

IRS : TC - 30/05

QS/STR/JF QUAD CABLE/

Page 1 of 8	Effective from Nov. 2003	STR for J.F. QUAD CABLE	Version 0
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GOVERNMENT OF INDIA

Ministry of Railways

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मनक नगर, लखनऊ, २२६०११

Quality Assurance (Q & T)

क.म.म.सं. सानक नगर, लखनऊ

R.D.S.O., Manak Nagar, Lko, 11

FOR

(Underground Railway Jelly Filled Quad Cables for special purposes in RE areas)

Research Designs & Standards Organisation

Manak Nagar Lucknow-226011

(*) Approved by PED/SBT at Note # 147 of e-file computer No. - 38091

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S. K. AGRAWAL

Asstt. Design Engg. (Telecom)

R.D.S.O. (Ministry of Railways)

LUCKNOW.

UNDERGROUND RAILWAY JELLY FILLED QUAD CABLES FOR SPECIAL PURPOSES IN RE AREAS (TC 30-~~97~~05

I. ESSENTIAL MACHINERY & PLANTS REQUIRED FOR PRODUCTION

I. Insulation/extrusion line for production of high quality telecommunication core with solid polythene insulation provided with:

- 1.1 Conductor pre heater
- 1.2 Polythene Drying Unit with air blast.
- 1.3 On line dia Controller preferably XY axis to ensure uniform thickness of insulation, eccentricity in the core & dia over insulated conductor & on line Spark Tester (0 -15 Kv AC) with numeric fault counter to monitor the number of spark over faults occurring during continuous extrusion of cores.
- 1.4 High Precision Temp. Controller Digital Display for Controlling each zone of extruder.
- 1.5 Cooling trough of the length of 25 feet (minimum), made up of stainless steel material or any other suitable material to avoid rusting. Rusting may affect the quality of polythene insulation resulting contamination of foreign particles over the surface of insulation.
- 1.6 D.C. Drive take up, with proper tension arrangements .
- 2 Quadding machine to make star quad of polythene insulated copper conductor with built in high frequency auto break off system, pay off, tension arrangements by hydraulic/pneumatic system.
- 3 Quad laying machine with on line tapping head straightner and autitwist arrangements with D.C. Drive control.
- 4 Heavy duty Jelly Filling Machine with provision of Automatic pressure & temperature controller facility preferably digital display .
- 5 Polyester taping head for core wrap application having uniform clutch tension system with D.C. motor or drive.
- 6 Inner polythene sheathing extruder of minimum size 65 mm or higher with simultaneous tapping of poly-Al tape and provision of :
- 61 Peak Inverse Digital (P.I.D.) controlled heating panel with digital display to be hauled by pneumatic/hydraulic controlled cater pillar or double capstan
- 62 D.C. drive control .
- 63 Jelly flooding unit along with uniform sizes of die and provision to display the Jelly pressure and temperature and suitable device for uniform coating of Jelly and system to wipe out excess jelly entering into the poly - Al patch unit.

6.4 Poly-Al patch unit (Glue - Applicator) make NORDSON , USA or similar make with heavy duty in built heating system and digital temperature controller to monitor the temperature of melted Glue and device for horizontal & vertical movement of its tip nozzle in order to ensure pressurised flow (maintained by adequate capacity compressor) of Glue for precise and accurate sealing of Poly - Al tape.

6.5 Tape folding unit having smooth running rollers with die holders for tape folding and uniform tension pay off system.

6.6 On line spark tester (0-15 Kv AC) with numeric fault counter.

6.7 Cooling trough of length of 25 feet (minimum) and made up of stainless steel body or any other suitable material to avoid rusting.

6.8 Take up tension arrangements with hydraulic or pneumatically control caterpillar system.

7 Aluminium screening machine with minimum 32 bobbins with pay off & take up tension arrangement.

8 PVC extruder of size 65 mm or higher with D.C. motor traction control and PID controlled heating panel to be hauled by pneumatic or hydraulic controlled caterpillar with provision of :-

- Automatic digital temp controller.
- Cooling trough of minimum 25 feet in length of stainless steel material-or any other suitable material to avoid rusting.
- Drier unit with air blast.
- Conductor Pre heater unit with controlled heating panels
- Mixer
- On line spark tester for detecting small pinholes, blow holes etc over intermediate & outer PVC during inprocess extrusion stage.
- Pay off & take up tension arrangements with hydraulic or pneumatic system.

