MECHANICAL ENGINEERING DEPARTMENT

ST/ME/SPM/ 7296 Dated- 19th October 2013

Remarks of General Manager (ME)

Subject:- Approval for inviting Open tender for purchase of 24 Volt Bus Tube Light Fixtures with Inverter and With Inbuilt Inverter, Inverter and Acrylic Cover

Ref:- Note ST/S&P/OPE/ OT / 18.10.2013

- As proposed by S&P Department tender be invited for item No 1 to 5 i.e Item no 1,2,3 pertaining to Tube light Fixture with Inverter and item no 4 & 5 peertaining to Tube Light Fixtures with Inbuilt Invertor.

- Specification applicable is as under :-

  for Item No 1,2 and 3 - ASRTU Specification No AS:261:68:Dec:2004 and Drawing No 2-04-40-112/D

  for Item No 4 & 5 - ASRTU Specification No. AS:463:79:Sept:2012 and Drawing No 1-03-40-200

- Quantity mentioned by S&P Department is confirmed..

- For item No 4 and 5 i.e items pertaining to Tube Light Fixtures with Inbuilt Invertor, last year tender was invited based on MSRTC Specification No ELE-279/1 dtd July 2012 and drawing No 1-03-40-200. Now ASRTU has finalized the specification for for these items i.e . AS:463:79:Sept:2012. Hence, it is recommended to invite the tender vbased on this ASRTU specification for item No 4 & 5 with MSRTC drawing No 1-03-40-200. The copy of the specication is enclosed herewith.

- The tender will be evaluated separately for Tube light Fixture with Inverter (item No 1,2,3) and Tube Light Fixtures with Inbuilt Invertor (Item No 4&5). The passing norm mentioned as per ASRTU Quality watch 2005-2010 is 50% .

  Above passing norm will be applicable for MSRTC tender also. Hence, to assess the quality of the firm we always consider the test reports data of ASRTU and MSRTC combine for the last 3 years for evaluation of passing norm criteria for each group. **(This criterion is applicable to MSRTC past suppliers, ASRTU Contract Holders and other tenderers whose test report data is available with ASRTU)**

- The standard approved condition of submission of 1 test report be included in the compulsory pre-qualification criteria. In order to fulfill this condition , the details about the test report to be submitted along with the tender are as under :-

Firms submitting quotation for **Tube light Fixture with Inverter (item No 1,2,3)**	1 **Test report for Item No 1 or 2**
Firms submitting quotation for **Tube light Fixture with Inverter (item No 4 & 5)**	1 **Test report for Item No 4**

General Manager (ME)

General Manager (S&P)

Subject:- Approval for inviting Open tender for purchase of 24 Volt Bus Tube Light Fixtures with Inverter and With Inbuilt Inverter , Inverter and Acrylic Cover

Ref:- Note ST/S&P/OPE/ OT / 18.10.2013

4538 19-10-13

Financial Advisor and Chief Accounts Officer

RS Dhongde 22/10/13

Vice Chairman and Managing Director

24/10

VC & MD
No.- S&P-373
D[illegible]N- 22/X/13
I[illegible] Out 23/X/13

ASRTU SPECIFICATION FOR 24V/20W INVERTER FOR BUS APPLICATION

0.0 SPECIFICATION NO. : AS:261: 68:DEC:2004

1.0 SCOPE

1.1 This standard prescribes method of testing and requirements for 24V Inverters for meant for 20W fluorescent light.

1.2 This is a purchase specification and does not include manufacturing details. The parts/material supplied against this specification shall be compatible with the original equipment.

1.3 The supplier shall provide detail drawings & specifications to the purchasing / inspecting authority whenever such information is specifically called for.

1.4 The material offered against this specification shall conform to this specification in full. The tests shall be carried out on the part directly or on the specimen prepared from the components' If any of the samples fail in any one or more tests spacified, the sample shall be considered as not having met the requirements of this specification.

1.5 It is the manufacturer's prime responsibility to satisfy the inspection authority that the commodity conforms to this standard. This may be accomplished by performing the tests specified in this standard.

1.6 Sample selection shall be the responsibility of the Quality Assurance Officer. Required quantity for complete testing as per this specification shall be supplied.

1.7 This specification supersedes earlier specifications including AS:261:61:OCT:2000

2.0 APPLICATION

2.1 This specification covers the requirement for 24V inverters meant for 20W fluorescent light for automotive application.

