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**GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS**

डीजल इलेक्ट्रिक लोकोमोटिव (एलको/ईएमडी) में ईएमडी टाईप हेडलाईट के
उपयोगार्थ 1 किलोवॉट डीसी डीसी कनवर्टर के विकास हेतु विशिष्टि

**SPECIFICATION FOR THE DEVELOPMENT OF 1 KW DC/DC
CONVERTER FOR APPLICATION OF EMD TYPE HEADLIGHT ON DIESEL
ELECTRIC LOCOMOTIVE(ALCo/EMD)**

विशिष्टि संख्या एमपी.0.0400.11 (संशो.-00)

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SPECIFICATION FOR 1 KW DC/DC CONVERTER FOR EMD TYPE HEAD LIGHT ON DIESEL ELECTRIC LOCOMOTIVE (ALCO/EMD)

1.0 INTRODUCTION

- 1.1 Twin beam headlight system on ALCo type diesel electric locomotives envisages 500 W DC-DC convertor for supplying power to headlight system as per RDSO specification no. ELRS/SPEC/DC-DC Converter/0021 Rev.1, Sept-2004. Provision of EMD type headlight on ALCo locomotives has been mooted from time to time in view of its inherent benefits in terms of higher reliability, maintenance free operation and improved performance.
- 1.2 Recently a Modification Sheet no. MP.Mod.EC-02-09-09, Rev 0.00 dated 27-04-2009 has been issued for provision of EMD type head Light on ALCO Locomotive. It requires upgradation of existing DC-DC Converter (500 W) used on ALCO Loco to higher capacity of DC-DC Converter (1 KW) to cater the need of GE Lamps 30V/200W provided in EMD type head Lights.
- 1.3 In EMD Locomotive, Head Light is used with HLPR for dropping the voltage required for the operation of 30 V sealed, pre focused head Light lamp. In the present arrangement, unnecessary dissipation of power takes place through the HLPR during the operation of Head Light and also there are quality problem/ unstable output with HLPR at lamp terminal.

This specification requires reference to following standard specifications:

- (i) IS: 616 - Safety requirements for mains operated electronics or related apparatus for household and similar general use.
- (ii) IEC: 60571 - Rules for electronic equipments used on Rail Vehicles.
- (iii) ELRS/SPEC/SI/0015- Reliability of Electronics used in Rolling Stock application.

2.0 SCOPE

This specification is meant for specifying technical requirements of DC-DC convertor to be used for supplying power to EMD type headlight systems for both EMD and ALCo class of locomotives. It also specifies prototype and acceptance test methods to ensure consistent quality of equipment.

3.0 SERVICE CONDITIONS

- 3.1 The equipment covered in this specification shall be suitable for traction application under the following environmental conditions, since these equipments will be used in diesel electric locomotives operating all over India.

Maximum temperature (Atmospheric)	(i) 70 °C (under sun). (ii) 47 °C (in shade) (Temperature inside locomotive may reach up to 60 °C.)
Minimum temperature (Atmospheric)	- 5 °C.

Humidity	90 % (Up to 100% during rainy season as per IEC 60721-3- 5.
Altitude	Max. 1200 meter above mean sea level
Reference site conditions	(i) Ambient temp. 47 °C (ii) Temp. inside engine compartment 55 °C (iii) Altitude 160 m.
Annual rainfall	Between 1750 mm to 6250 mm. The locomotive shall be designed to permit 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 atmosphere	All the equipments 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 / liter. (c) Max. concentration of chlorine: 6 mg / liter (d) Maximum conductivity: 130 micro siemens / CM.

- 3.2 The equipment and its mounting arrangement shall be of robust design for traction duty and withstand satisfactorily the vibrations and shocks normally encountered in service. The vibration, shock and bump test shall be subjected to the tests defined in IEC 61373 (as per clause 10.2.11 of IEC 60571)

4.0 DEFINITIONS

Type Tests: Tests carried out on prototype control system equipment and associated equipments to prove conformity with requirements of this specification.

Routine Tests: Tests carried out on each set of control equipment to check the requirements, which are likely to vary during production.

