~~DRAFT~~ SPECIFICATION
OF
JOINT ENCLOSURE FOR
ARMOURED OPTICAL FIBRE CABLE

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1.0 SUMMARY:

This document covers the general & technical requirements of joint enclosure suitable for armoured optical cable used in Indian Railway network. It provides mechanical protection and environmental sealing to the spliced fibres and the spliced cables. It shall be possible to branch out the cable from the joint enclosure as and when required without damaging the existing cables.

2.0 SOURCE:

2.1 Draft specification RDSO/SPN/TC/68/2007 was prepared by RDSO, Lucknow on basis of Generic Requirements No. G/OJC-02/01, March 1999 issued by Telecommunication Engineering Centre of Department of Telecommunication suitable for Indian Railway.

2.2 Revision to this specification is being issued due to changes is the product and TEC having issued its latest specification no. TEC/GR/TX/OJC-002/03/APR-2010.

2.3 ~~37th TCSC recommended to issue revision of specification of Optical joint enclosure approved by Railway Board vide letter no. 2011/Tele/9(1)/1 dated 10.01.2013.~~

2.4 Revision 2.0 to this specification is being issued as per Railway Board Letter No. 2020/Tele/9(2)/1 dated 04.01.2025 for specification of 48 OFC Jointing enclosure.

3.0 FOREWORD:

3.1 ~~RDSO/ SPN specification is issued as draft specification.~~ This specification is circulated to customers/ Railways and field inspection units for comments.

3.2 In the absence of IRS specification, procurement may be made as per RDSO/ SPN specification.

3.3 In preparing this specification, assistance has been derived from IS Specification No. IS 9606 – 1900.

4.0 GENERAL REQUIREMETS:

4.1 The joint enclosure shall be manufactured as per the latest state of art technology and shall be manufactured in accordance with the International Quality Standards ISO 9000 series of standards for which manufacturer shall be duly accredited.

4.2 The joint enclosure shall be compact and composite in construction. The mechanical design and construction of the joint enclosure shall be inherently robust and rigid under all conditions of operation, replacement, storage and transport etc.

4.3 The design of the joint enclosure must ensure.

4.3.1 Mechanical and Optical protection of the splice.

4.3.2 Environmental protection of the splice.

4.3.3 The possibility of the repeated, reopening and re-closing of the end cap and outer jacket for access of fibre organizer shall be possible without removing or modifying the entire structure but only by replacing the sealing material.

4.3.4 The addition of a new cable shall be possible without replacing the complete closure.

4.4 The materials used for manufacturing the components parts of the closure should not be noxious for the installation and maintenance personnel and shall not cause any environmental pollution.

5.0 OPERATIONAL REQUIREMETS:

5.1 Fibre optic joint enclosures shall enable:

a). Direct junctions (straight joints)

b). Branching junctions (Branch joints)

5.2 The closures must be suitable for the same installation conditions as those used for the installation of the following types of cables:

a) Underground, inside manholes, tunnels and galleries.

b) On bridges.

c) Directly buried in all type of soils.

5.3 The closures should be suitable for all types of cable structures for splicing the armoured optical fibre cables.

5.4 Optical fibre joint enclosure shall be compatible with the type of optical fibre cable being used on Indian Railways. Optical fibre cable used on Indian Railways is as per RDSO Specification no. ~~IRS/TC : 55-2006, Rev.1 with Amendment 1.1 and Amendment 2~~ ~~and~~ RDSO/ SPN/TC/110/2020 Rev.0.0

5.5 The joint enclosure shall hold mechanically all constituent parts of the cables (sheath, central part, peripheral reinforcements, etc.).

5.6 The joint enclosures shall be suitable for splicing of optical fibre cables with single mode fibres as per ITU Rec. G 652 D (03/03 or latest) for transmission at wavelengths of 1310 nm, 1490 nm, 1550 nm,1625 nm ~~and between 1285 to 1330 nm~~

5.7 The joint enclosures shall contain fibre organizer system where the extra length of fibres and splices are stored in systematic & secured manner. The method or device for safely routing and securing buffer tube and bare fibre shall be provided.

5.8 The joint enclosures shall allow an easy opening and re-closing without degradation in the performance of joint enclosure. Access to the inner junctions shall be possible without damaging the existing cables. The closure must be designed such that no installed cable is disturbed or require re-sealing of the existing cables during installation of additional cables.

5.9 It shall be possible to carry out the installation without inflicting any damage on the fibres or the fibre splices.

5.10 The increase in attenuation for each of the fibre splices in the installed joint enclosure as a result of operational strain shall not exceed 0.05 dB, measured at 1310 nm, 1490 nm, 1550 nm,1625 nm and between 1285 to ~~1330~~ 1380 nm and between 1285 to ~~1330~~ 1380 nm, 1390 to 1525 and between 1525 to 1625nm

5.11 The installed joint enclosure shall be resistant to mechanical stress, vibration, and impact that may result from normal operation and handling, or from external sources. The cable terminations shall withstand tensile stress, pressure, bending and twisting that may result from normal operation and handling, without any leaks arising or other damage being caused to the installed joint enclosure.

