Annexure B (1)-
Engineering Instructions for Installation of Aerial OFC

INSTALLATION PRACTICE OF

SELF SUPPORTING METAL FREE AERIAL OPTICAL FIBER CABLE

1. SCOPE:

This Engineering Instruction (EI) deals with the guidelines and the installation practice for installing self-supporting metal free aerial optical Fiber cable.

2. GENERAL:

Department Of Telecommunication has already introduced self-supporting metal free aerial optical Fiber cable for local junctions and short haul trunk working. This is particularly useful in situations where underground cable laying is not possible. It is also recommended for short term working.

3. ROUTE SURVEY:

The route should be inspected before the actual installation of optical Fiber cables. Survey of the aerial route should be carried out pole by pole.

4. OVER HEAD ALIGNMENT:

The existing route alignment wherever available should be used. On new routes, alignment should be erected. The span length must not exceed above 90 metres.

5. LINE DIAGRAM:

A line diagram should be prepared to mark the poles & the actual distance between the poles in a splice section (Normally 15 poles per km are recommended). Additional poles should be erected if required to keep the span length within the specified limits. Care should be taken that the alignment is easily accessible from the road. It is necessary to keep d clear head way (Ground clearance) of 12 to 15 feet in a section. A complete line diagram should be prepared i.e. from station A to station B. The number of road crossings, canals or nallahs, electric lines should be clearly marked in the route diagram.

6. HILLY REGIONS:

Line erection rules must be strictly followed. Additional poles may be erected for better support to optical Fiber cable & to avoid sharp curves & bends. Span lengths should be reduced to avoid sags in case of steep slopes.

7. TENSION POLES:

7.1 Tension poles are dead end or termination poles. The tension poles shall have dead end fittings. The Dead end fittings offer a continuous run of the aerial optical Fiber cable. These fittings relieve the optical Fiber cable of its compressive, bending & clamping stresses. The performed dead end fittings are suitably gritted for excellent tensile holding strength.

7.2 SELECTION OF TENSION POLES; Selection of tension poles depends upon the actual site location of the route. Every fifth pole should be a tension pole in straight alignment. Splicing location poles should be tension poles or wherever alignment takes a sharp turn (more than 15 degrees) should also be a tension pole.

8. SUSPENSION POLES:

8.1 The suspension pole assembly is designed to offer cushion to aerial optical Fiber cable against the dynamic stress of Aeolian vibration at the suspension point. They also reduce static stresses at the Support point.

8.2 SELECTION OF POLES:

i. Selection of suspension poles also depends upon actual site location of route.
ii. All the intermediate poles between two tension poles will be suspension poles.

9. SELECTION OF SPLICE LOCATION:

The splice box of the aerial optical cable should be kept overhead. Therefore it is necessary to fix & determine the splicing location as per the designated cable drum length.

10. AERIAL OPTICAL FIBER CABLE SPECIFICATIONS:

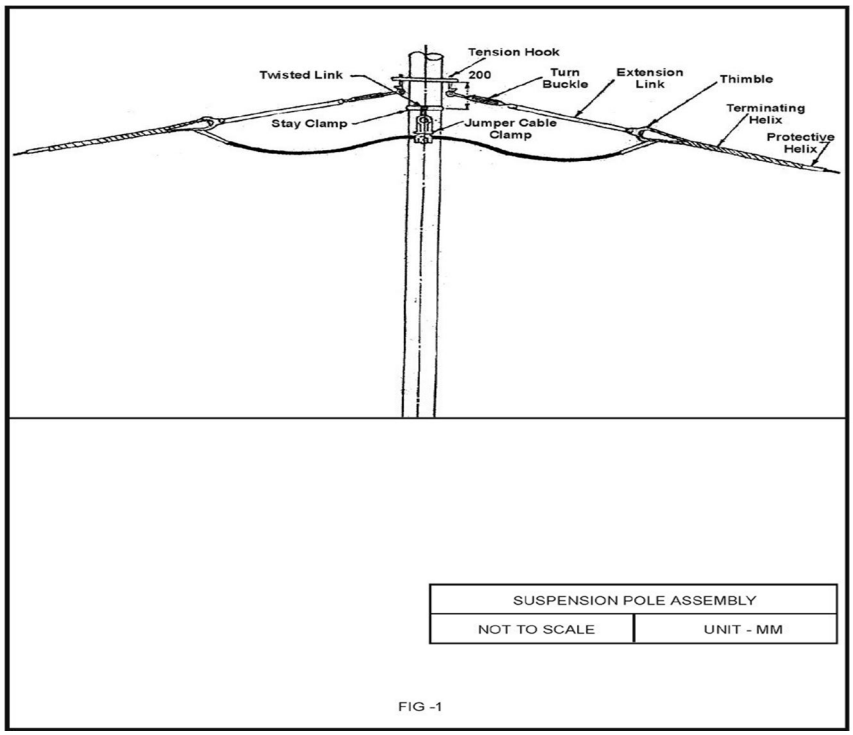
1.	Maximum span length	:	100 metres
2.	Maximum ice loading	:	1 Kg per meter
3.	Operational wind velocity	:	75Kms per hour
4.	Maximum sag allowed (Without excess load)	:	2% of span length
5.	Maximum sag allowed (With excess load)	:	3% of span length
6.	Temperature range	:	
	- operation & storage	:	-30 to +70 degree C
	- installation	:	-15 to +50 degree C
7.	Minimum bend radius	:	2D (D- Dia of cable)
8.	Tensile force		
	During installation	:	9.81 x 1.3 x **w**
	Permanent with ice & wind load:		9.81 x 3 x **w**