5.0 GENERAL REQUIREMENTS

- 5.1 Any deviations to this specification considered necessary to improve performance, reliability of the unit or any other reason, should be furnished by manufacturer with details and full particulars for consideration of purchaser. Unless such deviations are accepted in final contract, the provision of this specification will be binding on the contractor. The apparatus shall meet all requirements and the suppliers shall prepare their own drawings taking into consideration of all the design aspects mentioned in the specification.
- 5.2 All the raw materials shall be as per relevant IS/IEC specifications and shall be procured from reputed companies. Critical components/assemblies, wherever required should be procured only from RDSO approved sources. However supplier shall be wholly responsible for the quality of the items/components/materials procured.
- 5.3 There should be well-defined traceability of materials used in the manufacturing of the apparatus..

- 5.4 All hardware shall be zinc plated on steel and tin/silver plated on non-ferrous components. All hardware of 8.8/10.9 classes or any spring material, if plated, shall be hydrogen embrittlement treated.
- 5.5 Hardware of reputed companies like TVS, LPS, Un-brako, and PFL conforming to IS specification should only be used.
- 5.6 The tenderer may suggest superior design features, if any, which can be considered by RDSO/Purchaser based on overall cost benefits, technical superiority of the design proposals, simplicity in design, construction and operational reliability etc.

6.0 TECHNICAL REQUIREMENTS

- 6.1.1 DC-DC converter shall be designed for taking a continuous load of 1000 W under specified input and output conditions. The converter shall be designed to withstand starting in rush current of 50 ampere.
- 6.1.2 EMD type Headlight system of the locomotive uses a common DC/DC converter housing having two separate converters (one working at a time and other acting as standby), each designed for minimum continuous load of 1000 W for Diesel Electric locomotives. The input nominal voltage shall be 72 V/74 V DC (for ALCo /EMD locomotive respectively) and regulated output shall be 30.5 ± 0.5 V for bright and 15 ± 0.5 V for dim modes respectively to meet the photometric standards, considering voltage drop in cables from DC-DC converter to Headlight.
- 6.1.3 IGBT devices shall be used to achieve higher efficiency and low heat generation. Protective circuits shall be provided to prevent damages due to accidental short circuits, reversal of input supply wiring connections and surges that may occur in course of locomotive working. Heat sinks shall be of extruded aluminium section and black anodized. All steel parts shall be given suitable anti-corrosive treatment.
- 6.1.4 IGBT on the PCBs shall be properly fitted to take care of vibrations in service. Overhang for heavier equipment is not permitted. These shall be mounted with suitable clamps.
- 6.1.5 To ensure high reliability of electronic components, the guidelines indicated in the RDSO Reliability Assurance Specification no. ELRS/Spec/SI/0015 should be implemented. The compliance of the same is to be mentioned in the tender offer against the relevant clauses.

6.2 Input supply

The input voltage to DC-DC converter shall be as under:

Nominal input voltage 72 V/74 V DC for ALCo /EMD locomotive respectively. Variation in input voltage 50V to 85V and Ripple content up to 30% peak to peak.

6.3 Output supply

The output voltage shall be regulated and the voltage shall be maintained at 30.5 ± 0.5 V setting for the bright mode and dim mode will be kept as 15 ± 0.5 V respectively

6.4 Output, Efficiency & Dimensions

- a) The rated output of each converter for diesel electric locomotives shall be as under:

Output Wattage 1000 Watt

- (b) Efficiency not less than 90%.
- (c) Dimensions 360 (H) x 360 (W) x 200 (L)
- (d) System
- (i) Suitable for (-) ve earthed battery system.
 - (ii) Control must be on positive side.

6.5 Selection of converter

The main and standby converters shall not be energised simultaneously. Arrangements shall be provided to ensure that only one converter is energised at a time. A change-over switch shall be provided in the converter to select either of the converters.

6.6 PROTECTIONS

- 6.6.1 Individual HRC fuses for each of the twin converters shall be provided on positive side as Input fuses.

6.6.2 Output short circuit

The converter shall be protected from any output short circuits for indefinite period. The equipment should restore to its normal working condition after removal of short circuit.

6.6.3 Surge protection:

Protection against surges shall be provided in both the converters. Surges of 2 KV are expected in the system.