9 Rewinding machine with facility for controlling the speed with D.C. drive, length counter meter, pay off and take up suitable for 2.5 meter steel drums & on line spark testing arrangement.

10 Embossing or indenting cum printing and sequential length marking machine with 0.2% accuracy and automatic tape feeding arrangement.

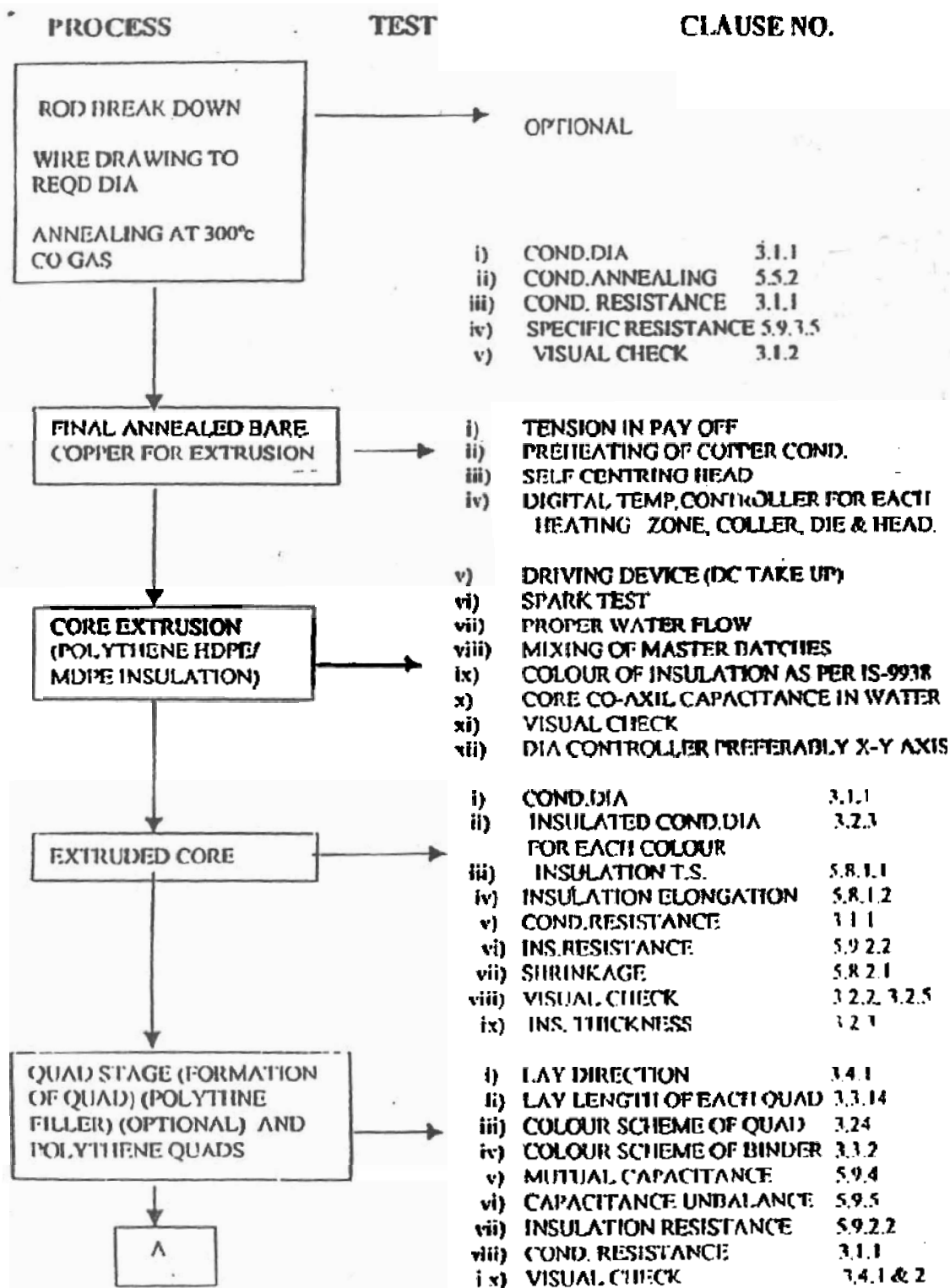
- 11 Steel tape armouring machine with D.C. drive for uniform gap/overlap.
- 12 Butt welding machine for making joints in steel tape.
- 13 Lathe, drilling, grinding and welding machines required for misc. activities in connection with maintenance of M&P.
- 15 D.G. set (heavy duty) 100 KVA minimum