(Where **w** is the mass of 1 km length of cable, in kg)

11. TYPES OF ACCESSORIES AND FIXTURES:

11.1 FORMED OFC DEAD END AND TERMINATION FITTINGS:

These fittings are used at tension/termination poles (dead end poles), or poles where splices are located and the poles where the overhead alignment takes a turn, (angle exceeding more than 15 degrees) as shown in below fig. 1.

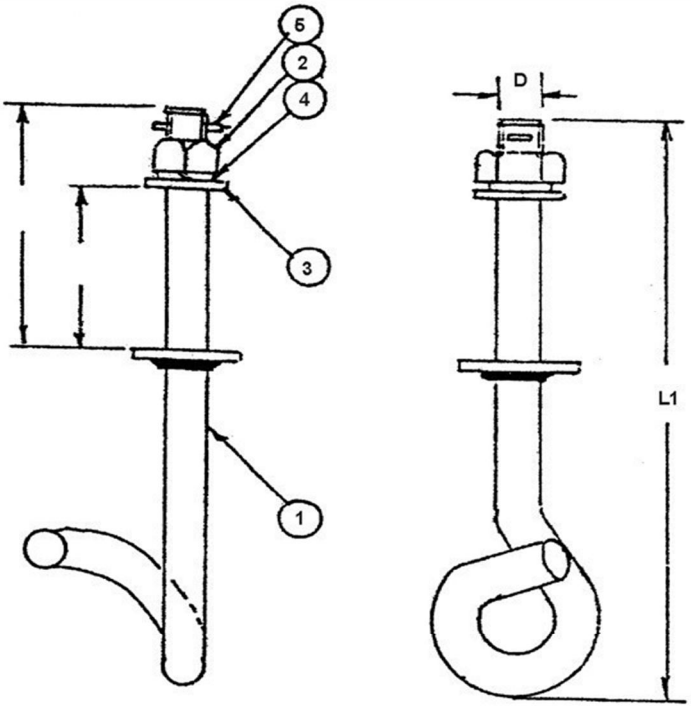


SUSPENSION POLE ASSEMBLY	
NOT TO SCALE	UNIT - MM

FIG -1

11.2 J-SHAPED TENSION HOOK:

J - Shaped tension hook is for the installation on cross arm channel C (C-Bracket) of the poles as shown in fig. 6.



DIMENSIONS IN MM :

L1	L2	L3	D
177	75	50	12

NOTE :- TOLERANCE SHALL BE AS PER IS : 2102
(DETAIL AS PER GR, UNLESS UNTILL SPECIFIED)
TO BE USED HERE C-BRACKET IS AVAILABLE ON POLE FOR FITMENT OF TENSION HOCK
HOT DIP GAVANISED AS PER IS : 2629

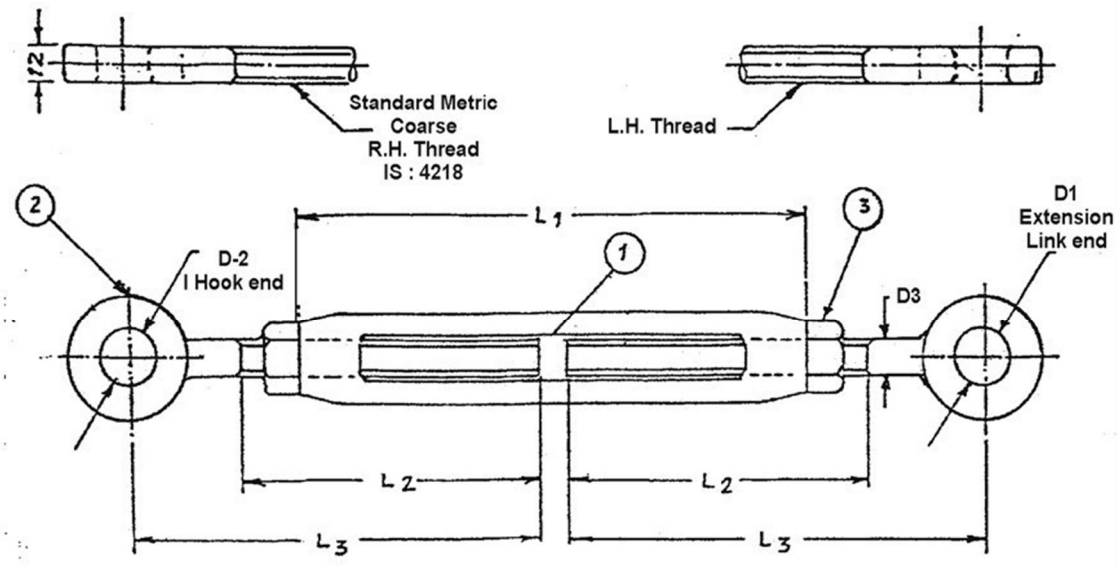
	DESCRIPTION	METERIAL	REF. Spec.	Qty.
1	BODY	ALLOY STEEL GALVANISED	IS : 2004	1
2	NUT	MILD STEEL GALVANISED	IS : 1363	1
3	PLAIN WASHER	MILD STEEL GALVANISED	IS : 2016	1
4	SPRING WASHER	SPRING STEEL GALVANISED	IS : 3063	1
5	SPILT PIN	STAINLESS STEEL	IS : 549	1