6.6.4 Under Voltage

The equipment shall function without any consequential damage at lower voltage. However it shall be able to prevent discharge to loco batteries at voltage below 50 V. The system shall go into hiccup mode so as to recover immediately as the voltage improves.

6.6.5 Reverse polarity

Reverse polarity protection shall be provided to ensure no damage under reverse polarity connection at input. Measures shall also be taken to ensure no damage to converter in case of accidental wrong connection of battery voltage (72 V) at output terminal.

6.7 INDICATION AND TERMINALS

6.7.1 Indications:

Indications shall be provided to indicate input and output for both modes (bright and dim) and for both the converters.

6.7.2 Terminals:

The input/output terminal board shall be located separately and shall be of fire retardant type, preferably of SMC/DMC moulded type with partition in between terminals and have provision for fitment of standard crimped type lugs. The DC input terminals shall be on left side and black in colour and the output terminals shall be on right side and red in colour. The dimensions of input and output terminals shall be different for easy identification. The input and output shall be clearly marked. Two separate stud type terminals shall be provided for DIM/BRIGHT control.

7.0 GENERAL GUIDELINES:

- (a) The equipment shall be mounted in machine room on locomotive.
- (b) All printed board assemblies shall be protected on both sides with a flame retardant protective transparent coating in order to prevent deterioration or damage due to moisture and atmospheric contaminants. It shall be possible to repair coated printed board assembly without the need for complete removal of coating.
- (c) Erasing of identification numbers/marks of components such as diodes, transistors, I C chips etc. is not permissible. All components shall be used with their identity marked on their body.
- (d) The use of Industrial grade components will be used for which a necessary certificate will be produced by the tenderer.
- (e) All the terminals, indications, switches, shall be marked for easy identification and connections. The rating plate with manufacturers' name, serial number and contract number shall be fixed on the equipment.
- (f) The use of jumper wire/fuse wire on PCB, soldered glass fuse base, rewirable fuse is not acceptable. The use of only HRC fuse with proper mounting arrangement is desirable.
- (g) The use of assembly/sub-assembly with resistors/ capacitors/semi-conductors devices etc. mounted on PCB and moulded in housing/epoxy potted are not acceptable.
- (h) The equipment shall not malfunction or be damaged when spikes or voltage surges are applied as indicated under surge test.
- (i) The equipment shall not generate voltage spikes or surges during normal and switching operation so as to have interference with other electronic equipment on the Locomotives. Suitable measures shall be taken to suppress such surges.

- (j) The rating of components shall be based on case component tolerances and environmental conditions. The safety margin calculations shall be based on derated ratings of components and load under worst conditions. The vendor shall provide details of electronic components with tolerances and circuit diagrams.
- (k) Equipment housing / exposed metal work shall be connected to vehicle frame for safety. Mounting arrangement shall not be treated as earthing and earthing-tinned pad with brass bolt shall be provided.
- (l) Equipment shall be designed such that regular / periodic maintenance of electronic components shall not be necessary.
- (m) The equipment (DC-DC converter) shall be burn-in after manufacture as per clause 7.7 & 12.2 of RDSO spec. for reliability of Electronics used in Rolling stock application as per spec no. ELRS/SPEC/SI/0015, Oct.'2001 in temperature range of -25 deg. C to +75 deg. C.

8.0 TESTING FACILITY:

The manufacturer shall offer all the testing facilities free of charge to the inspecting authority for all the tests conducted at his premises.

9.0 TEST FOR DC-DC CONVERTER:

The offered equipment shall be subjected to the following Type, Routine and Acceptance tests. These tests shall be conducted as per clause no. mentioned below

9.1 LIST OF TESTS TO BE PERFORMED ARE GIVEN BELOW

Sl. No.	Test description	Type	Routine	Acceptance	Clause No.
1.	Visual inspection-1	Y	Y	Y	As per spec
2.	Visual inspection-2	Y	Y	Y	As per spec
3.	Dielectric and Insulation test	Y	Y	Y	IEC60571 cl.10.2.10/10.2.9
4.	Performance test-1	Y	Y	Y	As per spec
5.	Performance Test-2	Y	Y	Y	As per spec
6.	Temp. rise test (Dry heat test)	Y	-	-	IEC 60571 cl.10.2.4
7.	Temp.rise test (Damp heat test) (Cyclic)	Y	-	-	IEC 60571 cl.10.2.5
8.	Surge and transient test (1.8KV,2µSec)	Y	-	-	IEC 60571 cl.10.2.6
9.	Transient Burst Susceptibility Test	Y	-	-	IEC 60571 cl.10.2.7 (IEC 61000-4-4)