2.2 **Design:** The inverter may be of any design and type i.e. symmetrical or asymmetrical, and the wave form may be square, quasi-sine or sine.

3.0 REFERENCE SPECIFICATION

3.1	IS:7027-1984 (Reaffirmed in 1996)	Specification for Transistorised Ballasts for Fluorescent Lamps.

4.0 TEST QUANTITY AND SCHEDULE OF TEST

4.1 **Test Quantity** : Minimum 3 Nos. shall be supplied for testing.

4.2 **Schedule of Test**

Sr. No.	Description of Test	Cl. No.	Sample A	Sample B	Sample C
1	Visual Examination	5.1	x	x	x
2	Marking	5.2	x	x	x
3	Constructional Details	5.3	x	x	x
4	Insulation Resistance Test	5.4	x	x	x
5	Performance Tests	5.5	x	x	x
6	Humming Noise Test	5.6	x	x	x
7	Flickering Test	5.7	x	x	x
8	Maximum Operating Voltage Test	5.8	x	x	x
9	Reverse Polarity Test	5.9	-	x	-
10	Short Circuit Test	5.10	-	-	x
11	Open Circuit Test	5.11	-	-	x
12	Electric Strength Test	5.12	x	-	-

x - Denotes sample to be subjected for testing.

5.0 TESTS AND REQUIREMENTS

5.1 **Visual Examination**
The inverter shall be examined visually for good workmanship and defects, if any.

5.2 **Marking**
The inverter shall be indelibly marked with the following information:

a) Name of the manufacturer or Trade name, if any

b) Type (Symmetrical/Asymmetrical, Low/High Resistance Cathode)

c) Wiring Diagram indicating the significance of code used for connecting wires

d) Rating (V & W)

e) Date of manufacture

5.3 **Constructional Details**
Since the design of bus body varies for STUs, it is left to each STU to specify the constructional details. However the following dimensions are recommended.

a)	Height	-	30 mm (max)	)
b)	Width	-	60 mm (max)	)
c)	Length	-	300 mm (max)	) For Record Only
d)	Input cable length	-	300 mm (min)	)
e)	Output cable length	-	600 mm (min)	)

5.4 **Insulation Resistance Test**
At 500 Vdc between the terminals and the body when the insulation resistance is measured, it should be minimum 2 mega ohms.

5.5 **Performance Tests**
The performance requirements of the inverter are as under:

	TYPE	Asymmetrical	Symmetrical
(i)	Striking Voltage - Vdc (max)	16	16
(ii) *	Open Circuit Voltage - Vrms (min)	180	110
(iii)	No load current - mA (max)	400	120
(iv)	Current Drawn - mA (max)	900	1000
(v)	Lead to Cathode current - mA (max)	650	1000

* **Open Circuit Voltage (Vrms) if observed as zero also can be accepted**

(vi) **Pre-heat conditions** -
Voltage across lamp cathode (Vrms)

(a)	For Low Resistance Cathode type -	3.05 - 6.5	—
(b)	For High Resistance Cathode type -	6.5 - 11.0	—
(vii)	Frequency of operation - KHz (min)	20	20

(viii) Wave Form - As declared by the manufacturer

5.6 **Humming Noise Test**
When tested in the operating range of voltage(20-30V), there should not be any humming noise.

5.7 **Flickering Test**
Within the voltage range of 20 to 30 Volt, the inverter should function satisfactorily without causing flickering to the tube assembly.

5.8 **Maximum Operating Voltage Test**

(i) The inverter should work satisfactorily for 6 hours at a voltage of 30 Vdc.

(ii) The inverter when tested at 35 Vdc, it should work satisfactorily minimum for 2 seconds.

5.9 **Reverse Polarity Test**
On reversing the polarity of input wires, the inverter should not get damaged.

5.10 **Short Circuit Test**
After short circuiting across the cathode, and when connected in the circuit with the appropriate wires, the inverter should work satisfactorily.

5.11 **Open Circuit Test**
After disconnecting the tube light load for a while, when again connected in the assembly, the inverter shall function satisfactorily.

5.12 **Electric Strength Test**
When a Test Voltage of 1000 V ac 50 Hz is applied gradually for one minute, between output terminals and the body of the inverter, there shall not be any failure.