5.12 The minimum bending diameter of the fibres outside the splice trays in the splice closure shall be at least 100 mm.

5.13 The materials used for manufacturing the components / parts of the joint enclosure shall be compatible with those used for manufacturing the cables in all respect and shall not effect the performance of the optical fibre cables and fibres.

5.14 Special tools, if required to open and close the joint enclosures should be provided and kitted in each box so that installer need not to carry his personal or additional tools.

6.0 JOINT ENCLOSURE REQUIREMENTS:

6.1 General Description:

6.1.1 The splice closure shall have a base and domed shaped body. The dome shall be fixed on the base. The dome shaped body shall cover the entire junction while the base shall enable the entries of the optical fibre cables.

6.1.2 The base and dome shall be made of High Density Polyethylene./Polypropylene/ Polypropylene with 30% Glass Fibre. The material used shall have minimum hardness of Rockwell R87 or equivalent. The material shall be termite proof (The standard test on the material for termite proof-ness shall be conducted). The base and dome shall be impact resistant. The body shall be smooth with no burrs or sharp edges. Ribs on the body of Splice closure shall be provided.

6.1.3 The splice closure shall be kitted with a full set of parts and materials and any associated tools or apparatus to fully prepare and seal the closure up to the maximum amount of cables and trays unless otherwise specified. All materials and required tools directly related to the installation of the closure shall be kitted along with the closure for each closure.

6.2 Dimensions:

6.2.1 The external dimensions of the joint enclosure i.e. of the main body (base & dome), excluding cable entry ports shall be as below:

a) Length : 400 mm (Minimum)
b) Internal Diameter : 220 mm (Maximum)

6.3 Cable Entry and Sealing Arrangements:

6.3.1 The base shall have a minimum 4 single cable entry ports and one port for express (looped) cable entry. The arrangement shall be provided for terminating looped or express cable by making a suitable necessary provision. All ports shall be sealed and entry ports (sealed) shall be opened as per the requirement. The opening of any port shall not cause any interference to any existing cable. No heat shrink of any type shall be allowed on the cable for sealing. The sealing material shall be termite proof. No consumable items shall

be required for sealing. The sealing components must be reusable and shall have unlimited shelf life. The sealing arrangements shall be specified along with opening and closing arrangement by the manufacturer and the same shall be tested.

6.3.2 It shall be possible to terminate all cables having outer diameter of 20 mm (Max.) and the arrangement shall be provided for terminating looped or express cable by making a suitable necessary provision. Alternatively, it shall be possible to install a mid accessed cable without routing a cable tubes through a window or other closure end plate hole.

6.3.3 All cable entry ports shall be independent to each other. All access and port sealing shall be accomplished by mechanical methods. No heat shrink of any type shall be allowed. In the event of growth or any other type of activity by the installer, it shall be able to access the cables and the existing trays with spliced fibres and separate the trays and the cable without disturbing any active fibre.

6.4 Strength Member & Cable Termination and Earthing Arrangement:

6.4.1 It shall be possible to fix the strength member(s) and the optical fibre cable firmly to the splice closure so that the strength member will not shift laterally or move inside the closure. Separate arrangements shall be made to fix strength member (FRP) and cable.The metallic component shall be of either stainless steel or electric grade aluminium.

6.4.2 The closure shall have metallic internal structure in order to support and hold the cable and strength members etc. The metallic components shall be either stainless steel or electric grade Aluminium and corrosion free.

6.4.3 A grounding device and mounting accessories shall be provided for grounding the joint enclosure.

6.4.4 Mechanical internal structure shall make metallic continuity of all the metallic parts of the cables and same shall be extend outside the body of the closure to ensure earthing.

6.4.5 For fixing cassettes, clamps should be continuous extension of metallic portion used for fixing the cable. The metallic strip shall be stainless steel or electric grade Aluminum running throughout the length of dome up to the end.

6.4.6 The mechanical structure for FRP and cable fixing has to be through proper metallic plate.

6.5 Sealing arrangement:

6.5.1 Sealing arrangement of base and dome:

6.5.1.1 The splice closure's base and dome shall be sealed by Mechanical sealing method using circular clamp.

6.5.1.2 The manufacturer shall indicate clearly the method mechanical sealing. The "O" ring (circular in cross section) required for sealing shall be made of Neoprene/Silicon/EPDM rubber. The clamps for sealing the base to dome shall be made of corrosion proof material (for example: Stainless steel or Thermoplastic). The clamp shall be circular in shape. A proper clamping system shall be provided which shall include the facility of lock. Screws or bolts & nuts of any type (used in sealing of the closure) shall not be acceptable. The sealing material shall be termite proof.