10.	Radio Interference Test	Y	-	-	IEC 60571 cl.10.2.8 (IEC 61000-4-3) & (IEC 61000-4-6)
11.	Vibration, Shock & Bump Test	Y	-	-	IEC 60571 cl.10.2.II (IEC 61373)
12.	Efficiency test	Y	-	-	As per spec.
13.	Other tests		-	-	
	- Temp. rise test	Y	-	-	As per spec.
	-Performance check	Y	-	-	As per spec.
14.	Salt mist test	Y	-	-	As per spec
15.	Reverse Polarity, Output short circuit Over voltage & under voltage	Y	Y	Y	As per spec.
16.	Dust Test	Y	-	-	IEC 571cl.27
17.	Low temp. storage test	Y	-	-	IEC 60571 cl.10.2.14 (at -25°C for 16hrs.)
18.	Reliability Test	Y	Y	-	As per spec
19.	Burn-in test as per Spec No:ELRS/SPEC/SI/00 15	Y	-	-	As per Annexure – A of the spec (-25°C to +75°C)

9.2 TYPE TEST

- 9.2.1 Type test shall normally be carried out on one unit of equipment of the approved design. If there is any change in the design or source of supply of any components/ sub-assembly/assembly units made to the changed design or from new source shall be treated as a separate batch for the purpose of conducting type tests.
- 9.2.2 Type test will be conducted on the basis of the approved type test scheme in the presence of RDSO/Railway representative. Type and routine test schemes shall be prepared in accordance with the relevant IEC/UIC/IS/BS specifications and furnished to RDSO for approval. However, any additional test, if felt necessary may also be conducted at the time of type test.
- 9.2.3 A copy of the type and routine test reports, conducted earlier by the supplier, shall be submitted for scrutiny and approval
- 9.2.4 Type test will be conducted on a prototype (manufactured by the supplier) at supplier premises or any national test laboratory for this purpose. The supplier shall be completely responsible for coordination with test laboratory. The total expenses incurred for type testing shall be borne by the supplier. The supplier shall arrange all

the facilities including test apparatus/instrument such as meters, gauges, measuring instruments etc. required for such testing

- 9.2.5 The supplier shall carry out any modification/alteration, felt necessary during type test at their cost and type test shall be repeated on the modified apparatus. Authority for finalising the modification, if necessary, shall be RDSO. After the units work satisfactorily in service, no modification in design shall be carried out without prior approval of RDSO.
- 9.2.6 The results of type tests shall be submitted to RDSO for approval.
- 9.2.7 Any failure during inspection/testing by RDSO/Railway representative at firm's premises will be considered as failure of the complete batch.

9.3 ACCEPTANCE TESTS:

The equipment offered shall be accepted after successful completion of all the tests mentioned in clause no.9.1 of this specification on 10%of batch quantity subject to minimum of 5 nos.

