



Maharashtra State Electricity Distribution Company Limited

Specification No. T&QC: MSC-II/ Carriers and Bases Used in Rewirable Fuses /2021/02

Technical Specification of Carriers and Bases Used in Rewirable Type
Electric Fuses Up to 650 Volts

For

Distribution System

In

MSEDCL

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MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO. LTD.

Technical Specification of Carriers and Bases Used in Rewirable Type Electric Fuses Up to 650 Volts

1.0 Scope :

- 1.1 This specification covers design, manufacture, testing before supply, inspection, packing and delivery and other basic technical requirements in respect of Carriers and Bases Used in Rewirable Type Electric Fuses Up to 650 Volts to be used at various sites in MSEDCL, Maharashtra. The Carriers and Bases Used in Rewirable Type Electric Fuses to be supplied against this specification is required for vital installations where continuity of service is very important. The design, materials and manufacture of the Carriers and Bases Used in Rewirable Type Electric Fuses shall, therefore, be of the highest order to ensure continuous and trouble-free service.
- 1.2 It is not the intent to specify herein complete details of design and construction of Carriers and Bases Used in Rewirable Type Electric Fuses. The Carriers and Bases Used in Rewirable Type Electric Fuses offered shall conform to the relevant standards and be of high quality, sturdy, and of good design and capable to perform continuous and satisfactory operations in the actual service conditions at site and shall have sufficiently life in service as per statutory requirements.

2.0 System Particulars:

- 2.1 Nominal System Voltage : Three Phase: 433 V and Single Phase 250V
2.2 Voltage variation on supply side : $\pm 10\%$
2.3 Frequency : 50 Hz with $\pm 3\%$ tolerance
2.5 Transient condition : -20 % or + 10 % combined variation of voltage and frequency.
2.6 Number of Phase : 3 Phases
2.7 Neutral earthing : Solidly earthed.
2.8 Fault level (minimum) kA : 3kA --- for 3 sec.

3.0 Service Conditions:

- A) Carriers and Bases Used in Rewirable Type Electric Fuses Used in Rewirable Type Electric Fuses Up to 650 Volts to be supplied against this specification shall be suitable for satisfactory continuous operation under the following tropical conditions.

- 3.1 Maximum ambient Temperature (Degree C) 50
3.2 Maximum temperature in shade (Degree C) 45
3.3 Minimum Temperature (Degree C) 3.5
3.4 Relative Humidity (percent) 10 to 100
3.5 Maximum Annual rain fall (mm) 1450
3.6 Maximum wind pressure (kg/sq.m) 150
3.7 Maximum altitude above mean sea level (Meter) 1000
3.8 Isoceran level (days per year) 50
3.9 Seismic level (Horizontal Acceleration) 0.3g

Moderately hot and humid tropical climate conducive to rust and fungus growth

B) The climatic conditions are prone to wide variations in ambient conditions and hence the Carriers and Bases Used in Rewirable Type Electric Fuses Up to 650 Volts shall be of suitable design to work satisfactorily under these conditions.

4.0 Applicable Standards :

- 4.1 The manufacture and performance of the Carriers and Bases Used in Rewirable Type Electric Fuses shall comply with all currently applicable statutes and regulations. Nothing in this specification shall be construed to relieve the bidder off his responsibilities.
- 4.2 Unless otherwise specified, Carriers and Bases Used in Rewirable Type Electric Fuses offered shall conform to the latest applicable Indian, IEC, British, U.S.A. or International Standards and in particular, to the following:-

Sr. No.	Standards	Particulars
1.	IS: 2086, 1993	Carriers and Bases Used in Rewirable Type Electric Fuses Up to 650 Volts upto 100Amps.
2.	IS: 9926, 1981	Fuse Wire Used in Rewirable Type Electric Fuses Up to 650 Volts
3.	IS: 13411, 1992	Glass Reinforced Polyester Dough Moulding Compounds
4.	IS: 1897/1983	Electrolytic Copper
	IS: 191, Part IV	Silver contain
	IS: 1264/1981 and IS: 410 of 1977	Brass (tinned)