6.5.1.3 The clamp of the fibre optic closure shall be equipped with a locking device to prevent un-authorized entry.

6.6 Cable sealing system:

6.6.1 The closure shall provide cable sealing system that uses a mechanical type seal and that does not allow for any kind of heat shrinkable substance.

6.7 Splice Tray (Fibre Organiser):

6.7.1 Splice Trays shall be non-metallic made of ABS material.

6.7.2 A system of cassettes or trays shall be provided on which the junctions and the extra length of fibres after splicing will be placed (fibre organization). At both ends of the cassettes, an arc type guide should be provided to hold the fibre having a diameter not less than 100 mm. Proper arrows should be provided on the cassettes for guiding the fibres.

6.7.3 The splice trays (cassettes) system shall be built in such a way as to offer the facilities of its movement about a hinge and it shall offer easy access to each tray such that working with fibres and splices in any one of tray shall not disturb the fibres on the other trays. This shall ensure to splice all fibres of the cables in predetermined order.

Size of the Splice Tray (Cassette):

Depth	:	5 mm (minimum)
Length	:	200 mm (minimum)
Width	:	90 mm (minimum)
Thickness	:	1.5 mm (minimum)

6.7.4 It shall provide storage space of slack fibres (800 mm minimum length) from the cables for realignment and rejoining.

6.7.5 Splice trays shall be so designed that they shall not harm the fibres from sharp edges etc.

6.7.6 The minimum bending diameter allowed for the fibre coils inside the splice trays shall be at least 75 mm.

6.7.7 Arrangement to hold 12 spliced protection sleeves in the splice tray shall be provided. Splice protection sleeves (heat shrink type, up to 61±1 mm in length and up to 3 mm in diameter) shall be used for the protection of the splice.

6.7.8 Slots of the splice tray shall be able to fix the splice protection sleeves in such a way that they will not shift or move inside the splice tray or come into conflict with the fibre coils once fixed in a slot of the tray. The slots shall not cause any stress or strain neither on splice protection sleeve nor on the optical fibres.

6.7.9 The fastening arrangement for entry of the fibres into the splice tray shall be suited to primary and secondary coated fibres in tubes, without there being any risk of bending loss or damage to the fibres.

6.7.10 It shall be possible to lead fibres from one tray to another tray inside the joint enclosure to allow flexibility for branch joints and in the splicing of different cable constructions to each other.

6.7.11 It shall be possible to take any individual fibre out of the splice tray for repair during normal operation without damaging the remaining fibres.

6.7.12 Splice trays shall be fixed inside the joint enclosure in such a way that this shall not loosen once fixed or to shift or move in any way, due to vibration and or movement of the closure.

6.7.13 Each tray should have the capacity to store at least 12 primary / secondary coated fibres.

6.7.14 Cassette-cover shall be provided on top of splice trays which shall be made of either transparent perspex sheet or of same material as used in tray.

6.7.15 The quantity of splices trays in the joint enclosure shall be supplied as per the number of fibres in a particular cables and shall be as below and to be supplied accordingly:

Quantity of Splice Trays (Fibre organizer):

Type of cable	Splice Trays	Fibre splices / tray
24 Fibres	4	6
48 Fibres	4	12

7.0 MECHANICAL PERFORMANCE:

7.1 The splice closure shall be examined physically for the workmanship and to design technology employed. It shall be checked for any flaws, defects, cracks etc. visible to naked eye.

7.2 The following tests will be performed to ensure the mechanical performance of the joint enclosure:

(i). Water Ingress Test.
(ii). Drop and Topple Test.
(iii). Air Tightness Test.
(iv). Static Load Test.
(v). Impact Test.
(vi). Vibration Test.
(vii). Environmental Cycle Test.
(viii). Salt Spray (Mist) Test.
(ix)(a). Resistance to Aggressive Media Test.
(ix)(b). Resistance to Stress Cracking Test.
(x). Variation in Attenuation.
(xi). Torsion Test.
(xii). Flexure Test.
(xiii). Clamping Test.
(xiv). Thermal Aging.
(xv). Current Surge Test.
(xvi). UV Test.

Test methods for the above tests are given below:

7.3 Water Ingress Test:

7.3.1 OBJECTIVE: To determine the water tightness of the cable joint box when subjected to immersion in water.

7.3.2 Test Parameters:

(i)	Water Head	:	6.10 meters.
(ii)	Duration of immersion	:	7 days.
(iii)	Temperature	:	Ambient Temperature.

7.3.3 TEST EQUIPMENT: An immersion tank of sufficient dimension to house the joint box under test and to provide the specific height of water column.