TENSION HOOK	
NOT TO SCALE	UNIT - MM

FIG - 6

11.3 TURN BUCKLE:

Galvanized forged steel turn - buckle is used at the dead end and at tension positions (for adjusting the sag & tension) as shown in fig. 7.



DIMENSIONS IN MM :

L1	L2	L3	D1	D2	D3
170	100	140	18	18	12

NOTE :- TOLERANCE SHALL BE AS PER IS : 2102
(DETAIL AS PER GR, UNLESS UNTILL SPECIFIED)

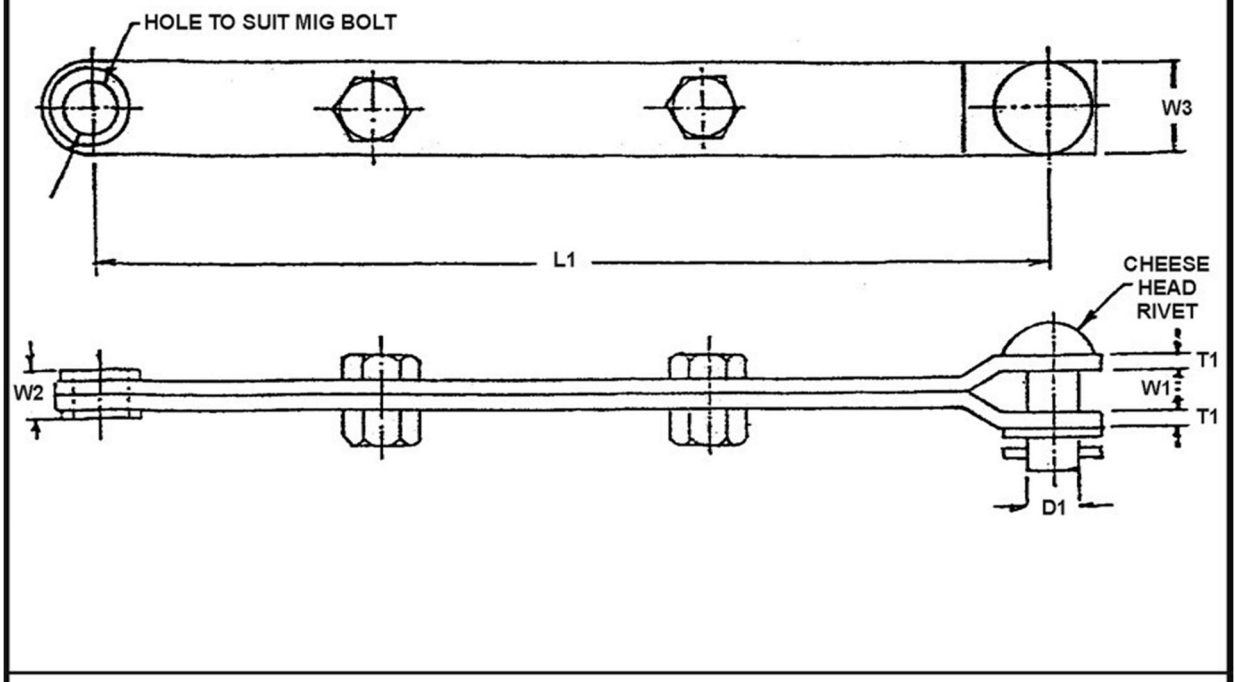
MIN. LENGTH : 290 MM
MAX. LENGTH : 400 MM
RANGE OF ADi. : 110 MM
HOT DIP. GALVANISED AS PER IS : 2629

	DESCRIPTION	METERIAL	REF. Spec.	Qty.
1	BODY	MILD STEEL FORGED GLAV.	IS : 2004	1
2	NUT BOLT	MILD STEEL FORGED GLAV.	IS : 2062	2
3	NUT	MILD STEEL	IS : 1363	2

TURN BUCKLE	
NOT TO SCALE	UNIT - MM

FIG - 7

11.4 EXTENSION LINK:



DIMENSIONS IN MM :

L1	T1	W1	W2	W3	D1
465	5	14	16	30	16

NOTE :- TOLERANCE SHALL BE AS PER IS : 2102
(DETAIL AS PER GR, UNLESS UNTILL SPECIFIED)