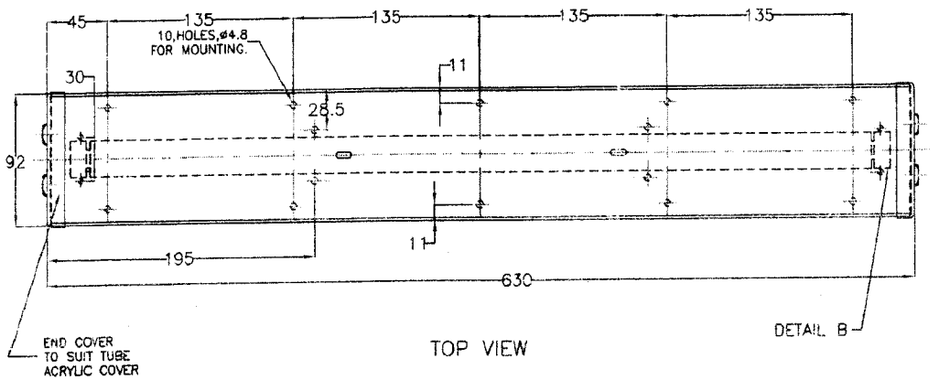
6.0 PACKING

The inverter shall be packed suitably so as to withstand the vibrations encountered during transit and also during handling. The carton should be appropriately marked with the details given in the para 5.2 above.

WEIGHTAGE MARKS FOR 24V/20W INVERTER FOR BUS APPLICATION AS:281:68 DEC:2004

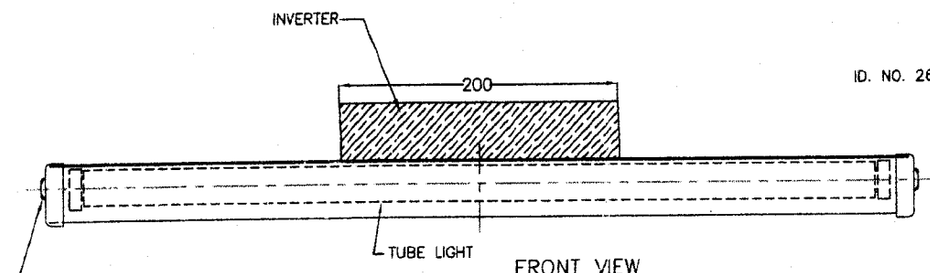
Sr. No.	Test Parameter	Clause No.	Weightage Marks	P/T
1	Visual Examination	5.1	2	T
2	Marking	5.2	1	T
3	Insulation Resistance Test	5.4	6	T
4	Performance Tests	5.5	49 (7 for each test)	P
5	Humming Noise Test	5.6	6	T
6	Flickering Test	5.7	6	T
7	Maximum Operating Voltage Test	5.8	6	T
8	Reverse Polarity Test	5.9	6	T
9	Short Circuit Test	5.10	6	T
10	Open Circuit Test	5.11	6	T
11	Electric Strength Test	5.12	6	T
		Total	100	

P = Proportionate marks shall be considered.
T = Total marks shall be considered.