9.4 INSPECTION:

- 9.4.1 The whole of the material or fittings used in the construction of the equipment shall be subjected to inspection by the Inspecting authority and shall be to his entire satisfaction.
- 9.4.2 The inspecting authority shall have the power to :-
 - 9.4.2.1 Adopt any means he may consider necessary to satisfy himself that all the materials or fittings specified are actually used throughout the construction.
 - 9.4.2.2 Visit at any reasonable time and without previous notice, either contractors' works or his sub-contractor's works to inspect the manufacturers and the quality of the work at any stage.
 - 9.4.2.3 To reject any materials or fittings that does not conform to the relevant standard specifications or have not been manufactured in accordance with the approved practices. The rejected materials or fittings shall be marked in a distinguishable manner and shall be disposed on in such manner as the inspecting officer may direct to avoid its inadvertent use in the product order as per this specification.
- 9.4.3 The manufacturer shall offer all the testing facilities free of charge to inspecting authority. Testing of equipment and fittings shall, as far as possible be carried out at the works of the manufacturers. Testing of bought out components may also be carried out at sub-contractor's premises, if so required. The contractor shall provide free of charge, such materials or fittings as may be required for testing whether at his own or his subcontractor's premises. The test for which facilities are not available may be carried out at RDSO or any other approved laboratory for which the testing charges shall be payable by the supplier.
- 9.4.4 All the equipments and the fittings required for test shall be selected by the inspecting officer and the tests shall be carried out in his presence.
- 9.4.5 No material shall be packed or despatched until it has been passed by the Inspecting officer but the contractor's responsibility for its efficiency in every way, shall remain the same as if the work had been manufactured and tested by himself.

- 9.4.6 Should any part require alteration or any defect appear during the test or trial the contractor shall make such alteration or rectify the defects without any extra charges to the satisfaction of the inspecting authority.
- 9.4.7 Copies of Maker's test certificate, guarantee obligations the performance of the equipment shall be supplied in duplicate along with the delivery of each unit.

9.5. TEST METHODS FOR DC-DC CONVERTER

9.5.1 Visual Inspection (1)

- (a) The initial visual inspection shall be carried out to ensure that the equipment is of sound construction, good workmanship, free from defect and meet the requirements of this specification. The inspecting authority is free to point out defects /checks. However, for guidance some checks are given below
- (b) Dimensional check, mounting dimensions fastening arrangement, knob, terminals, switches, indications, serial numbers, type numbers, terminal marking etc. are correct as per approved drawings and free from defects i.e. missing nut-bolts, sharp edges crack/broken terminal/ knobs, worn screw too tight ,dents ,scratches, deformation of fins, fixing holes too close to screws, loose screws etc.
- (c) Main component i.e. diodes, transistor, power transistor, IC's etc. are as per approved drawings and material.
- (d) The protective-cum-adhesive coating used on PCB's is clear, transparent, not affecting colour code of electronic components and type number of devices and is in dry conditions. Heavy components are properly tied or fixed. The soldered connections are with good finish, no peeling off copper connecting circuit path/ repaired by solder or jumper and the surface is coated with solderable protection coating.
- (e) All the resistors, capacitors, semi-conductor devices and other components mounted on PCB should be with round bend instead of sharp 90 deg bends, the height of components to be uniform and minimum to avoid breakage, overhang/cantilever mountings of components is to be avoided, heavy components are tied down with PCB's, resistors of more than 5 watts are provided with heat resistant sheet below to avoid burning of PCB's and heat dissipating components are to be separately mounted.
- (f) Standard and good code of practice has been followed i.e. wiring are properly laid, tied, terminated, colour code followed, mounting pads have been used for IC's/transistors where necessary, no repaired PCB's have been used. No hylam PCB has been used.
- (g) Check that all nuts, bolts, spring washers, washers and other parts used are galvanised or plated. Hexagonal head bolts provided with slot for screw driving has been used. Welded nut construction is preferable instead of threads in housing sheet metal.

- (h) Anodised rating plate, engraved terminal marking have been provided, indications, switches, terminal etc. are marked as per drawing.
- (i) Normally the manufacturer have a check list to avoid mistakes/missing of any item etc. a copy of the same should be obtained and left over points included in visual inspection.
- (J) In case the sample did not pass the visual inspection, no further test shall be conducted and firm may be asked to screen the offered lot.

9.5.2 Visual Inspection (2)

The second visual inspection (2) shall be carried out to check whether any damage or deterioration has occurred resulting from the test/tests performed. Under visual inspection (2) mainly it should be checked that there are no cracks, loosening of components, loosening of nut/bolts, buckling of PCB, deterioration of surface finish of components, PCB/peeling of copper paths, damage to protective coating, developing dry solder, components lead breakage/crack, corrosion at the root of components leads, flash over mark, sparking etc.

9.5.3 DIELECTRIC AND INSULATION TEST:

9.5.3.1 Insulation test:

The test shall be conducted on fully assembled equipment ready for inspection.