HOT DIP. GALVANISED AS PER IS : 2629

	DESCRIPTION	METERIAL	REF. Spec.	Qty.
1	STRAP	MILD STEEL GALVANISED.	IS : 2067	1
2	RIVET & WASHER	MILD STEEL GALVANISED	IS : 2016	1
3	SPLIT PIN	STAINLESS STEEL	IS : 549	1
4	BOLT & NUT M 16	MILD STEEL GALVANISED	IS : 1363	1

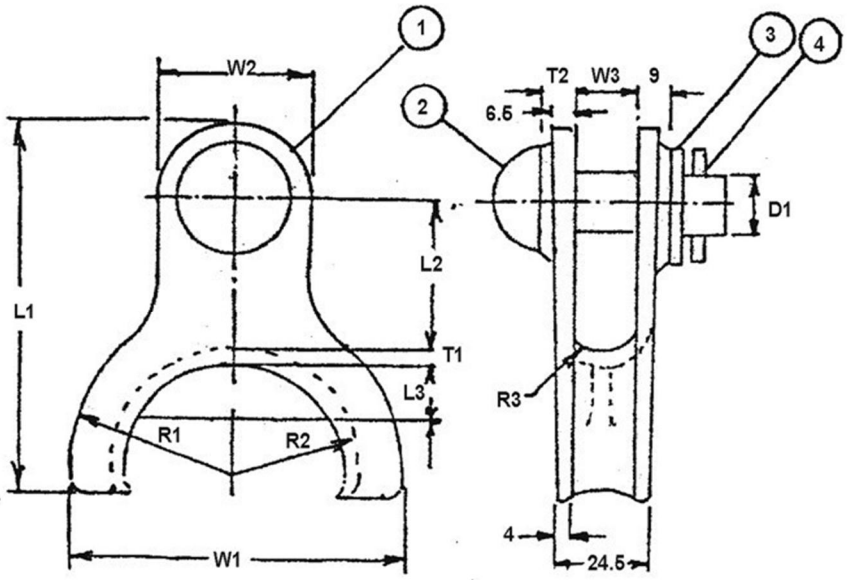
EXTENSION LINK	
NOT TO SCALE	UNIT - MM

FIG - 8

Galvanized steel extension link is used along with turn buckle as shown in fig. 8.

11.5 CLEVIS THIMBLE:

Aluminium alloy die cast thimble is used to attach the extension link and for accommodating the loop of the helically formed terminating helix at the other and its smooth internal contour as shown in fig.9.



DIMENSIONS IN MM :

L1	L2	L3	T1	T2	R1	R2	R3	W1	W2	W3	D1
102	42	15	4	9	23	15	8	92	40	18	16

NOTE :- TOLERANCE SHALL BE AS PER IS : 2102
(DETAIL AS PER GR, UNLESS UNTILL SPECIFIED)

FEROUS PARTS ARE HOR DIP GALVANISED
AS PER IS : 2629

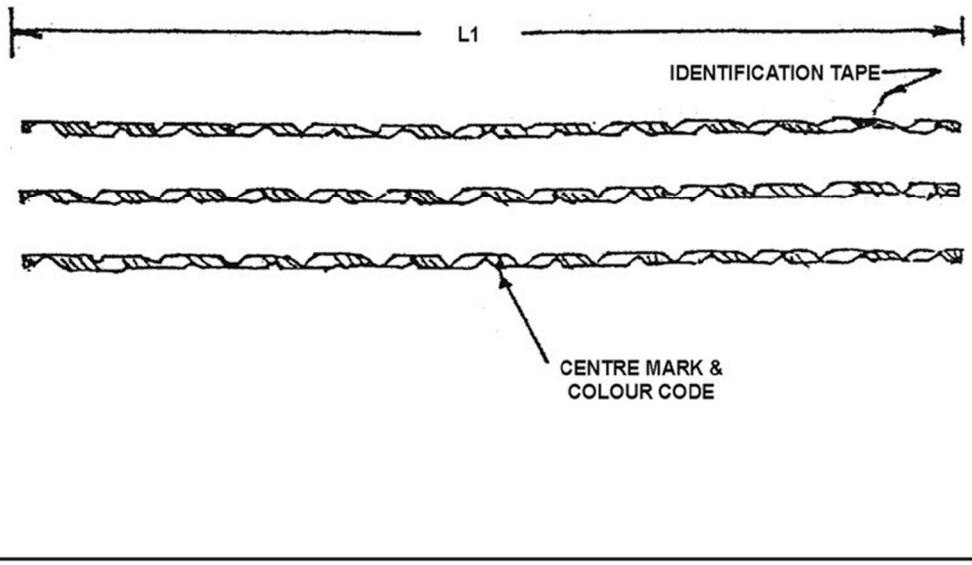
	DESCRIPTION	METERIAL	REF. Spec.	Qty.
1	CLAMP	ALUMINIUM ALLOY GDC.	IS : 617	1
2	RIVET M16 x 45	GALV. STEEL	IS : 2016	1
3	WASHER	GALV. STEEL	IS : 2016	1
4	SPLIT PIN	STAINLESS STEEL	IS : 549	1

CLEVIS THIMBLE	
NOT TO SCALE	UNIT - MM

FIG - 9

11.6 PROTECTIVE HELIX (T):

Set of aluminium alloy helically formed protective helix having predetermined spiral shape is used & making them conveniently applied on the optical Fiber cable without excessive clamping pressure at any point. See fig. 11.