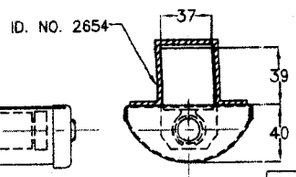


TOP VIEW

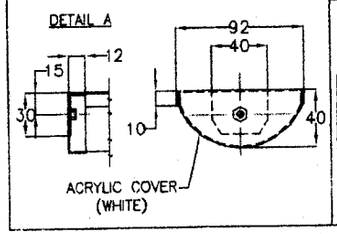
NOTES:
1. ALL DIMENSIONS ARE IN MM.
2. NOT TO SCALE.
3. ALL WELDED CONSTRUCTIONS UNLESS OTHERWISE STATED.
4. THIS DRAWING IS ONLY FOR GUIDANCE & NOT FOR MANUFACTURING PURPOSE.
5. TUBE LIGHT END CLAMP SHOULD BE FITTED IN SUCH A FASHION ,HAT IT SHOULD ACCOMMODATE FLORESCENT TUBE OF THE FOLLOWING SPECIFICATION
   (A) WATTS–18W,24V (B) DIA. OF TUBE 25 (C) LENGTH OF TUBE 600MM.
   IT SHALL ACCOMMODATE TUBE OF ABOVE SIZE OF ANY STANDARD MAKE.
6. ACRYLIC SHEET: 2MM THICK.
7. THE TRAY SHOULD BE POWDER COATED WITH MILKY WHITE SHADE.
8. TUBE LIGHT END CLAMP SHOULD BE DESIGNED IN SUCH A WAY THAT THE TERMINALS OF TUBE LIGHT SHOULD BE SOLDERED. THE TUBE LIGHT FITTING IN CONVENTIONAL ROTARY HOLDER SHALL NOT BE ACCEPTABLE. THE CLAMP SHOULD BE SUCH THAT TUBE LIGHT IS FREE FROM VIBRATION.
9. THE TUBE LIGHT SHOULD BE DESIGNED IN SUCH A WAY THAT IT SHOULD BE FLICKER FREE.
10. GUARANTEE FOR SET: 2 YEARS MINIMUM. THIS SHALL INCLUDE THE GUARANTEE FOR TUBE LIGHT, WIRING , FIXTURES AND ACRYLIC COVER AND ACCESSORIES. THE GUARANTEE FOR THE INVERTORS SHOULD BE 5 YEARS MIN.
11. THE INVERTER SHOULD BE COVERED ONE AND NOT LOOSE ASSEMBLY.
12. THE WIRE SHOULD BE PROPERLY CLAMPED INSIDE THE TUBE LIGHT ASSY. SO THAT THE UNDER VIBRATION IT DOES NOT GET LOOSE OR TOUCH TUBE LIGHT.
13. THE INVERTER SHOULD BE SO FITTED TO THE FIXTURE THAT IT SHALL NOT GET LOOSE DURING VIBRATION.
14. THE INVERTER SHOULD FLICKER FREE AND FREE FROM END BLACKING OF TUBES.
15. TUBE LIGHT FIXTURE TO BE FABRICATED FROM 22 GAUGE MS SHEET.
16. THE END CLAMPS AND TUBE LIGHT CLAMPS SHOULD BE OF MOULD TYPE AND MOULD FROM GLASS FILLED NYLON SO THAT IT HAS PROPERTY ABSORBING SHOCK AND SHOULD THAT AND HIGH TEMPERATURE.
17. THE INVERTER DIMENSIONS SHOWN ARE MAXIMUM REDUCED DIMENSIONS SHALL BE ACCEPTABLE. THE INVERTER SHOULD BE ACCOMMODATED IN TOP HAT SECTION ID NO. 2654.
18. THE NUTS SHOULD BE SPOT WELDED TO END CLAMPS MOUNTING SO THAT THE END CLAMPS SHALL NOT GET LOOSE IN VIBRATION.
19. THE INVERTER & TUBE LIGHT SHOULD BE SUITABLE FOR 24V SYSTEM.
20. ALL OTHER PARAMETER OF INVERTER BE TESTED AS PER AS:261:61:OCT.2000.
21. ASYMMETRICAL LOW RESISTANCE CATHOD.

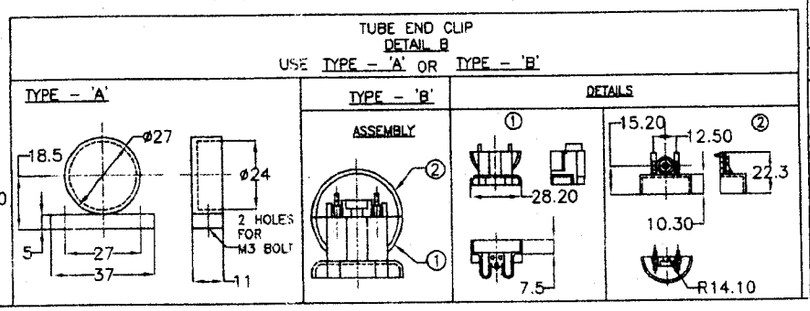


FRONT VIEW



SIDE VIEW





DATE & NO.	AMENDMENT
'C' 17.11.2013	ADDITIONAL HOLDER DETAILS ADDED
'D' 11.12.2013	DIMENSIONS CORRECTED

MAHARASHTRA STATE TRANSPORT
R&D SECT. CENTRAL WORKSHOPS PUNE12.