Insulation resistance measurement and dielectric test shall be conducted on:-

- i) Each circuit where galvanic isolation has been provided.
- ii) Each circuit of this type and earth, individual circuit may be connected together electrically for the purpose of this test.
- iii) For board assemblies with a metallic support frame the test shall be performed between all short-circuited connections of the plug connector and the metallic-supporting frame.

The test shall be conducted with 500 V megger and the insulation resistance shall not be less than 20 mega ohms.

9.6.3.2 Dielectric test:

The test shall be conducted corresponding to 1500V rms, 50 Hz for 1 min applied between shorted connections and the metallic supporting frame. The test shall be considered as unsatisfactory if either a disruption, discharge or flashover occurs or dielectric equipment trips before one minute during the test.

9.6.4 Performance test-1

The performance test shall be conducted to determine that the unit is capable to meet the operating requirements specified in the specification. The following tests shall be conducted under performance Test -1

- (a) Each dc-dc converter with rated load of 1000 W, ammeters, voltmeters and variable voltage power supply shall be connected to measure input and output parameters under the following conditions: -

Vary the input voltage gradually from 0-85V and note the input and output voltage and current with lamp in circuit. Note the readings accurately when the output voltage becomes 30.5 V at the minimum and maximum voltage. Now load the DC-DC converter at its full capacity and observe the input & output current at minimum and maximum input voltage. Repeat this test three times. And test procedure shall also be followed for another output voltage terminal (with 15.5V required for DIM mode operation of head Light). Repeat the above test at 25%, 50% and 75% rated load.

- (b) Set the input voltage at nominal voltage and switch it 'ON' and 'OFF' at least 5 times from input side and 25 times from output side. Check the current limit of circuit by overloading the output. The maximum in-rush current shall not be more than 50 A. Repeat the test at maximum input voltage of 85 V.
- (c) Set the input voltage at nominal voltage and connect a contactor across the load. Close the contactor to create the short circuit condition. Note the input, output voltage and current readings. The unit shall be kept shorted for two hours and the current limit circuit shall limit the current satisfactorily.

9.6.5 Performance Test-2

The performance test 2 shall be at nominal voltage to determine whether any deterioration has occurred due to the previous tests.

9.6.5.1 Performance Check

The performance check is a short performance test, which is performed during and after environmental tests and before performance test (1) and (2) to prove that the equipment under test is within its operational limits and that it has survived on environmental test.

9.6.6 Temperature Rise Test (Dry Heat Run test)

The test shall be carried out as per clause 10.2.4 of IEC-60571 on the complete electronic assembly as in normal operation at full load.

At the end of this test, a performance check as per clause 9.6.5.1 of this specification shall be conducted.

9.6.7 Temperature Rise Tests

The test shall be carried out at room temperature with power supply 'ON' and output fully loaded for worst condition of input voltage at 50V and the temperature rise of critical components is measured to ensure that it is within the limit agreed by RDSO.

9.6.8 Temperature Rise Test (Damp Heat Test)

The test shall be conducted as per clause 10.2.5 of IEC-60571 and performance test (2) as per clause 9.6.5 of this specification after the damp heat test.

9.6.9 Surge and Transient Test

Test shall be conducted as per clause 10.2.6 of IEC 60571 and performance check to be done as per clause no.9.6.5.1 of this specification.

9.6.10 Transient Burst Susceptibility Test

Test shall be conducted as per clause 10.2.7 of IEC 60571 & IEC61000-4-4 and performance check as per clause no.9.6.5.1 after the test.

9.6.11 Radio Interference Test:

Test shall be conducted as per clause 10.2.8 of IEC 60571, IEC61000-4-3& IEC61000-4-6 and performance check as per clause no.9.6.5.1 after the test.

9.6.12 Vibration test, shock and bump Test

The test shall be carried out as per clause 10.2.11 of IEC 60571 and IEC61373

9.6.13 Efficiency Test

The efficiency of DC-DC converter shall be calculated based on readings 25%, 50%, 75% and 100% load. The full load efficiency shall not be less than 90 %.

9.6.14 Salt Mist Test

This test shall be carried out as per IEC-60571 clause 10.2.10.