FOR EXAMLE
DIMENSIONS (FOR CABLE SIZE, D - 14.4 MM)

I. DIA. OF EACH WIRE - 3.2 ± 0.1
II. NO. OF SETS - 3
III. NO. OF WIRE PER SET - 5
IV. LENGTH OF HELIX - 1000

DIMENTION DETAILS FOR OTHER CABLE SIZE SHALL BE INDICATED BY THE MANUFACTURER INCLUDING THE PITCH OF HELIX

NOTE : ENDS OF RODS SHALL BE DEBURRED TOLERANCE SHALL BE AS PER IS : 2102 (DETAIL AS PER GR, UNLESS UNTILL SPECIFIED)

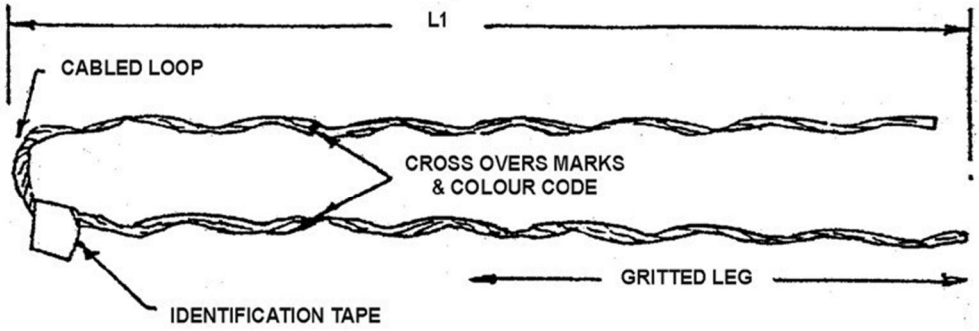
	DESCRIPTION	METERIAL	REF. Spec.	Qty.
1	PROTECTIVE HELIX	ALUMINIUM ALLOY 6061		

PROTECTIVE HELIX (T)	
NOT TO SCALE	UNIT - MM

FIG - 11

11.7 TERMINATING HELIX:

Helically formed terminating helix of Aluminized steel having a prefabricated loop shall be to fit into the grooved contour of the thimble and for fixing over protective helix over the optical Fiber cable. See fig.12.



DIMENSIONS
FOR EXAMPLE

L1	T1
1000	2.2±0.1

D IS DIA OF EACH WIRE ROD
NO. OF WIRES USED 5

NOTE : TOLERANCE SHALL BE PER IS : 2102
(DETAIL AS PER GR, UNLESS UNTILL SPECIFIED)

DIMENSION DETAIL FOR DIFFERE CABLE SIZES TO BE DECIDED AP TYPE TEST APPROVAL
FOR EXAMPLE CABLE SIZE
ENDS OF RODS SHALL BE DEBUR LENGTH OF TERMINATING HELIX 1000 MM,
TER MINATING HELIX TO BE USED WITH THIMBLE C DIA - 14.4 MM

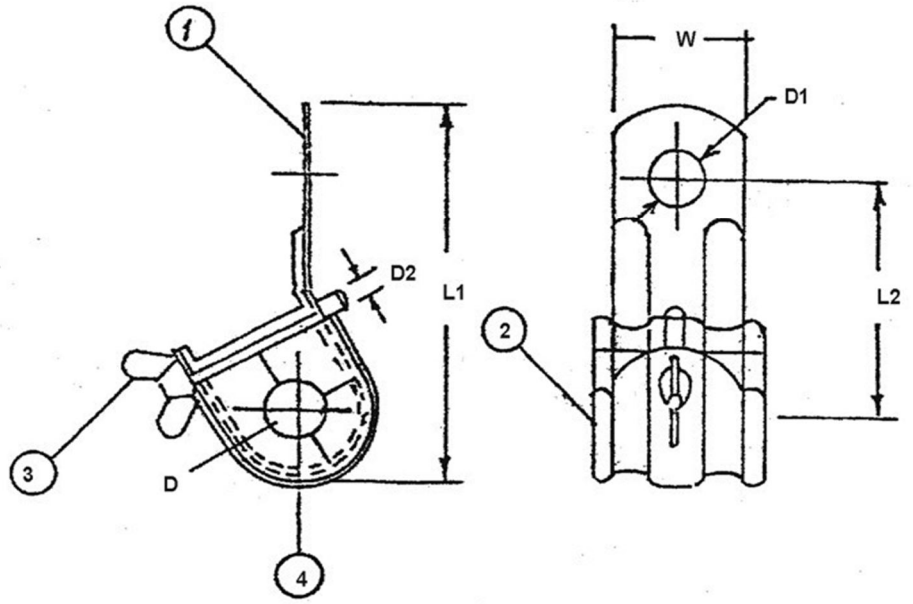
	DESCRIPTION	METERIAL	REF. Spec.	Qty.
1	DEADEHD GRIP	ALUMINISED STEEL		

TERMINATING HELIX	
NOT TO SCALE	UNIT - MM

FIG - 12

11.8 JUMPER CABLE CLAMP:

Galvanized steel jumper cable clamp is used to support the through length of optical Fiber cable at the intermediate tension poles as shown in fig. 15.