5.0 Principal Technical Parameters of Carriers Used in Rewirable Type Electric Fuses:

The Carriers Used in Rewirable Type Electric Fuses covered under this specification shall conform to specific parameters given below:

- i) Nominal Three Phase System Voltage : 433V
- ii) Frequency : 50 Hz with $\pm 3\%$ tolerance
- iii) Neutral Earthing : Solidly Effectively Earthed
- iv) Fault level (minimum) kA : 4kA --- for 3 sec.
- v) Rated Current : 32 Amps, 63 Amps, 100Amps and 200Amps
- vi) Mechanical Endurance : 100 cycles.
- vii) Withdrawal Force : 30N to 100N for 63Amps.
40N to 100N for 100Amps.
60N to 100N for 200Amps.
- viii) Material : Glass Reinforced Polyester Dough Moulding Compounds

6.0 Principal Technical Parameters of Bases Used in Rewirable Type Electric Fuses:

The Bases Used in Rewirable Type Electric Fuses covered under this specification shall conform to specific parameters given below:

- i) Nominal Three Phase System Voltage : 433V
- ii) Frequency : 50 Hz with $\pm 3\%$ tolerance
- iii) Neutral Earthing : Solidly Effectively Earthed

- iv) Fault level (minimum) kA : 4kA --- for 3 sec.
- v) Rated Current : 32 Amps, 63 Amps, 100Amps and 200Amps.
- vi) Material : Glass Reinforced Polyester Dough Moulding Compounds

7.0 General Technical Requirements of Carriers and Bases Used in Rewirable Type Electric Fuses:

- 7.1 Fuse Carriers Used in Rewirable Type Electric Fuses – The removable portion of the fuse for carrying the fuse element, fitted with fuse contacts.
- 7.2 Rated Current (Assigned to a Fuse-Element) - A current used in the designation of a Fuse Base, Fuse Carrier, namely, the current, the Fuse, when fitted with Fuse-Element of the same rated current, can carry continuously without deterioration and without exceeding the temperature rise limits.
- 7.3 Fuse Bases Used in Rewirable Type Electric Fuses –The fixed part of the fuse provided with terminals for connection to the circuit and which is suitable for the reception of Fuse Carrier.
- 7.4 Rewirable Fuse – A fuse in which the fuse element consist of a wire which may be replaced when necessary.
- 7.5 Fuse Carriers and Bases Used in Rewirable Type Electric Fuses shall be of 'A' Type. In this the Fuse Carrier shall be introduced into the Fuse Base and drawn out, the Fuse Carrier shall then be turned by 180° around an axis perpendicular to the Fuse Base and its introduction and drawing out shall be repeated for 100 cycles.
- 7.6 Fuse Element: The part of a fuse which is designed to melt and thus open a circuit.

7.7 Material :

- i) The Fuse Carriers and Bases shall be made of non-tracking, heat resistant insulating material of Glass Reinforced Polyester Dough Moulding Compound (DMC) of D3 Grade as per IS:13411/1992. The Fuse Carriers and Bases shall be sturdy in construction. The design and dimensions of Fuse Carriers and Bases shall be in accordance with the drawing enclosed with this specification. i.e. MSEDCL's design.
- ii) The insulating compound shall conform to the requirements of B.S.1858/57or equivalent I.S.
- iii) The color of Carriers and Bases shall be as below:
 - 32 Amps Fuse Carriers and Bases: Sea Green, Shade No. 217.
 - 63 Amps Fuse Carriers and Bases: Light Brown, Shade No. 410.
 - 100 Amps Fuse Carriers and Bases: Dark admiral gray, Shade No. 632.
 - 200 Amps Fuse Carriers and Bases: Deep Indian Red, Shade No. 448.The color of Carriers and Bases shall be as per IS: 5, 2007.

iv) Tests for Glass Reinforced Polyester Dough Moulding Compound material as below:

Material Requirements for Dough Moulding Compound as per IS: 13411, 1992				
Sr. No.	Characteristics	Grade D ₃ , Requirement	Nature of Test	Method of Test, Ref. to
1.	Glass content, percent by mass, Minimum	20	Type	Annexure 'A'
2.	Mould shrinkage linear percent, Maximum	0.2	Acceptance	Annexure 'B'
3.	Flow, mm, Minimum	170	Acceptance	Annexure 'C'
Requirements for Dough Moulding Compound as per IS: 13411, 1992				
1.	Density of moulding, g/cm ³	1.6 to 2.0	Routine	IS: 8543(Part 1/ Sec 2), 1979
2.	Water absorption, percent, Maximum	0.2	Type	Annexure 'D'
3.	Izod Impact strength (Notched), KJ/m ² , Minimum	18	Type	Annexure 'E'
4.	Flexural strength, MPa, Minimum	70	Routine	Annexure 'F'
5.	Modulus of Elasticity, MPa	12 x 10 ⁵ to 15 x10 ⁵	Type	IS: 8543(Part 4/ Sec 1), 1984
6.	Surface Resistivity(24 h in water), ohm, Minimum	1 x 10 ¹²	Routine	IS: 3396, 1979
7.	Volume Resistivity, ohm-cm, Minimum	1 x 10 ¹⁵	Routine	IS: 3396, 1979
8.	Tracking Resistance, CTI, Minimum	1000	Type	IS: 2824, 1975
9.	Power arc resistance, Sec, Minimum	180	Type Acceptance	Annexure 'G'
10.	Dielectric strength at 90°C in oil kV/mm, Minimum	10	Type	IS: 6262, 1971
11.	Dissipation Factor(4 days at 80% RJI at 1kHz)	0.01	Type	IS: 4486, 1967
12.	Heat Distortion Temperature, °C, Minimum	135	Type	Annexure 'H'
13.	Oxygen Index, percent, Minimum	25	Type	IS: 13360(Part 6/ Sec 6), 1992
Optional Requirements for Moulded Dough Moulding Compounds				
1.	Continuous use temperature(long term), °C, Maximum	130	---	-----
2.	Resistance to chemicals	Agreed between Purchaser and supplier	---	Annexure 'J'
3.	Post shrinkage, percent, Maximum	0.01	---	Annexure 'B'
4.	Coefficient of linear thermal expansion, cm/cm/°C	20 x 10 ⁶	----	Annexure 'K'

7.8 Contacts:

i) Fuse Carrier Contacts: The contacts which are fitted to the fuse carrier, suitable for engaging with the contacts in the fuse base and capable of having a fuse element attached to it.

ii) Fuse Base Contacts: A conducting part secured to the fuse base and designed to engage with the fuse carrier contacts, if any, or otherwise directly with the fuse link contacts and connect to or entangled with fixed terminals.

iii) The contacts of the fuse base, fuse carrier, terminal blocks/strips shall be as under:

Sr. No.	Description	For 32 Amps, 63 Amps and 100 Amps	For 200 Amps
1.	Fuse Carrier Contacts	Tinned Brass	Electrolytic Copper
2.	Fuse Base Contacts	Tinned Brass	Electrolytic Copper
3.	Terminal Block / Strip	Tinned Brass	Electrolytic Copper

iv) The current carrying screws and washers shall be of tinned brass while the screw, washers not carrying current shall be M.S. Galvanized M.S. Electro Galvanized bolt and nut with one plain washer and one spring washer suitable for 25mm², 50mm², 150mm² & 185 mm² cable lugs shall be provided with extended strips for 32 Amps, 63 Amps, 100 Amps and 200 Amps fuse respectively.

v) Current carrying pointed screws and washers shall be of tinned brass, while the Screws / washers not carrying current shall be of MS Electro galvanized. Brass (tinned) used for contacts of Rewirable Type Electric Fuses' shall conform to IS as stated below:

It shall conform to grade DCB-I/DCB-II as per IS: 1264/1981 (amended up to date)/IS: 410 of 1977 (amended up to date). However, the metal composition as given below will be acceptable.

Sr. No.	Copper %		Tin, Lead, Nickel, Iron, Aluminum, Manganese and other Impurities put together %	Zinc %
	Minimum	Maximum	Maximum	
1.	58.00	63.00	8.60	Remaining

vi) Copper strips used for contacts of Fuse Carrier and Base should conform to IS: 1897/1983 with latest amendments. The material shall be of copper electrolytic tough pitch (ETP) grade with minimum 99.9% of copper and silver as per Table- I of IS:191, Part IV.