7.3.4 INITIAL EXAMINATION: The cable joint box shall be assembled with all its components like rubber sealing etc. and a continuous cable passing through it as per the relevant procedure.

7.3.5 CONDITIONING: The joint box in its assembled condition shall be secured at the bottom of the immersion tank. The water shall be filled to a specified height (2.0 meters) at ambient temperature.

7.3.6 DURATION: The cable joint box will be kept under the water column for duration of 7 days.

7.3.7 RECOVERY: After 7 days joint box shall be removed from immersion tank and all its external surfaces will be thoroughly wiped off and cleaned for water.

7.3.8 FINAL EXAMINATION: The cable joint box shall be examined externally for any abnormality. The joint box will be opened as per the specified procedure and visually examined for any ingress of water.

7.3.9 ACCEPTANCE: The cable joint box will be declared to have passed the water ingress test in case there is no water vapour present inside the joint box.

7.4 Drop and Topple Test:

7.4.1 OBJECTIVE: To determine the ability of joint box to withstand the knocks and jolts likely to occur during installation, repair work or rough handling in its use.

7.4.2 TEST EQUIPMENT: A drop test platform consisting of steel plate not less than 6.5 mm thick is to be used. The steel plate is bolted to a fully-set concrete block at least 460 mm thick and shall have surface dimension larger than the least surface of the equipment under test. The method of releasing the equipment to the drop test platform from the specified height (2000 mm) shall be such as to allow free fall from the position of suspension with a minimum of disturbance at the moment of release.

7.4.3 MOUNTING: The joint box shall be mounted on the platform in the assembled ready to use condition and in its normal position.

7.4.4 INITIAL EXAMINATION AND MEASUREMENTS: The joint box shall be visually inspected and mechanically checked as required by the relevant specification.

7.4.5 CONDITIONING: The joint box shall be subjected to the tests with a cable passing through the enclosure. The cable to be cut 50 mm long outside this joint box at both ends.

7.4.6 DROP ALONG LENGTH: Hold the joint box parallel to testing surface at the specified height. Allow the joint box to fall freely on test surface along the length.

7.4.7 Number of drops in the drop test shall be 10 numbers.

7.4.8 TOPPLE: The joint box standing in its normal position is tilted about one bottom edge till it reaches a position of instability. It is then allowed to fall freely from this position on to an adjacent face. The closure shall be subjected to one topple on each one of the two ends.

7.4.9 FINAL EXAMINATION AND MEASUREMENT: The joint box shall be visually inspected, and mechanically checked as required by the specification immediately after completion of these tests. The results shall be compared with the results of initial examination and measurements.

7.4.10 ACCEPTANCE: The cable joint box will be declared to have passed the drop and topple test in case there is no visible damage to the enclosure.

7.5 Air Tightness Test:

7.5.1 OBJECTIVE: To determine the effectiveness of sealing alignment of cable joint box.

7.5.2 Test parameters:

(i)	Internal pressure	:	1.5Kg/sq cm.
(ii)	Temperature	:	Ambient Temperature.
(iii)	Test Time	:	24 Hrs.
(iv)	Air	:	Dry Air.

7.5.3 TEST EQUIPMENT: The following test equipments are required to carry out this test:

i. It should be possible to produce the air pressure of at least 5kg/cm^2
ii. A pressure gauge with reading accuracy of 0.05 kg/cm^2 or less.
iii. A pressure regulating arrangement.
iv. Assorted nozzles, valves, connecting hoses etc.

7.5.4 SCHEME OF TESTING: The cable joint box shall be subjected to these tests in assembled condition with all rubber sealing and a continuous cable passing through its ports. A suitable nozzle should be available or provided on the cable joint box for making connection to pressure gauge compressor etc.

7.5.5 SEALING TEST (PRESSURE): The cable joint box shall be connected to compressor and pressure gauge. The test shall be conducted at the room temperature. The pressure within the cable joint box shall be adjusted to 1.5 kg/sq.cm. The dry air source shall be turned off when the specified pressure is attained.

There shall be no noticeable fall in pressure in a period of 24 hours, making allowance for any temperature variation. Maximum fall in pressure allowed is 0.05 kg/cm^2.

7.5.6 FINAL EXAMINATION AND MEASUREMENT: The cable joint box shall be mechanically checked at the end of these tests and the results compared with the values as per equipment specification for being within permitted limits.

7.5.7 ACCEPTANCE: The cable joint box shall be declared to have passed this test in case the pressure does not fall beyond specified limit.

7.6 Static Load Test:

7.6.1 OBJECTIVE: To determine the mechanical strength capability of cable joint box under the action of static load.

7.6.2 Test parameters:

(i)	Internal Pressure	:	0.5 Kg/sq cm.
(ii)	Static Load	:	250 Kg
(iii)	Duration for keeping load	:	24 Hrs.
(iv)	Change in pressure allowed	:	≤ 0.05 Kg/sq cm.