DIMENSIONS IN MM

L1	L2	D1	D2	W
105	65	17.5	5-6	35

DIMENSIONS IN MM OF INSERT PAD

L	INNER DIA	OUTER DIA
40	15	30

NOTE : TOLERANCE SHALL BE AS PER IS : 2102
(DETAIL AS PER GR, UNLESS UNTILL SPECIFIED)
INSERT IN TOW HALVES D TO SUIT CABLE DIA FERROUS PARTS ARE HOT DIP GALVASIED AS PER IS : 2629

	DESCRIPTION	METERIAL	REF. Spec.	Qty.
1	STRAP	MILD STEEL GALY	IS : 2062	1
2	INSERT	POLYCHLORADPRENE COMPOUNDED		1
3	WING BOLT	MILD STEEL GALY	IS 2062	1

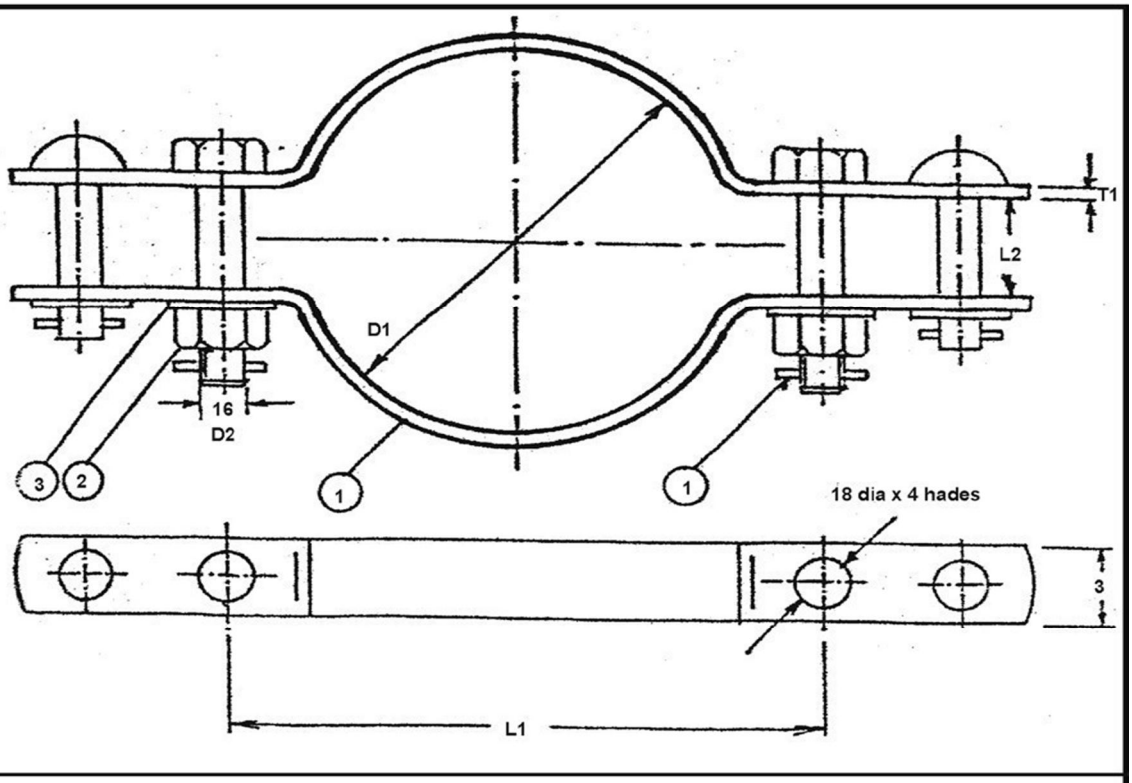
JUMPER CABLE CLAMP	
NOT TO SCALE	UNIT - MM

FIG - 15

11.9 POLE MOUNTED STAY CLAMP (RAIL) OR POLE MOUNTED STAY CLAMP (TUBULAR)

Galvanized mild steel pole mounted stay clamp should be used at the pole for the fixing with a twisted eye & turn buckle; see figs.4 & 5. The selection of the type of stay clamp will depend upon the type of poles.