7.9 Protection:

The carrier and fuse base when installed in the intended manner shall have all live parts so protected as to prevent inadvertent contact with such live parts.

7.10 Handle or grip:

The fuse carrier shall be provided with a handle or grip and shall be shaped in acceptable manner so that it will be easy to withdraw the carrier without use of any tools and without danger to any Line Staff of MSEDCL.

7.11 Metal Parts:

All metal parts shall be protected against corrosion by suitable methods.

7.12 Fuse base:

- i) The fuse base shall be provided with two fixing holes for fixing the fuse base by means of screwier bolts.
- ii) The fuse base shall have contacts for suitably engaging with the contacts of the fuse carrier rigidly under any condition. The contacts shall be made out of such a metal which will not lose its electricity due to heating of the contacts on full load with 20% overload current or heat generated and required pressure is maintained even after repeated engagements and disengagement. The contact for rating 63 Amps and above will also have extended strips for fixing cable lugs by means of bolt
- iii) Live parts on the underside of the fuse base for surface mounting shall be either covered by a shield or barrier of insulating materials or be counter sunk not less than 3mm below the surface of the base and covered with water proof insulating sealing compound which will not deteriorate or flow at a temp. lower than 1000 C or on full load current with 20% overload or blowing of fuse under short circuit condition or shall have clearance of not less than 6.0 mm for 32A and 9mm for 63Amps, 100Amps and 200Amps size from the mounting surface and reliably prevented from loosening.
- iv) The asbestos cloth to be provided in fuse base shall be fire proof insulating and of sufficient length width and thickness.

7.13 Fuse carrier(top):

- i) The fuse carried shall have contacts suitable for engaging with fuse base contacts.
- ii) They shall be provided with suitable terminals for the connection of the fuse elements. The fuse carrier shall be so constructed that it is capable of being reversible for introduction into the fuse base. The contacts shall be made out of the metal which will not lose its elasticity on account of heating of the contacts on full load with 20% overload conditions or heating due to blowing of the fuse element due to short circuit and required pressure is maintained and even after repeated engagement and disengagement.
- iii) Live parts of the fuse carrier shall be covered either by a shield for barrier of insulating materials or be counter sunk not less than 3 mm below surface of the base and covered with water proof insulating sealing compound which will not deteriorated or flow at temperature lower than 100° C.
- iv) Spring for Base Phosphor Bronze Contacts (For 200 Amps Carriers and Bases Used in Rewirable Type Electric Fuses only):
This should be round/ elliptical made from high quality spring steel sufficient to maintain uniform pressure on the contact surface when fuse carrier is fitted. The spring shall be of sufficient width and having 1 mm thickness.

7.14 Screws:

- i) Screws upon which the general assembly of the fuse base and carriers' terminals and contacts depend shall be prevented from loosening or backing out buy lock, washers, stacking or other reliable means.
- ii) If screws used in the assembly of a fuse are loosened or removed in order to install the fuse elements or to connect the fuse into a circuit they should be thread into metal and shall be provided with washers.

7.15 Current carrying parts:

- i) Current carrying parts shall be of robust construction and capable of carrying their rated current without exceeding the temperature rise limits. The carrier and base shall be so designed and proportioned, that when they carrying their rated current continuously, the temperature rise of the carrier and base contacts does not exceed 55°C for rating 32 Amps to 100 Amps & 65°C for 200 Amps Rewirable Type Electric Fuse.
- ii) Iron and steel parts shall not be used for current carrying parts except as clamping device or pressure such as punching screws, clamps or wire binding screws, springs and nuts.

7.16 Tolerances to Dimensions of Rewirable Fuses:

- i) Dimensional tolerances shall be + 0.3mm + 0.01 x length
- ii) Dimensional Tolerance for all contacts/current carrying parts shall be:
 - a) Up to and including 20 = + 0.5
 - b) Above 20 = +1
 - c) For thickness = Negative tolerance is not permissible.

