting officer at final assembly stage.
- 5.3. If any part requires alteration or any defect appears during the test or trial, the manufacturer have to rectify all the defects and alteration to the satisfaction of the Inspecting Officer. No extra cost shall be paid to the manufacture.
- 5.4. Copies of Maker's test, guarantee the performance certificate of the equipment shall be supplied in duplicated along with the dispatch of each set of equipment.

CHAPTER 6 – TEST

Following are the type of tests to be carried out on the equipment to be supplied against this specification.

6.1 TYPE TESTS:-

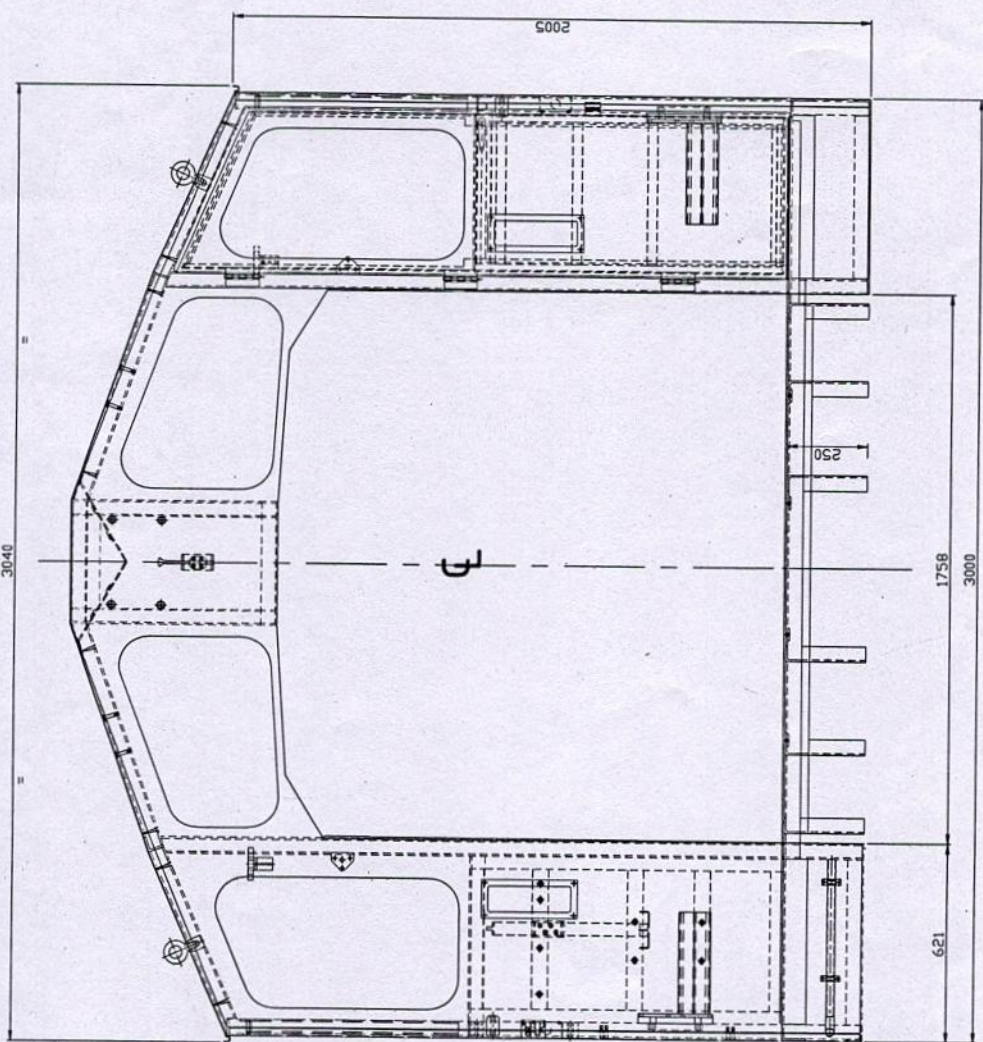
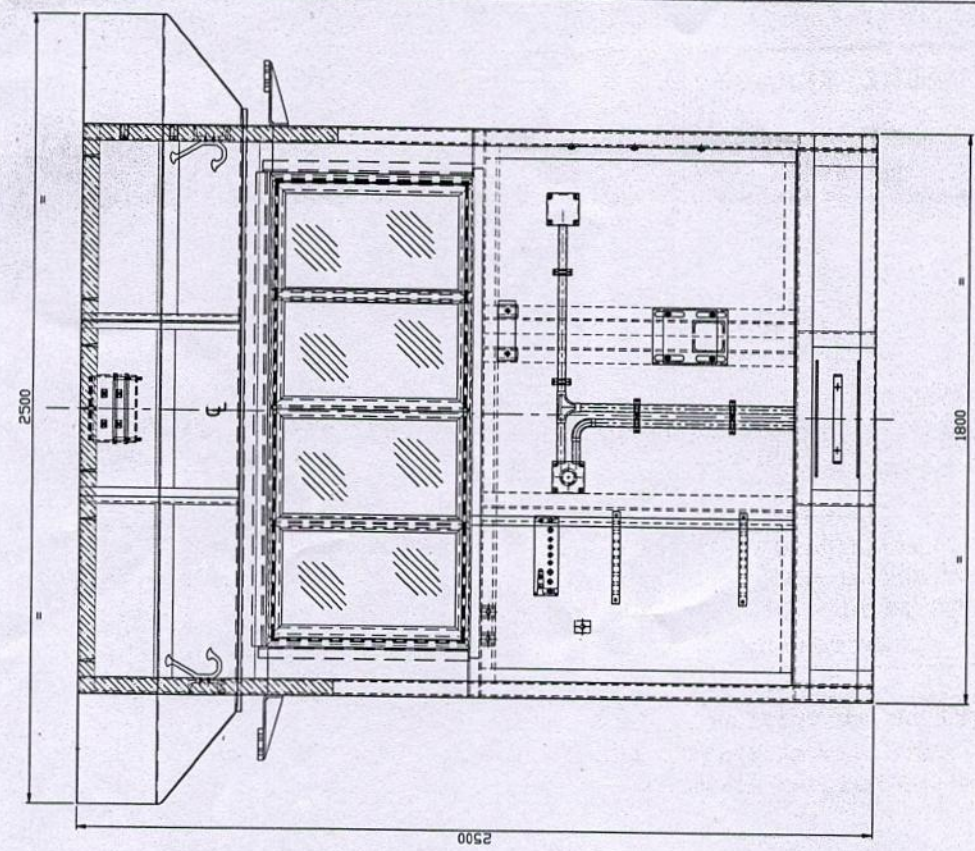
Type test shall be performed on sample basis to verify the product meets the requirements specified and agreed upon between users and manufacturer. Subject to agreement between user and manufacturer, some or all the type tests shall be repeated once in every 5 years. Purchaser so as to confirm the consistency of quality of the product. Besides this, Type tests shall be repeated in following cases

- Modification of equipment, which is likely to affect its function
- Failure or variations established during type or routine test and unsatisfactory performance during service.
- Resumption of production after an interruption of more than two years
- At the time of indigenization, if the firm has supplied the product with foreign collaboration

6.2 ROUTINE TESTS

Routine tests shall be carried out on all equipments of each order.

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DRIVER'S CAB ASSEMBLY