

GOVERNMENT OF INDIA  
MINISTRY OF RAILWAYS

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TECHNICAL SPECIFICATION OF HEAT SHRINK TUBINGS  
FOR USE ON POWER CABLES  
OF  
DIESEL ELECTRIC LOCOMOTIVES

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MOTIVE POWER  
RESEARCH DESIGNS & STANDARDS ORGANISATION  
MANAK NAGAR, LUCKNOW - 226011.

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TECHNICAL SPECIFICATION OF HEAT SHRINK TUBINGS  
FOR USE ON POWER CABLES OF  
DIESEL ELECTRIC LOCOMOTIVES  
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1.0 SCOPE

This specification covers the technical requirements for Heat Shrinkable Tubings for use on crimped cable terminals and crimped cable joints on power cables of diesel electric locomotives for protection against climatic conditions and oil ingress.

2.0 SERVICE CONDITIONS & USE

2.1 The tubings shall be suitable enough to be used satisfactorily in the following climatic conditions :-

- (a) Ambient temperature ----- 55 deg.C
- (b) Humidity ----- 100% max.

2.2 The manufacturers should take due account of the following factors while designing the tubing :-

- (a) The locomotive shall be required to operate in heavy rain, dusty storms etc.
- (b) The equipment compartment of the locomotive can have oil and oil fumes.

2.3 The sleeves shall be cut into pieces depending on the cable size / joint size and intended use etc. and slipped loose over the cable ends which has already been provided with crimped socket. The sleeve will be then heated and on account of heat application, the sleeve should shrink tight and fit snugly on cable and socket or complete crimped joint if so required.

3.0 REQUIREMENTS

3.1 Colour : The tubing can be of a colour specified by the purchaser which shall not change after heating and shrinking the tubings.

In case it is specially provided that the tubing shall be used for protection of cable identification number fixed on each end of the cable, only transparent and clear tubings shall be supplied which shall remain transparent and clear after shrinkage by heating.

- 3.2 The tubing shall be anti corrosive and resistant to oil.
- 3.3 The shrinking of the tube should be at least 50% of the supplied dia.
- 3.4 The shrink temperature of the tubing should be such that the shrinking may be done in diesel locomotive sheds using a kerosene blow torch and a hot air gun is not required.
- 3.5 The change in length after shrinking shall not exceed 6% of the original.
- 3.6 Values of physical properties and test methods for tensile strength, elongation at break, density, moisture absorption and volume resistivity shall be declared by the manufacturer.
- 3.7 The tubing shall be flame retardant and shall have a dielectric strength comparable with the cable elastomer.

#### 4.0 DIMENSIONS

The outer dimensions of the cables on which the cut pieces of the heat shrinkable tubings would be slipped over and subsequently made shrunk-fit by heating are identified as under :-

SL.NO.	STRANDS/DIA. OF CABLE (MM)	VOLTAGE GRADE (V)	OUTSIDE DIA.OF THE CABLE (MM)
1	225/.50	1000	17.40
2	650/.50	1000 / 1500	26.14 / 26.79
3	1325/.50	1000 / 1500	34.34 / 35.05
4	1525/.50	1500	38.00
5	1925/.50	1000 / 1500	39.60 / 40.13

The tenderer shall indicate the following regarding the heat shrinkable tubes offered for the above type of cables.

- i) Type
- ii) Free inside dia. in mm. before heating. 'D'

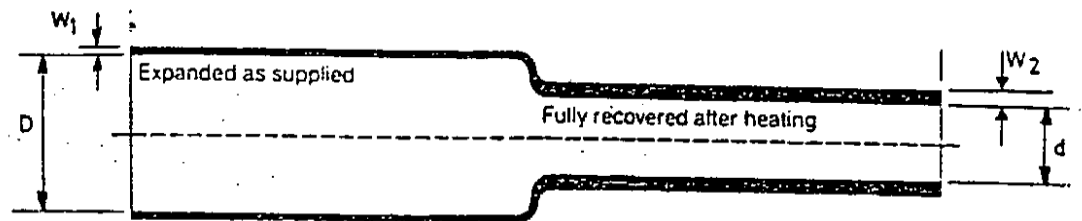
iii) Thickness in mm.

(a) before heating 'W1'

(b) after heating 'W2'

iv) Inside dia. after heating. 'd'

The tenderer shall indicate the dimensions in the following sketch for each type of heat shrinkable tubings offered by them.



## 5.0 PRODUCT APPROVAL & TESTS

5.1 Type approval of a product which has not found widely successful use on traction application on Indian Railways shall be carried out.

5.2 Dimensional check shall be carried out as under :-

For this test specimen shall be prepared from tubing 200 mm long initially in expanded condition.

The wall thickness of each specimen shall be measured by micrometer. The measurements shall be made at six approximately equally spaced points around the periphery of the specimen, and care shall be taken to ensure that the maximum and minimum thickness is measured. The smallest measurements expressed as a ratio of the largest measurement shall be recorded for the wall thickness ratio, which shall not be less than 95%.

Specimens shall be measured for length to within a tolerance of  $\pm 2$  mm.

The internal diameter of both ends of each specimen shall be measured using a graduated tapered mandrel and the results recorded. These shall not vary by more than  $\pm 2\%$  over the declared value.

The specimen shall then be fully recovered and cooled. The recovered length of each specimen shall be measured and the longitudinal change during recovery shall be expressed as a percentage of the original length. The inside diameter of both ends of the specimen shall again be measured and the results recorded.

The results shall be examined for compliance with the clause 3.5 of this specification. Further the inside diameter after recovery shall not vary by  $\pm 2\%$  over the declared value.

5.3 Physical properties given in the clause 3.2 and 3.6 shall be tested by an accepted test method agreed to between the purchaser and the manufacturer.

#### 5.4 Flame Retardance Test

Three specimens, each 600 mm  $\pm 25$  mm long, shall be recovered on to a similar length steel mandrel. The mandrel shall be solid and have a diameter equal to the nominal fully recovered diameter of the specimens under test.

The flame shall be applied for 60 s. The specimens shall be deemed to have passed the test if, after removal of the burner, the flame extinguishes within 60 s and, when the sample has been wiped clean, the charred or effected portion does not exceed 250 mm.

#### 5.5 Dielectric Test

20 KV for one minute across one mm thick wall of tubing. The tubing shall show no signs of crack, damage or deformation after the test.

5.6 Product approval shall be done only after extensive field trials in diesel locomotive sheds. Successful performance of Heat Shrinkable Tubings on lead cable of traction motors of at least six locomotives shall be monitored for the purpose.

5.7 Following shall constitute acceptance tests :-

- (a) Visual and dimensional check
- (b) Verification of declared physical properties

#### 6. STORAGE

The heat shrinkable tubings should have at least two year shelf life when stored at 40 deg.C.