7.6.3 TEST EQUIPMENT: Weight measure, a platform with dimension more than that of cable joint box, a curved hollow profiled mandrel for application of load.

7.6.4 MOUNTING: The cable joint box assembled with all its metal fittings and rubber sealing shall be kept on the platform. The hollow profiled mandrel shall be at the middle straight part of cable joint box.

7.6.5 INITIAL EXAMINATION AND MEASUREMENT: The cable joint box shall be visually inspected for any damage like cracks, fracture etc. on the outside surface.

7.6.6 CONDITIONING: Weight measures shall be gradually placed on the flat surface of hollow profiled mandrel till the weight becomes equal to 250 kg. The cable joint box shall be kept under 250 kg. weight for a period of 24 hours.

7.6.7 ACCEPTANCE: The cable joint box will be declared to have passed the static load test in case there are no cracks or fracture observed after the static load has been removed. There shall not be any fall in the air pressure more than the prescribed limit.

7.7 Impact Test:

7.7.1 OBJECTIVE: To determine the ability of cable joint box to withstand impacts likely to occur during installation or otherwise.

7.7.2 Test parameters:

(i) Internal pressure : 0.5 Kg/sq cm
(ii) Striking Force : 5 Kg
(iii) Dropping height : 500 mm
(iv) Radius of spherical weight : 50 mm
(v) Location & no. of impacts : 3 Impacts along the length of closure each, at 3 different points located at 120° along the circumference (Total 9 impacts) At least 3 impacts on the mould line.

(vi) Change in pressure allowed: ≤ 0.05 Kg/sq cm.

7.7.3 TEST EQUIPMENT: A platform with surface dimension larger than the least surface dimension of cable joint box, a provision for dropping a weight, length measure.

7.7.4 MOUNTING: The cable joint box assembled with all the fittings and rubber sealing shall be kept on the platform. The spherical weight should have a radius of R = 50 mm at striking end & shall be positioned at the middle of cable joint box.

7.7.5 CONDITIONING: A weight of 5 Kg will be made to strike the cable joint box at middle after having been released from a height of 500 mm. The number of impact shall be ten.

7.7.6 FINAL EXAMINATION: The cable joint box will be removed from platform and examined visually for any cracks, permanent deformation or fracture and fall in pressure.

7.7.7 ACCEPTANCE: The cable joint box will be declared to have passed the impact test, in case there are no cracks deformation or fracture observed. There shall not be any fall in the air pressure more than the above prescribed limit.

7.8 Vibration Test:

7.8.1 OBJECTIVE: To check the effect of vibration on cable joint box and on its components.

7.8.2 Test parameters:

(i) 3 planes : (X-axis, Y-axis, Z-axis)
(ii) Sweep : (10-300)Hz ± 2% at 1 octave ± 10% per minute
(a) sine sweep (10-28) ± 1Hz 0.1” (2.5 mm) double amplitude.
(b) Sine sweep (28-300)Hz ± 2% max. 4 g acceleration.
(iii) Time : 2 hours each axis.
(iv) Internal pressure : 0.5 Kg/sq cm

(v) Change in pressure allowed : ≤ 0.05 Kg/sq cm

7.8.3 **Final Examination & Measurement:** The sample shall be checked for any cracks, permanent deformation or fractures and gas tightness. There shall not be any fall in the air pressure more than the prescribed limit.

7.8.4 **Acceptance:** The cable joint box shall be declared to have passed the vibration test, in case there are no cracks, permanent deformation or fractures and air tightness.

7.9 Environmental Cycle:

7.9.1 OBJECTIVE: To determine the working capability of joint closure for climate conditions:

Lowest temperature	: -20°C
Highest temperature	: 60°C
Dwell Time	: 4 hrs.
Transition time	: 2 hrs.
Cycle duration	: 10 and 1/2 hrs.
Number of cycles	: 20
Closed system pressure	: 0.5 kg/sq.cm.
Change in pressure allowed	: 0.05 kg/sq.cm.

Humidity to be kept at 95% at 60°C and uncontrolled % humidity for all other temperature during the cycle.

7.9.2 Requirement:

7.9.2.1 There shall not be any cracks, permanent deformation of fractures and gas tightness.

7.9.2.2 There shall not be any fall in air pressure more than prescribed limit and change in attenuation shall not be more than 0.02 dB.

7.10 Salt Spray (Mist) Test:

7.10.1 OBJECTIVE: To determine the suitability of the joint closure for use or Storage and / or transport in salt laden atmosphere`.

7.10.2 REQUIREMENTS: It shall meet the requirements of salt mist test and shall be tested as per QM-333 (latest issue) document.