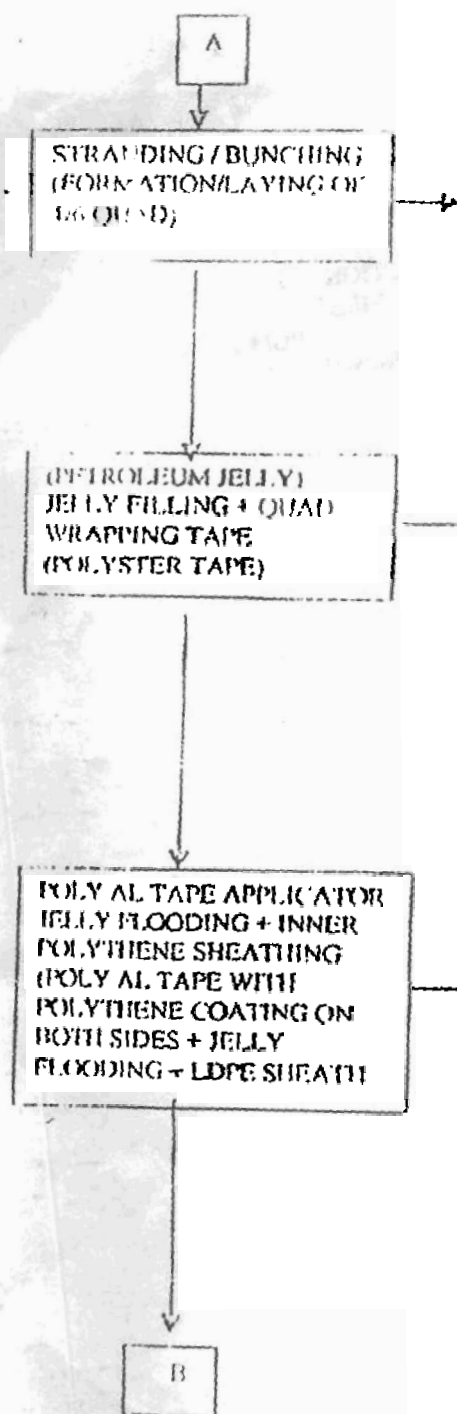
II. ESSENTIAL TESTING EQUIPMENTS REQUIRED FOR QUALITY ASSURANCE

- 2.1.1 Tensile testing machines with ranges as given below, (each with 3 sub ranges) to test copper wire, rods, steel tapes, laminates & Al wires etc:-
 - i) Tensile testing machine 0 to 200 N
 - ii) Tensile testing machine 0 to 500 N
 - iii) Tensile testing machine 0 to 10000 N
- 2.1.2 Vernier calipers, least count 0.001mm with digital display.
- 2.1.3 Micrometer - least count 0.001mm with digital display.
- 2.1.4 Apparatus for determining melt flow index (extrusion plasto meter with digital temp indication, thermostatic control, accuracy 0.1°C.
- 2.1.5 Analytical monopan balance to weigh to an accuracy of 0.1 mg.
- 2.1.6 Apparatus for environmental stress cracking test to ASTM-1693 (Blanking die, Jig, specimen, holders, test tubes, corks, aluminium foil, test tube rack, bending clamps and transfer tools constant temperature, bath range 0 to 100 deg.C with thermostatic controlled heating system, inbuilt digital temperature metre, hour metre and sealing arrangement.
- 2.1.7 Facilities for Dip Test for galvanisation
- 2.1.8 Two nos. of Air circulating ovens with controls to maintain the the setting within $\pm 2^{\circ}\text{C}$. Temp. range 0 to 200 °C. with PID control digital display. Hour meter with sealing arrangement to monitor tests timings.
- 2.1.9 Environmental / cold chamber (Minimum).
- 2.1.10 Apparatus for stability test of filling compound (water bath range, 0 - 100°C with inbuilt digital temp.controller & digital display for monitoring temperature, hour meter for recording test duration. Sealing arrangement may also be made for sealing.
- 2.1.11 Sharp point digital micrometers – least count 0.001mm
- 2.1.12 Set up for water penetration test (separate room required for conducting the tests).
- 2.1.13 Set up for reduction factor test as per VDE spec.