POLE MOUNTED STAY CLAMP (RAIL)



POLE MOUTED STAY CLAMP (RAIL)

L1	L2	L3	L4	L5	L6	L7	L8	T1	T2	D1	W1
270	170	251	151	20	32	50	120	5	20	16	60

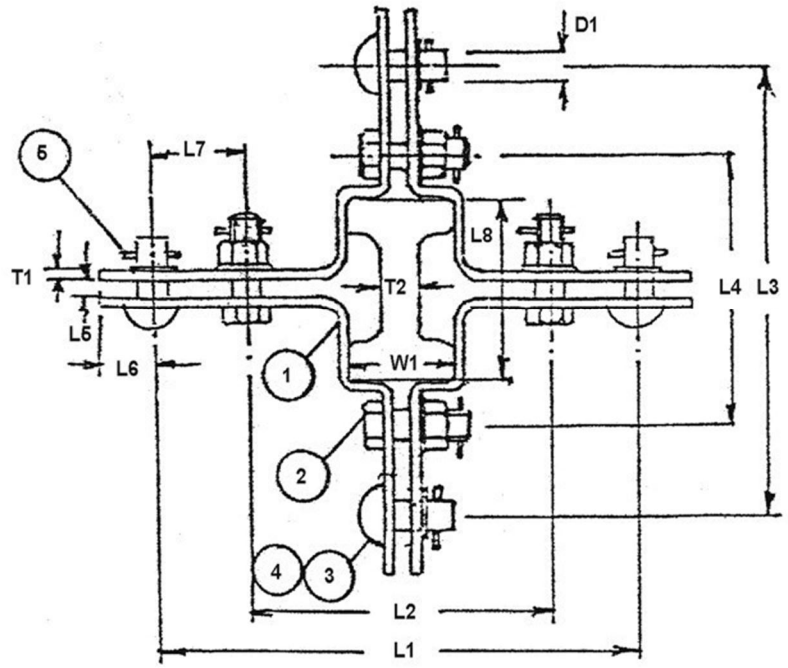
NOTE :- TOLERANCE SHALL BE AS PER IS : 2102
(DETAIL AS PER GR UNLESS UNTILL SPECIFIED)
HOT dIP Galvainised as per is : 2629

	DESCRIPTION	METERIAL	REF. Spec.	Qty.
1	CLAMP	MILD STEEL GALVANISED	IS : 2062	1 SET
2	BOLT & NUT M 16	MILD STEEL GALVANISED	IS : 1363	2
3	RIVET 16	MILD STEEL GALVANISED	IS : 2016	2
4	WASHER	MILD STEEL GALVANISED	IS : 2016	4
5	SPILT PIN	STAINLESS STEEL	IS : 549	4

POLE COLLAR CLAMP	
NOT TO SCALE	UNIT - MM

FIG - 4

11.10 POLE MOUNTED STAY CLAMP (TUBULAR)



DIMENSIONS IN MM :
POLE MOUTED STAY CLAMP TUBULAR

L1	L2	D1	D2	T1	W
210	20	150	16	5	30

NOTE :- TOLERANCE SHALL BE AS PER IS : 2102
(DETAIL AS PER GR UNLESS UNTILL SPECIFIED)
HOT DIP GALVANISED AS PER IS : 2629

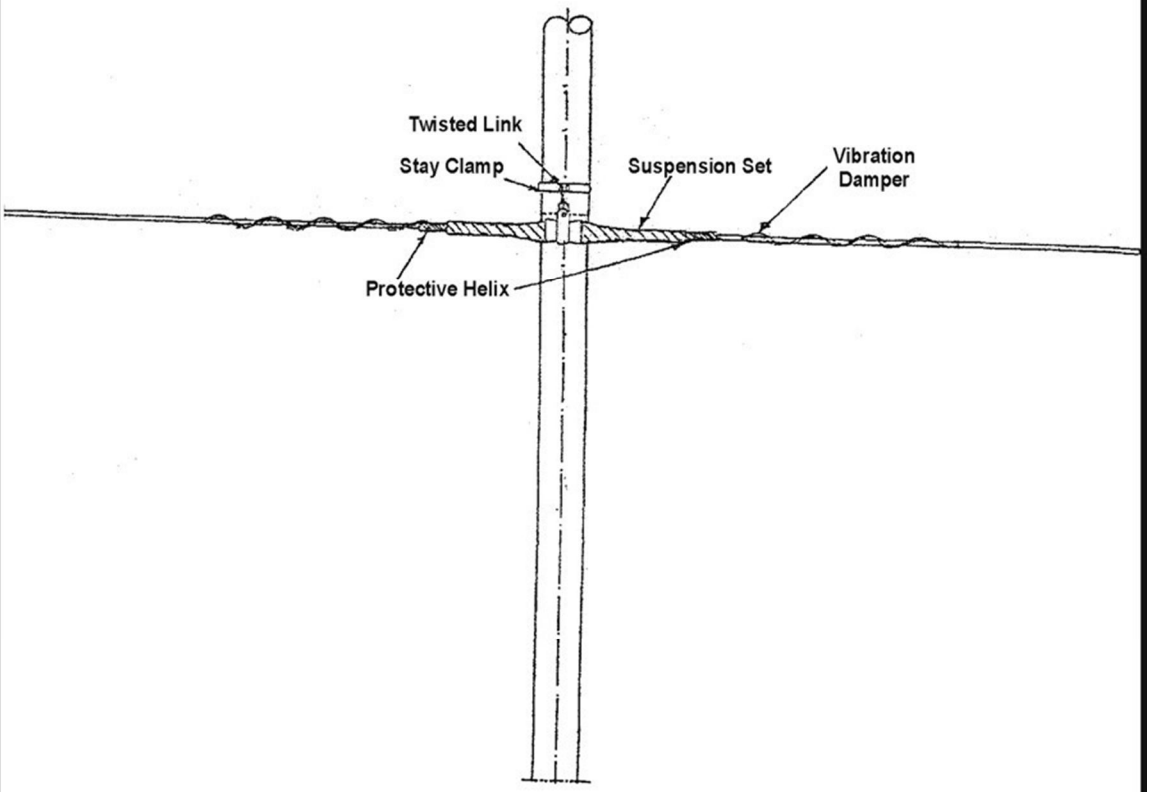
	DESCRIPTION	METERIAL	REF. Spec.	Qty.
1	CLAMP	MILD STEEL GALVANISED	IS : 2062	1 SET
2	BOLT & NUT M 16	MILD STEEL GALVANISED	IS : 1363	4
3	RIVET 16	MILD STEEL GALVANISED	IS : 2016	4
4	WASHER	MILD STEEL GALVANISED	IS : 2016	8
5	SPILT PIN	STAINLESS STEEL	IS : 549	8 SET