7.11 To Test the Joint Closures for:

i) Resistance to Aggressive Media Test
ii) Resistance to Stress Cracking Test

7.11.1 Resistance to aggressive media test:

7.11.1.1 Test conditions: The samples shall be checked under internal pressure of 0.5 Kg/sq cm in the solutions as stated below at ambient temperature:

Change in pressure allowed: ≤ 0.05Kg/sq cm.

Solution	**Test Time**
pH 2	5 days
pH 12	5 days
Kerosene	5 days
Petroleum jelly	5 days
Fuel Oil	5 days

Requirement: The sample shall be checked for the receptivity of splice closure in the given media. There shall not be any fall in the air pressure more than the prescribed limit.

7.11.2 Resistance to stress cracking test:

7.11.2.1 Test conditions:

The samples shall be checked under internal pressure of 0.5 Kg/sq cm in the solutions as stated below:

Test temperature	: 50 ± 2°C
Test medium	: 10% Igepal
Internal pressure	: 0.5 Kg/sq cm
Test time	: 7 days
Change in pressure allowed	: ≤ 0.05 Kg/ sq cm

Requirement: The sample shall be checked for the receptivity of splice closure in the given media. There shall not be any fall in the air pressure more than the prescribed limit.

7.12 Variation in Attenuation (Residual Loss):

7.12.1 OBJECTIVE: To check the effect of the use of fibre organiser and other arrangement on the transmission characteristics of optical fibres in assembled condition.

7.12.2 REQUIREMENTS :

Wavelength of operation	:	1310 nm & 1550 nm
Change in attenuation	:	≤ 0.05 dB

Note:

(a) The Fibres attenuation shall be measured:

i) Leaving the fibre unlooped,

ii) After the arrangement on the tray and stabilization time of one hour.

(b) Test shall be conducted on at least 50% of fibre in a cable.

7.13 Torsion Test:

7.13.1 OBJECTIVE: To check the effect of torque on the cables of the joint closure.

7.13.2 REQUIREMENTS :

Torque : 10 * D [Nm], where D is the external diameter of the cable in mm (Max. 50 Nm)
Internal pressure : 0.5 Kg/sq.cm
Distance from the entry port : 250 mm
Rotation : 90^0 max.
Temperature : Ambient
No. of cycles : 5
Holding Time : 5 minutes at each rotation
Change in pressure allowed : ≤ 0.05 kg/sq cm.

The extending cables shall be clamped rigidly at specified distance. Only one cable shall be clamped at a time but the test shall be repeated with each extending cable. The closure shall be axially rotated through 90^0 and retained for five minutes. It shall be rotated to normal position and then towards the opposite direction.

It shall be checked for any flaws, defects, cracks visible to naked eyes and then Gas tightness.

7.13.3 Acceptance:

The cable joint will be declared to have passed in torsion test if:
(i) There shall not be any flaws, defects, cracks visible to naked eye.
(ii) There shall not be any fall in pressure more than prescribed limit.

7.14 Flexure Test:

7.14.1 OBJECTIVE: To test the Flexure strength of the joint closure.

7.14.2 REQUIREMENT:

(i).	Test pressure	: 0.5 Kg/sq.cm.
(ii).	Change in pressure allowed	: 0.05 Kg/sq.cm
(iii).	Force	: Max. 500 N or 30 degree bending force application 10*D from the end of cable seal sleeve. (D = dia. of cable in mm.)
(iv).	No. of cycle	: 5
(v).	Holding time	: 5 minutes
(vi)	Change in pressure allowed	: ≤ 0.05 Kg/ sq cm

The sample shall be checked for gas tightness. There shall not be any fall in air pressure more than the prescribed limit and there shall not be any physical damage to the cable or the closure.

7.15 Clamping Test:

7.15.1 Cable Clamping:

7.15.1.1 OBJECTIVE: The cable-clamping test means to determine the effect of installing the closure, if any and on the optical transmission characteristics of the fibres and splices.

7.15.1.2 Test Conditions:

(i) Place two fibre optic cables inside the closure. Very loosely secure the cables to permit splicing. Sheath retention clamps and environmental seals shall not be used at this time.
(ii) Splice fibres of the cables.
(iii) Measure and record the initial value for the optical attenuation of the 50% fibres of the cable.
(iv) Assemble the closure using all associated cable clamping and sealing hardware according to the manufacturer's instructions. Rigid and non-rigid strength members shall also be terminated as per the manufacturer's instructions. Care should be taken to minimize movement of the splices.
(v) Repeat the optical measurements on the same 50% fibre of the cable.

7.15.1.3 FINAL EXAMINATION: The change in attenuation shall not be more than 0.05 dB.

7.15.1.4 ACCEPTANCE: The joint enclosure shall be declared to have passed the cable clamping test if change in attenuation shall not be more than 0.05 dB.

7.15.2 Cable Axial Tension (Sheath Retention) Test:

7.15.2.1 OBJECTIVE: To check the cable and sheath holding mechanism for the axial tension if applied to the assembled Splice Closure.