- 2.1.14 Double kelvin's bridge.
- 2.1.15 Test set up for resistance to compression test.
- 2.1.16 Multi meter Analog/Digital
- 2.1.17 Calibration Box for CR, IR and Capacitance etc.
- 2.1.18 Stamping die (for cutting dumbbell and other type of samples)
- 2.1.19 Digital/Analog Thermometer (duly calibrated)
- 2.1.20 Digital/Analog Stop watch
- 2.1.21 Travelling Microscope /Projector for checking eccentricity / circularity of core.
- 2.1.22 Ageing oven range 0 to 200 deg. C. with Digital temperature controller & pressure monitoring facility. Hour meter (with sealing arrangement).
- 2.1.23 Thermal stability test apparatus range 0 to 250°C
- 2.1.24 Flammability test set up.
- 2.1.25 Cold impact test apparatus (cold chamber as mentioned in cold bend test)
- 2.1.26 Bleeding and blooming test apparatus with PVC indicator tape and requisite size of filter paper.
- 2.1.27 Hot deformation test apparatus.
- 2.1.28 Heat shock test apparatus
- 2.1.29 Winding test for testing of steel-tapes.
- 2.2 Automatic/semi automatic/manual test set up for the following tests:
- 2.2.13 D.C. High voltage tester 0-5 KV (5 amps capacity)
- 2.2.14 AC High voltage tester 0-10 KV (30 amps capacity)
- 2.2.15 Digital million Meg ohm meter range 1 Megohm to 10E9 Megohm in six ranges, DC test voltage, 100 Volt to 500 Volt $\pm 2\%$ with one minute timer.
- 2.2.16 Digital capacitance meter range 0.01 mfd to 1000 mfd in three ranges $\pm 1\%$ of the reading.
- 2.2.17 Resistance unbalance & conductor resistance meter with digital display.
- 2.2.18 Capacitance unbalance meter for measurement of capacitance pair to pair & pair to ground with adequate range & digital display.
- 2.2.19 Characteristic impedance test set up (0-20 K Ohm) in three ranges, test frequency 800 Hz & 5 KHz
- 2.2.20 Cross talk & attenuation meter suitable to measure (-30dB to 70 dB) 0 to 600 ohms balanced output and 75 ohms unbalanced output (with suitable frequency generator starting from DC to 600 KHz.)
- 2.2.10 Test equipment/test meters/test bridges to check calibration of manual meters.
- 2.3 Carbon black content test set up for black LDPE sheath
- 2.4 Carbon black dispersion test set up for black LDPE sheath
- 2.5 Transmission measuring set to measure (in mv & dB) with digital display attenuation of cable between 300 -- 3400 Hz at 470, 600 & 1120 ohm impedance.

QUALITY ASSURANCE FLOW-CHART (4/6 QUAD JELLY FILLED ARMoured CABLE) (IRS:TC30-97)





- i) LAY DIRECTION 3.4.1
- ii) LAY LENGTH 3.3.1
- iii) COLOUR SCHEME EACH QUAD 3.2.4
- iv) MUTUAL CAPACITANCE 5.9.4
- v) CAPACITANCE UNBALANCE 5.9.5
- vi) INSULATION RESISTANCE 5.9.2.2
- vii) COND. RESISTANCE 3.1.1
- viii) H.V. TEST 5.9.1
- ix) CENTER LAYER FILLER 43.4.1
- x) VISUAL CHECK 1.4.2

- i) JELLY PRESSURE
- ii) JELLY TEMPERATURE
- iii) POLYESTER TAPE OVERLAP 3.5.2
- iv) INSULATION RESISTANCE 3.9.2
- v) COND. RESISTANCE 3.1.1
- vi) H.V. TEST 5.9.1
- vii) MUTUAL CAPACITANCE 5.9.4
- viii) CAPACITANCE UNBALANCE 5.9.5
- ix) RESISTANCE UNBALANCE 5.9.3.4
- x) VISUAL CHECK

- i) POLY AL THICKNESS & POLYTHENE COATING 3.5.
- ii) POLY AL OVERLAP 3.5.3.1
- iii) INNER SHEATH THICKNESS 3.5.4.2
- iv) DIA OVER INNER SHEATH
- v) INNER SHEATH CENTRE (ELECTRICITY)
- vi) SURFACE FINISH 3.5.4.2
- vii) SPARK TEST
- viii) H.V. TEST 5.9.1
- ix) INSULATION RESISTANCE 5.9.2
- x) COND. RESISTANCE 3.1.1
- xi) CROSS TALK & ATTENUATION 5.9.7, 5.9.8
- xii) IMPEDANCE & MUTUAL CAPACITANCE 5.9.4.2, 5.9.6
- xiii) CAPACITANCE UNBALANCE PAIR TO PAIR & TO EARTH

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