7.17 Extension Terminal strips:

The terminal connector strips of the Fuse Base Contacts shall be projecting out of the Fuse Base for minimum length of 65 mm on one side and 65 mm on other side. The cross section of the strips shall be 25 X 4 mm on outside of the Fuse Base Contacts and the length and cross section inside the Fuse Base Contacts shall be provided as per manufacturer design. The material shall be EC grade tined brass for 63 Amps and 100 Amps Rewirable Fuses. The material shall be Electrolytic Copper for 200 Amps Rewirable Fuse.

7.18 Terminal block:

The terminal block of Fuse Base Contacts shall be made from EC grade tined brass for 32 Amps Rewirable Fuses. The design shall be such that the current carrying capacity should be remain as per capacity of Rewirable Fuses.

7.19 Withdrawal Force:

The Withdrawal force of fuse carrier from fuse base shall be as below:

Sr. No.	Rated Current in Amps.	Withdrawal force in N
1.	32	15 to 55
2.	63	30 to 100
3.	100	40 to 160
4.	200	147 to 686 or as per Manufacture

8.0 Tests:

A) Type Test:

The Rewirable Fuses offered in the Bid should have been successfully type tested at NABL laboratories or Government laboratories for the tests indicated as follow in line with the IS: 2086, 1993 and technical specification. The type tests carried out in In-house(Owner/manufacturer) NABL accreditate laboratory are not accepted. These Type Tests should have been carried out within Ten years prior to the date of opening of tender. The bidder shall be required to submit complete set of the type test reports along with the offer. The purchaser reserves the right to demand repetition of some or all the Type Tests in presence of purchaser’s representative at purchaser’s cost

Type Tests :

a) Mechanical Test Sequence:

- 1) Visual Examination.
- 2) Test for Dimensions.
- 3) Test for Mechanical endurance.
- 4) Test for Mechanical Strength.
- 5) Test for Withdrawal Force.

b) Electrical Test Sequence:

- 1) Test for Temperature Rise.
- 2) Insulation Resistance Test.
- 3) High Voltage Test.
- 4) Test for Braking Capacity.

c) Test for Proving Material Properties:

- 1) Test for Water absorption.
- 2) Ignition Test.

B) Acceptance Tests :

All acceptance tests as stipulated in the IS: 2086, 1993 amended up-to-date for Rewirable Fuse shall be carried out by the supplier in the presence of purchaser's representative without any extra cost to the purchaser before dispatch.

The bidder shall have full facilities to carry out all the acceptance test as per the IS: 2086, 1993 amended up-to-date.

The Number of fuse carriers and fuse bases to be selected from the lot shall be in accordance with Appendix-B of IS: 2086/1993. However, the lot size shall constitute of all the fuse carriers and fuse bases of the same ratings.

The fuse carriers and fuse bases selected as above shall be subject to the acceptance test in following order.

Acceptance Tests:

- 1) Visual Examination.
- 2) Test for Dimensions.
- 3) Test for Mechanical endurance.
- 4) Test for Withdrawal Force.
- 5) Test for Temperature Rise.
- 6) Insulation Resistance Test.
- 7) High Voltage Test.
- 8) Test for Water absorption.

C) Routine Tests :

The routing test certificate duly signed by the testing engineers of the firm clearly stating that the following routine tests has been conducted by him on each fuse unit, shall be kept ready and submitted to the inspecting officer prior inspection of lot offered and testing of samples.

Routine Tests:

- 1) Visual examination
- 2) High voltage test.

9.0 Inspection:-

- i) The inspection may be carried out by the purchaser at any stage of manufacture. The successful bidder shall grant free access to the purchaser's representative at any reasonable time when the work is in progress. All facilities must be made available by supplier/ manufacturer for unrestricted inspection of the works, raw material & manufacture of all the accessories & for conducting necessary tests as declared therein.
- ii) The supplier shall keep the purchaser informed, in advance, of the time of starting and of the progress of manufacture of Rewirable Fuse in its various stages so that arrangement should be made for inspection.
- iii) No Rewirable Fuse shall be dispatched from its point of manufacture unless the Rewirable Fuse has been satisfactorily inspected and tested.
- iv) Inspection and acceptance of Rewirable Fuse under this specification by the purchaser shall not relieve the supplier of his obligation of furnishing Rewirable Fuse in accordance with the specification and shall not prevent subsequent rejection, if the Rewirable Fuse is found to be defective.