9.6.15 Over Voltage Test

The equipment shall be operated at 1.8 times the nominal voltage for two minutes and the unit shall work satisfactorily

Reverse Polarity Test

The test shall be carried out as per clause as per cl. 6.6.5 of the spec.

Output Short circuit Test

The test shall be carried out as per clause as per cl. 6.6.2 of the spec.

Under Voltage test:

The test shall be carried out as per clause as per cl.6.6.4 of the spec.

9.6.16 Dust Test:

In case the facilities are available, it is preferable to conduct combined dust, humidity and heat test as per clause 27 of IEC-571. If the facilities do not exist for combined test, the dust test alone may be conducted against combined test.

9.6.17 Low Temperature Storage Test

This test shall be carried out as per IEC-60571 clause 10.2.14.

9.6.18 Reliability Test

The equipment shall be operated at rated resistive load of 1000W and nominal voltage of 72 V and placed in a chamber for 100 hours. During the test the temperature in the test chamber shall be maintained at 70deg±2 deg. C

Performance tests shall be conducted at ambient temperature on completion of 100-hour period to ensure that there is no deterioration in performance of converter.

9.6.19 Burn-in Test

The DC-DC converter unit in energized condition shall be burnt in for minimum 72 hours at 75°C and -25 °C as per cycle at Annexure I of spec. no. ELRS/SPEC/SI/0015, Oct.'2001. The unit will be tested functionality to the extent possible after the burn in test.

10 FIELD TRIALS AND EVALUATION

One or two prototypes as decided by IR shall be subjected to field trials for one year before approval is given for bulk supply. During this period, the performance of the equipment shall be closely monitored and evaluated by RDSO. Any failure during the trial period will be considered as failure of product and will be rejected. These trials are intended to prove

- Reliability under rigorous environmental and operating conditions
- Maintainability of the equipment.

The supplier at their cost shall carry out any modification/alteration felt necessary during field trial and it shall be again repeated on the modified product.

11. EVALUATION CRITERIA

The supplier / renderer offering their standard product for diesel traction application should submit the following documents enclosed with the offer.

- 11.1 OGA and mounting drawings of item should be submitted by the successful tenderer. It is desirable that the 3D unigraphics (NX3) model on CD may also be submitted along with the offer
- 11.2 Design data of the equipments required for establishing the adequacy of the design.
- 11.3 Printed standard catalogue consisting complete technical details. Credential of supplying the offered product and Quality assurance plan (QAP) .
- 11.4 A list of tools & fixtures and manufacturing facilities available and proposed.
- 11.5 List of customers with complete supply details of the offered product.
- 11.6 Reference list of customers should have the contact person details.
- 11.7 The following documents to be furnished after successful type testing

11.7.1 Design Manual

- a) Circuit diagram, component nos., rating of components and data sheets of all components.
- b) Drawing of the converter assembly along with part drawings.

11.7.2 Maintenance manual

- a) Maintenance manual of the equipment with full description of maintenance and repair procedures.
- b) List of maintenance spares
- c) Trouble shooting handbook.

11.8 Prototype Test Report

Complete prototype test report along-with test program, circuit diagram, component details, working of the circuit etc. shall be presented in booklet form and two copies of such booklet shall be submitted to RDSO for record.

12.0 TYPE APPROVAL

Complete design details along with set of drawings shall be submitted to RDSO for approval. BOM for various items shall also be furnished before the design is approved. Outer dimensions of the fittings can be finalised by actual mounting of the prototype on a locomotive in a diesel shed of Indian Railways. Only after the drawings and material details are finalised and approved by RDSO, the prototype unit shall be manufactured and offered for prototype tests. Type tests on one unit shall be carried out by the representatives of RDSO at the manufacturer's works. Type approval shall be granted by RDSO in case all the tests are successful.

13.0 MARKING

An anodized aluminium plate carrying following markings shall be fitted on the casing of DC-DC converter at a suitable place:-

- (i) Maker's name and trade mark
- (ii) Maker's serial number and year of manufacture.
- (iii) System Voltage.
- (v) Rating of converter.