7.15.2.2 Test Parameters:

Tension applied longitudinally on cables	: 50 Kg
Test Time	: 30 minutes
Internal Pressure	: 1.5 Kg/sq cm
Temperature	: Ambient
Change in pressure allowed	: ≤ 0.05 Kg/sq cm

The load shall be applied individually to each cable.

7.15.2.3 REQUIREMENT:

(i) The holding mechanism shall not cause any damage to the cable or the clamping hardware.
(ii) There shall not be any fall in the air pressure more than the prescribed limit and the change in attenuation shall not be more than 0.05 dB.
(iii) There shall not be no visible flaws or defects after the test.

7.16 Thermal Aging:

7.16.1 OBJECTIVE: Sealing components (gasket, grommets, O-ring, seals etc.) used in a closure shall not permit the entry of water into the closure after thermal aging at 90°C ± 1°C for 720 hours.

7.16.2 PROCEDURE: Place two sets of components (gasket, grommets, O-ring, seals etc.) in a air oven perpendicular to air flow. Age the components at 90°C for 720 hours (30 days). Allow the components to stabilize at room temperature for minimum 24 hours.

7.16.3 REQUIREMENT: There shall not be any visible deterioration or deformation or melting or cracking of the samples. This test should be conducted on the sealed closure followed by the Gas tightness test.

7.16.4 NOTE: The aged components shall be used on the closure subject to remaining environmental test.

7.17 Current Surge Test:

7.17.1 OBJECTIVE: This test is intended to check that externally grounded closures can safely conduct an accidental current surge on the cable through a controlled metal path to ground.

7.17.2 Test Parameters: The internal current carrying components shall with stand a current surge of 1000 Amps for 5 seconds.

7.17.3 REQUIREMENT: No damage to any component part of the splice closure.

7.18 UV Test:

7.18.1 OBJECTIVE: To determine the effect of ultraviolet exposure if any on the Tensile and Elongation properties of the non-metallic materials.

7.18.2 TEST METHOD: ASTM G-53 (latest issue) or as per Telcordia's GR 771 issue 1 July 94 (Section 6.4.9).
7.18.3 DURATION: 2000 Hours.

7.18.4 Test Procedure:

(i) Prepare four-test sample of the non-metallic material. Keep two samples inside the chamber and expose them to ultraviolet radiation. Continue the test for 2000 hours.

(ii) Check and compare the properties of the tensile and elongation of the two samples subject to radiation with the other 2 samples kept outside at ambient temperature.

7.18.5 REQUIREMENT:

(i) There should not be any crack or damage to the sample.

(ii) The parameters of tensile and elongation shall not be reduced more that 20% from the two samples at ambient temperature.

7.18.6 NOTE: If the facility is not available , the type test shall be conducted in any recognized laboratory by the vendor on type test sample

8.0 PHYSICAL AND CHEMICAL TEST ON RAW MATERIAL AND FINISHED PRODUCT:

8.1 For ABS Materials:

S.No.	Parameter	Specified Values	Test Method	Raw Material/ Finished Product Test
(a)	Density	1.01-1.21 gm/cc	ASTM-D-792	To be tested on finished product.
(b)	Vicat Softening Point	(100-108)°C	ASTM D-1525	-- do --
(c)	Tensile Strength	≥ 2 Kg/mm^2	ASTM-D-638	To be tested on raw material.
(d)	Elongation	< 50%	ASTM-D-638	-- do --
(e)	Water Absorption	0.4 max	ASTM-D-57-59	-- do --
(f)	Rock Well Hardness	R81-R111	ASTM-D-785A	-- do --

8.2 **For The material of High density polyethylene / Polypropylene / Polypropylene with 30% Glass Fibres characteristics and the performance requirements:**

a) Tensile Strength : > 17 N/mm^2

b) Elongation at breaking : > 350 %
(velocity 25mm/min, +25 ± 2^oC)

c) Resistance to chemical agents : No traces of grazing or cracking
(The sample shall be soaked in
filling jelly, iso paraffinic solvent derived from petroleum for 30days)

d) It shall be UV stabilized : (Tested as per ASTMG53 for 1000 Hours)

e) Thermal ageing : 168 hours at +100 ± 2^{o}C

i) Tensile strength : >15 N/mm^{2}

ii) Elongation at breaking : > 300%

f) It shall not be affected by the soil at any PH, or by the micro-organisms and insects or termite and rodents.