CAD	PKP.	
CHECKED	ALP.	
SPECIFIED	SBK.	
R'MOND	RMP.	
APPVD		
AMENDMENT		

TUBE LIGHT FIXTURE
FOR MSRTC BUSES

SCALE– NTS. DATE– 28–06–1995

A B C D
~~1995 2003 2013~~ 2013

2-04-40--112/D

ASRTU SPECIFICATION FOR 24V/20W INBUILT INVERTER WITH TUBE LIGHT FITMENT (WITHOUT TUBE LIGHT) FOR BUS APPLICATION

0.0 SPECIFICATION NO. : AS:463:79:SEPT:2012

1.0 SCOPE

1.1 This standard prescribes method of testing and requirements for inbuilt 24V Inverters with tube light fitment (without tube light) meant for 20W fluorescent light.

1.2 This is a purchase specification and does not include manufacturing details. The parts/material supplied against this specification shall be compatible with the original equipment.

1.3 The supplier shall provide detail drawings & specifications to the purchasing / inspecting authority whenever such information is specifically called for.

1.4 The material offered against this specification shall conform to this specification in full. The tests shall be carried out on the part directly or on the specimen prepared from the components'. If any of the samples fail in any one or more tests specified, the sample shall be considered as not having met the requirements of this specification.

1.5 It is the manufacturer's prime responsibility to satisfy the inspection authority that the commodity conforms to this standard. This may be accomplished by performing the tests specified in this standard.

1.6 Sample selection shall be the responsibility of the Quality Assurance Officer. Required quantity for complete testing as per this specification shall be supplied.

2.0 APPLICATION

2.1 This specification covers the requirement for inbuilt 24V Inverters with tube light fitment (without tube light) meant for 20W fluorescent light for automotive application.

2.2 **Design:** The inbuilt inverter may be of any design and type i.e. symmetrical or asymmetrical, and the waveform may be square, quasi-sine or sine.

3.0 REFERENCE SPECIFICATION

3.1	IS:7027-1984 (Reaffirmed in 1996)	Specification for Transistorised Ballasts for Fluorescent Lamps.

4.0 TEST QUANTITY AND SCHEDULE OF TEST

4.1 **Test Quantity :** Minimum 3 Nos. shall be supplied for testing.

4.2 **Schedule of Test**

Sr. No.	Description of Test	Cl. No.	Sample A	Sample B	Sample C
1	Visual Examination	5.1	x	x	x
2	Marking	5.2	x	x	x
3	Constructional Details	5.3	x	x	x
4	Insulation Resistance Test	5.4	x	x	x
5	Performance Tests	5.5	x	x	x
6	Humming Noise Test	5.6	x	x	x
7	Flickering Test	5.7	x	x	x
8	Maximum Operating Voltage Test	5.8	x	x	x
9	Reverse Polarity Test	5.9	-	x	-
10	Short Circuit Test	5.10	-	-	x
11	Open Circuit Test	5.11	-	-	x
12	Electric Strength Test	5.12	x	-	-

x - Denotes sample to be subjected for testing.

5.0 TESTS AND REQUIREMENTS

5.1 **Visual Examination**
The inbuilt inverter shall be examined visually for good workmanship and defects, if any.

5.2 **Marking**
The details of inbuilt inverter shall be indelibly marked on the tube light fitment with the following information:

a) Name of the manufacturer or Trade name, if any

b) Type (Symmetrical/Asymmetrical, Low/High Resistance Cathode)

c) Wiring Diagram indicating the significance of code used for connecting wires

d) Rating (V & W)

e) Date of manufacture

5.3 **Constructional Details (** TUBE LIGHT FITMENT)
Since the design of bus body varies for STUs, it is left to each STU to specify the constructional details. However the following dimensions are recommended.

a)	Height	-	50 mm (max)	For record only
b)	Width	-	100 mm (max)	
c)	Length	-	750 mm (max)	

5.4 **Insulation Resistance Test**
At 500 Vdc between the terminals and the body when the insulation resistance is measured, it should be minimum 2 mega ohms.

5.5 **Performance Tests**
The performance requirements of the inbuilt inverter are as under:

	TYPE	Asymmetrical	Symmetrical
(i)	Striking Voltage - Vdc (max)	16	16
(ii)	*Open Circuit Voltage - Vrms (min)	180	110
(iii)	No load current - mA (max)	400	120
(iv)	Current Drawn - mA (max)	900	1000
(v)	Lead to Cathode current - mA (max)	650	1000

*** Open Circuit Voltage (Vrms) if observed as Zero also can be accepted.**

(vi) **Pre-heat conditions –**

Voltage across lamp cathode (Vrms)

(a)	For Low Resistance Cathode type -	3.05 - 6.5	---
(b)	For High Resistance Cathode type -	6.5 - 11.0	---

(vii) Frequency of operation - KHz (min) 20 20

(viii) Wave Form - As declared by the manufacturer

5.6 **Humming Noise Test**
When tested in the operating range of voltage (20-30V), there should not be any humming noise.