10.0 Verification of Glass Reinforced Polyester Dough Moulding Compound properties/composition and metallic composition of contacts:

MSEDCL reserves the right to draw the samples of Glass Reinforced Polyester Dough Moulding Compound / metallic parts of Rewirable Fuses for verification of their properties/ metallic composition at the time of manufacture from the lot offered for inspection. In addition to this, the sample will be drawn from the lots received by the consignees for verification of properties/metallic composition. In the event of metallic composition does not conform to our specification, the MSEDCL reserves the right to cancel the order at the risk and cost of the supplier.

11.0 Performance Guarantee:

Rewirable Fuse (top & base) supplied against this specification shall be guaranteed for a period of 24 months from the date of receipt at the consignee's Stores Center.

Documentation:-

A) List of Documents :-

The bidder shall furnish two sets of the following drawings along with his offer.

- a) Type Test reports in case the Rewirable Fuse has already been type tested.
 - b) Test reports, literature, pamphlets of the bought out items, and raw material
 - c) Bill of material and packing list.
- B) Adequate copies of Type Test, duly approved by the Chief Engineer (Testing & QC Cell), shall accompany the dispatched consignment.**
- C) The manual shall also contain a set of all the approved Type Test reports etc.**
- D) Approval of Type Test reports by purchaser shall not relieve the supplier of his responsibility and liability for ensuring correctness and correct interpretation of the Type Test reports for meeting the requirement of the Technical Specification, latest revision of applicable standards. The Rewirable Fuse shall conform in all respects to high standards of engineering, workmanship and latest revisions of relevant standards at the time of ordering and purchaser shall have the power to reject any work or materials which, in his judgment, is not in full accordance therewith.**

12.0 Packing:

The Rewirable Fuse shall be supplied packed in suitable manner in good quality thermo plastic container to avoid damage in ordinary handling and transit or loosening of components. The marking stamp shall be a fixed on each box containing the Rewirable Fuses.

13.0 Marking:

Every Fuse Carrier shall be clearly and indelibly marked with the following information:

- a) Rated current.
- b) Rated Voltage.
- c) Size of Fuse wire.
- d) Manufacturer's name or trade mark.
- e) The words 'MSEDCL'

Every Fuse Base shall be clearly and indelibly marked with the words 'MSEDCL'.

14.0 Guaranteed Technical Particulars :

The bidder should fill up the details in schedule A - 'Guaranteed Technical Particulars' and the statement such as "as per drawing enclosed", "as per MSEDCL requirement", "as per IS", "as per specification" etc. shall be considered as details not furnished and such offers will be rejected.