9.0 JOINT ENCLOSURE ACCESSORIES:

9.1 Accessories and Jointing Materials:

i.	Velcro Tape	2 nos.
ii.	Splice Protection Sleeves	30
iii.	Cable Tie (90mm)	1 dozen
iv.	Numbering Ferrules	2 sets
v.	Cotton Buds	12 nos.
vi.	Isopropyl Alcohol or its equivalent	100 ml.
vii.	Tissue Paper (cleaning pad) (3”x4”)	10 pieces
viii.	Cleaning Khadi Cloth	1/2 meter
ix.	Tape (minimum 2 meters) length	1 no.
x.	Instruction Manual	1 no.
xi.	PVC Tape (5m length of 10mm width)	1 Roll
xii.	Pig Tail Cables	2 nos. (Pig Tail cables should be supplied with type test sample only)
xiii.	Gasket or O-rings for mechanical sealing	1+1 (One O-ring to be supplied as a spare)
xiv	Sealing arrangement	1 complete set extra (1+1)
xv	Silica gel	2 packets each of 50grams for each closure supplied. This shall be so packed that it can be tied with the internal mechanical structure of the closure inside the closure.
xvi	Fibre guiding pin	1 no.
xvii.	Any other item required for the installation and assembly	As per the requirement

9.2 **Quantity of Splice Trays:**

Type of cable	Splice trays	Fibre splices/ Tray
24 Fibres	4	6 to 8
48 Fibres	4	12

10.0 TESTS:

10.1 Manufacturer will submit the following documents during type test & acceptance test to inspecting authority.

10.1.1 Statement of deviation, obtained from the specification at the time of type testing if any.

10.1.2 Statement of raw material used in offered lot and at the time of type testing.

10.1.3 Routine test results as per Cl. 10.4 on all the offered lot should be submitted during type & acceptance tests.

10.1.4 During acceptance test, sampling percentage figure shall be rounded off to the next higher integer.

10.2 Type Tests:

10.2.1 Two complete assembly of Optical Fibre Cable Splice Closure for Armoured Optical Fibre Cables shall be tested for this purpose. The splice closure shall successfully pass the entire type test for proving conformity with this specification.

10.2.2 Following shall constitute the type tests:

10.2.2.1 Visual Test:

10.2.2.1.1 The splice closure shall be examined physically for the workmanship and the design technology employed. It shall be checked minutely for any flaws defects, cracks visible to naked eye.

10.2.2.1.2 Tests as per clauses 5.10, 5.12, 6.2, 6.3, 6.5, 6.7.3, 6.7.4, 6.7.6, 6.7.7, 6.7.15, 11 and 12.

10.2.2.1.3 All tests as per clause 7.2.

10.2.3 Physical and chemical test on raw materials and finished product as per clause 8.0.

10.3 Acceptance Tests:

Following shall constitute the Acceptance Testing:

10.3.1 Visual Test:

10.3.1.1 The splice closure shall be examined physically for the workmanship and the design technology employed. It shall be checked minutely for any flaws defects, cracks visible to naked eye. The above test shall be conducted on 10% equipment offered.

10.3.2 The following tests, shall be conducted on 10% equipments offered as per Clause 6.2, 6.3, 6.5, 6.7.3, 6.7.7, 6.7.15, 7.15, 9, 11 & 12.

10.3.3 In addition to above, the following tests shall be conducted on 2% of the lots (minimum one number of Joint Enclosure) offered for acceptance testing: Clause 7.3,7.4 & 7.7.

10.3.4 Tests as per Clause 7.5,7.6 & 7.12 shall be done on minimum one sample of each lot offered.

10.3.5 Any other test shall be carried out as considered necessary by inspecting authority.

10.4 Routine Tests:

Manufacturer shall submit the routine test results of raw material and finished product. These tests will be conducted on every new lot/ batch of raw material as per clause 8.0.

11.0 MARKING ON BODY OF THE JOINT ENCLOSURES:

11.1 The following information by marking on splice closure shall be provided:

a) Manufacturer's name & date / year of production.
b) RDSO Specification No.
c) Number of splice (organizer) cassettes
d) Number of splices per cassette.
e) Batch Number
f) Serial Number

12.0 DOCUMENTATION:

12.1 The technical literature in English language along with detailed drawings of all the assemblies and parts shall be provided. All the aspects of installation, operation, maintenance and repair including illustration of external and internal parts shall be covered in the manual. The manual shall include the following:

i) Installation, Operation and Maintenance & repair manual.
ii) Safety measures to be observed in handling the closure.

iii) Precautions.
iv) Illustration of internal and external parts.
v) List of the parts including their source and ordering information for all the replaceable parts.
vi) Detailed method for re-opening and re-closing of the joint enclosure.
vii) Each joint enclosure shall be supplied along with small booklet giving the installation method etc. in brief to help the installer in field by way of illustrations.

13.0. All the provisions contained in RDSO's ISO procedures laid down in Document No. QO-D-8.1-11 latest version (titled "Vendor-Changes in approved status") and subsequent versions/amendments thereof, shall be binding and applicable on the successful vendor/vendors in the contracts floated by Railways to maintain quality of products supplied to Railways

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