5.7 **Flickering Test**
Within the voltage range of 20 to 30 Volts, the inbuilt inverter should function satisfactorily without causing flickering to the tube assembly.

5.8 **Maximum Operating Voltage Test**

(i) The inbuilt inverter should work satisfactorily for 6 hours at a voltage of 30 V dc.

(ii) The inbuilt inverter when tested at 35 Vdc, it should work satisfactorily minimum for 2 seconds.

5.9 **Reverse Polarity Test**
On reversing the polarity of input wires, the inbuilt inverter should not get damaged.

5.10 **Short Circuit Test**
After short-circuiting across the cathode, and when connected in the circuit with the appropriate wires, the inbuilt inverter should work satisfactorily.

5.11 **Open Circuit Test**
After disconnecting the tube light load for a while, when again connected in the assembly, the inbuilt inverter shall function satisfactorily.

5.12 **Electric Strength Test**
When a Test Voltage of 1000 V ac 50 Hz is applied gradually for one minute, between output terminals and the body of the inbuilt inverter, there shall not be any failure.

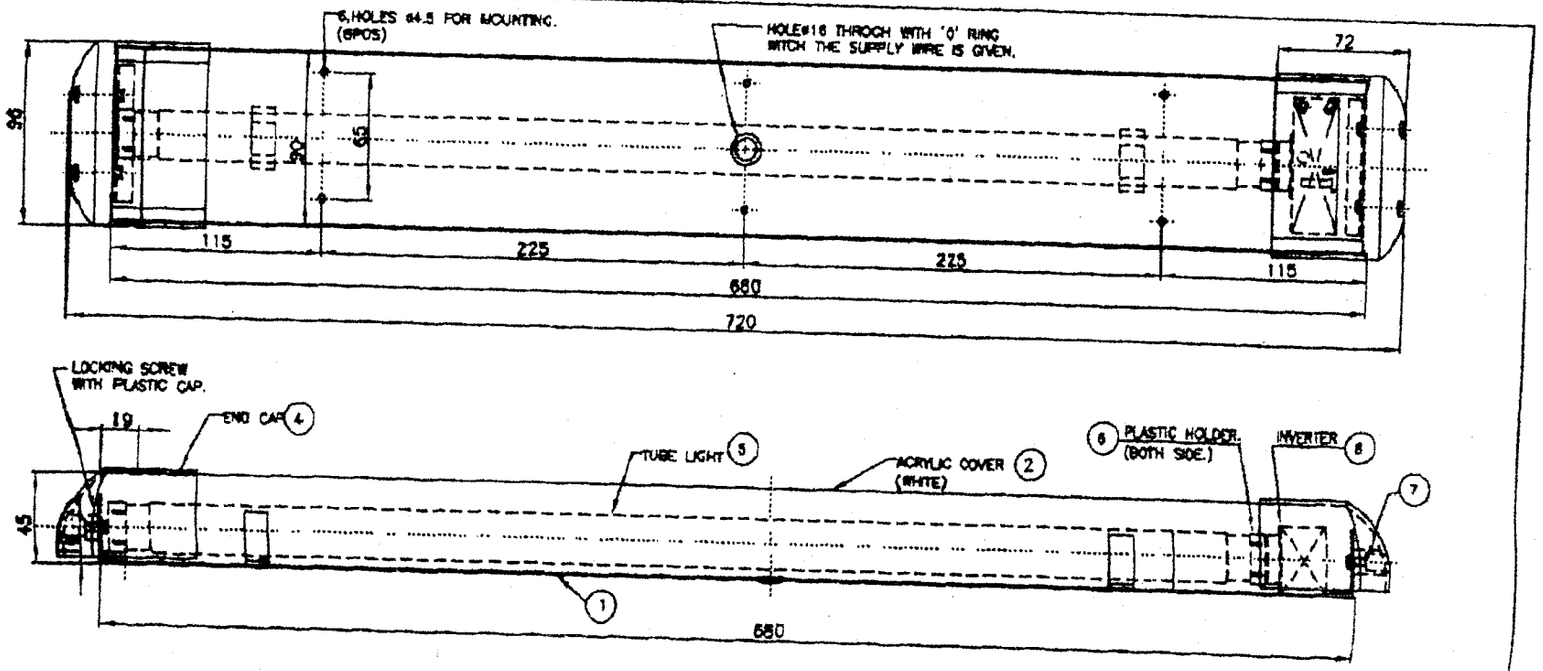
6.0 PACKING

The 24V/20W inbuilt Inverter with tube light fitment (without tube light) shall be packed suitably so as to withstand the vibrations encountered during transit and also during handling. The carton should be appropriately marked with the details given in the Para 5.2 above.

WEIGHTAGE MARKS FOR 24V/20W INVERTER WITH TUBE LIGHT FITMENT (WITHOUT TUBE LIGHT) FOR BUS APPLICATION AS:463:79:SEPT:2012

Sr. No.	Test Parameter	Clause No.	Weightage Marks	P/T
1	Visual Examination	5.1	2	T
2	Marking	5.2	--	--