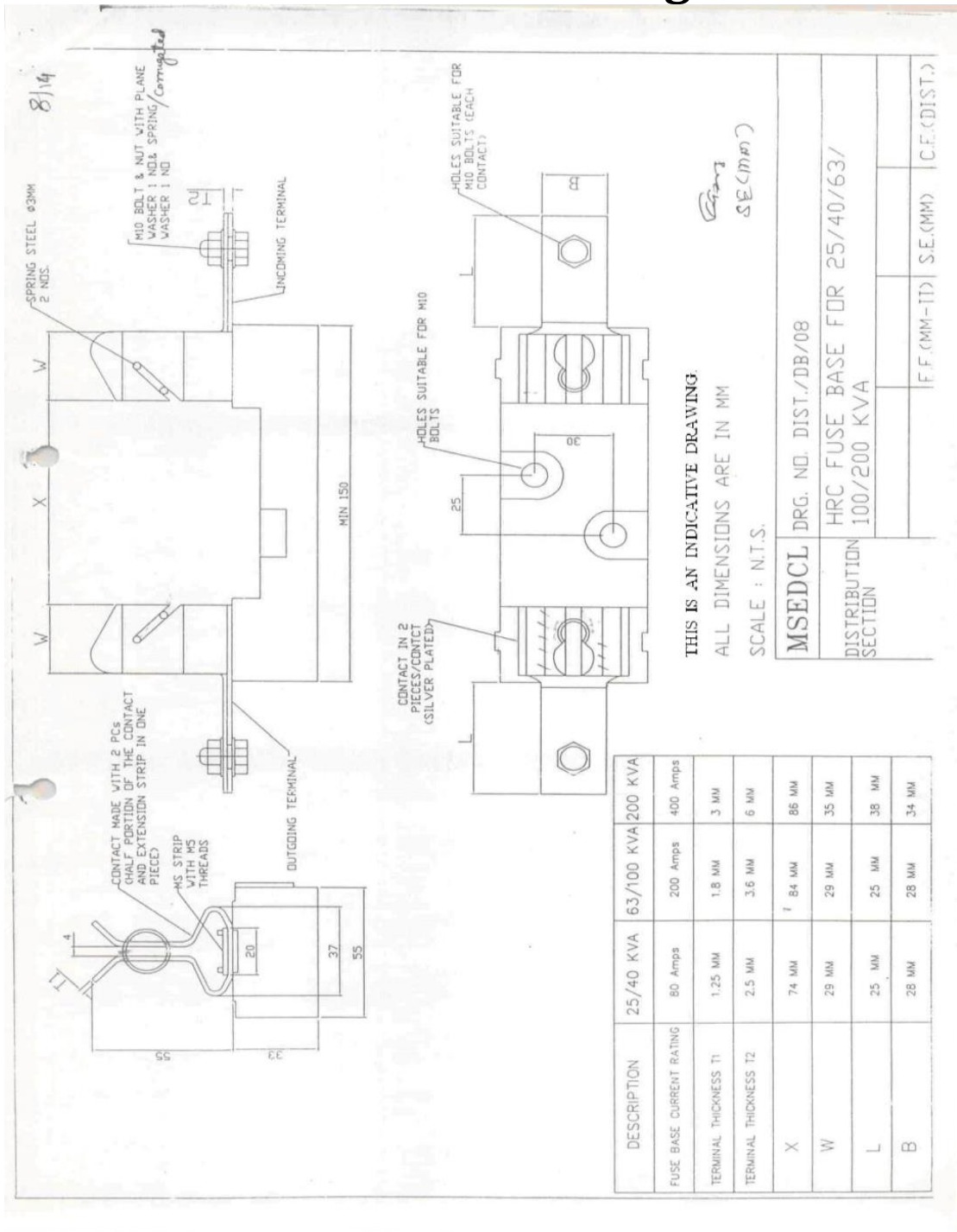
15.0 Schedules :

The bidder shall fill in the following Schedule which forms part of the Tender Specification and offer. If the schedules are not submitted duly filled in with the offer, the offer shall be liable for rejection.

Schedule - 'A ' - Guaranteed Technical Particulars of Rewirable Fuses.

The Bidder shall submit the list of orders for supply of Rewirable Fuses executed or under execution during last three years, with full details, in the schedule of Bidders experience (Schedule 'D') to enable the purchaser to evaluate the tender.

Indicative Drawing



Schedule 'A'

Guaranteed Technical Particulars of Rewirable Type Electric Fuses Up to 650 Volts

Sr. No.	Particular of GTP Parameter	Type
1.	Manufacturer's Name & address	TEXT
2.	Manufacturer's Type Designation	TEXT
3.	Rated voltage	TEXT
4.	Rated current	TEXT
5.	Embossing every fuse carrier shall be clearly & indelibly embossed with the following: Rated current	TEXT
	a) Rated current	TEXT
	b) Rated Voltage	TEXT
	c) Size of Fuse wire	TEXT
	d) Manufacturer's name or trade mark	TEXT
	e) The words 'MSEDCL'	TEXT
6.	Every Fuse Base shall be clearly and indelibly marked the following: The words 'MSEDCL'	TEXT
		TEXT
7.	Size of Fuse Carrier, L x B x H	TEXT
8.	Size of Fuse Base, L x B x H	TEXT
9.	Metal used for current carrying part	TEXT
10.	Current density	TEXT
11.	Material used for manufacturing of Carrier and base	TEXT