14.0 PACKING

The complete assembly shall be placed in a craft board box wrapped in polythene packing and then packed in a wooden box (of adequate strength) in such a manner that there shall be no transit damages.

15.0 GUARANTEE

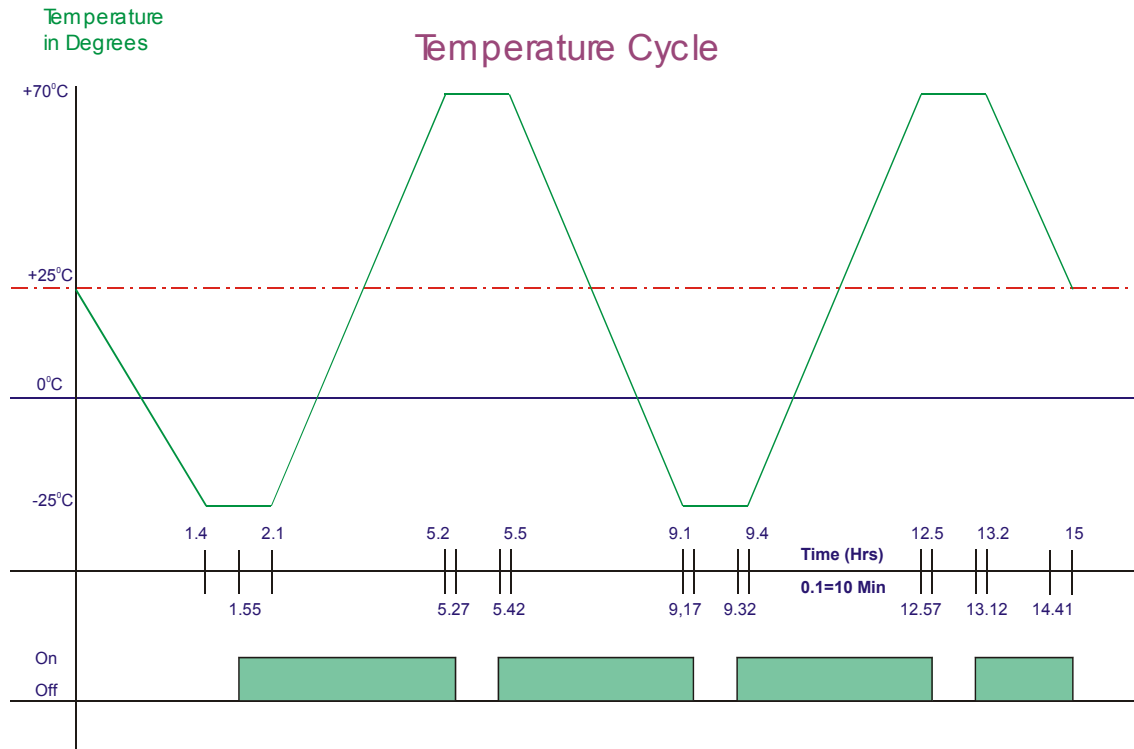
The DC/DC converter shall be guaranteed for a period of one year from the date of commissioning. Any component found defective within one year shall be repaired or replaced by the manufacturer free of cost.

16.0 INFRINGEMENT OF PATENT RIGHTS:

Indian Railways shall not be responsible for infringement of patent rights arising due to similarity in design, manufacturing process, use of components used in design and manufacturing of DC-DC converter and any other factor, which may cause such dispute. The responsibility to settle any issue rests with the manufacturer.

Annexure-A

BURN-IN TEST



Annexure - B

Technical details of DC-DC converter to be furnished

by the Tenderer along with Tender :

1. Input voltage : a) Minimum.....V
: b) NominalV
: c) Maximum.....V
2. Input current : a) At 72 V DC input VoltageA
(For diesel electric locomotives)
3. Output voltage : Nominal setting
: Bright....V
: Dim...V
4. Rating of each converter : W
5. Dimensions : a) Length.....mm
: b) Breadth....mm
: c) Height.....mm
6. Weight of assembly :Kg
7. Mounting arrangement :
8. Details of each component : a) Type No.....
: b) Rating with tolerance..
: c) Junction temp. of diodes,
transistors, thyristors etc.,
: d) Heat sinks details.