3	Constructional Details	5.3	--	--
4	Insulation Resistance Test	5.4	7	T
5	Performance Tests	5.5	49 (7 for each test)	P
6	Humming Noise Test	5.6	6	T
7	Flickering Test	5.7	6	T
8	Maximum Operating Voltage Test	5.8	6	T
9	Reverse Polarity Test	5.9	6	T
10	Short Circuit Test	5.10	6	T
11	Open Circuit Test	5.11	6	T
12	Electric Strength Test	5.12	6	T

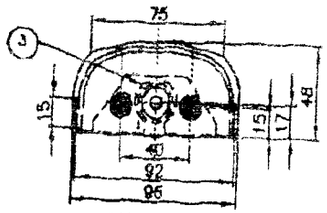
P = Proportionate marks shall be considered.
T = Total marks shall be considered.



NOTES –
- ALL DIMENSIONS ARE IN MM.
- DO NOT SCALE.
- THIS DRG IS FOR GUIDANCE ONLY.
- OPEN TOLERANCE ARE AS PER IS: 2102-1980

S.NO	DETAIL NAME	MATERIAL	QTY.
8	INVERTER	24V-18/20W.	1 NO.
7	SCREW FOR END CAP.	3mm DIA	4 NOS.
6	TUBE HOLDER.	PLASTIC.	2 NOS.
5	TUBE.	18/20W.	1 NO.
4	SIDE COVERS.	PPCP.	2 NOS.
3	MOUNTING CLAMP	PLASTIC.	2 NOS.
2.	COVER.	WHITE ACRYLIC	1 NO.
1.	CASE (BODY.)	20G. MS. SHEET WITH WHITE COTTING	1 NO.

S.NO.	SPACIFICATION PARAMATER	DISCRIPTION.
10	LUMINOUS INTENSITY (MESURED FROM 1 MTR.)	120 LUX.
9	WEIGHT OF THE TUBE. (WITH BOX DIMENSION.)	1.0 Kg. NEAR ABOUT
8	WIRE SIZE.	1MTR.(15/0.3)
7	WIRE COLOUR CODE.	RED & BLACK.
6	MATING CONNECTOR DETAILS.	TYPE:- 2POLE /SINGLE POLE
		SERIES:- C-250
		MAKE:-JVC.
5	PRECAUTIONS OF YOUR ELECTRONIC PARTS / INVERTOR IF ANY	REVERSE POLARITY DIODE
4	NO. OF TUBE LIGHT.	1.NO.
3	TUBE/ LAMP MAKE.	I.S. MARK.
2	WATTAGE OF THE TUBE LIGHT.	18/20W
1	OPERATING VOLTAGE	24V.



END VIEW.

		SIGN.
CAD	SHR.	
SPACIFIED	SSB.	
R'MOND	RMP.	
APPVD		
AMENDMENT		

MAHARASHTRA STATE TRANSPORT
R&D SECT. CENTRAL WORKSHOPS PUNE12.

NEW TUBE LIGHT ASSEMBLY WITH INBUILT INVERTOR. 24V DC.-18/20W TUBE.

SCALE:- NTS. DATE- 12-07-2012

1-03-40-200