POLE COLLAR CLAMP (R)	
NOT TO SCALE	UNIT - MM

FIG - 5

11.11 OFC SUSPENSION FITTINGS:

Helically formed suspension fittings along with the elastomeric pads inserts strapped by a galvanized steel eye-band is used to hang from the twisted eye-link connected to a pole mounted stay clamp or on the tension hook (J-shaped) installed on the C bracket at the intermediate poles as shown in fig. 2.

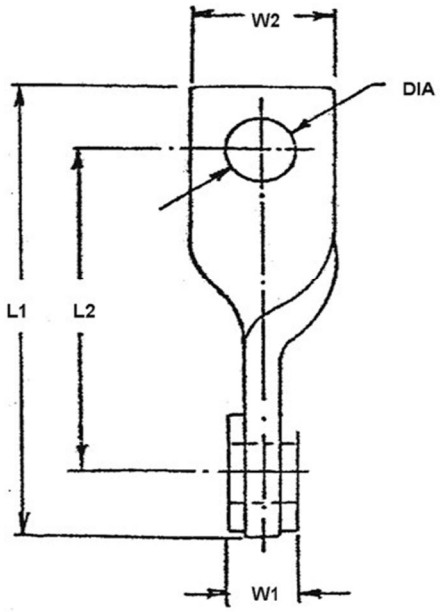


SUSPENSION POLE ASSEMBLY	
NOT TO SCALE	UNIT - MM

FIG - 2

11.12 TWISTED EYE LINK:

The twisted eye link is used for installing suspension fitting on stay clamp or on tension hook as shown in fig. 14.



DIMENSIONS IN MM

L1	L2	W1	W2	DIA
138	100	27	38	18

NOTE : TOLERANCE SHALL BE AS PER IS : 2102
(DETAIL AS PER GR, UNLESS UNTILL SPECIFIED)
HOT DIP GAVANISED AS PER IS : 2629

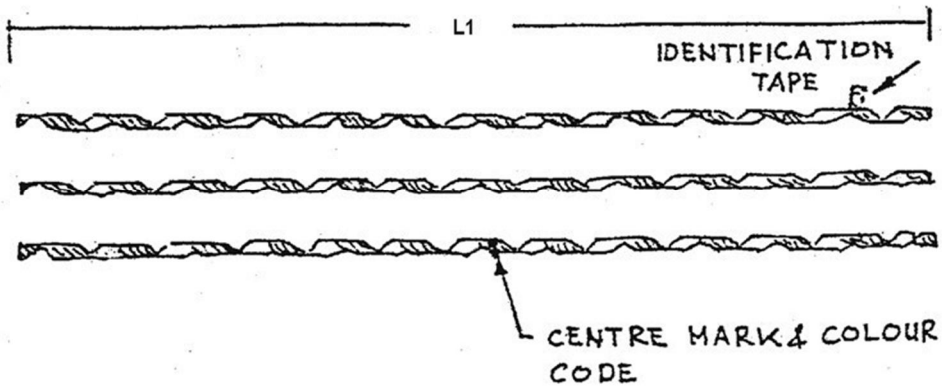
	DESCRIPTION	METERIAL	REF. Spec.	Qty.
1	LINK	MILD STEEL	IS : 2062	1

TWISTED EYE LINK	
NOT TO SCALE	UNIT - MM

FIG - 14

11.13 PROTECTIVE HELIX (S)

Set of aluminium alloy helically formed protective helix having predetermined spiral shape is used & making them conveniently applied on the optical Fiber cable without excessive clamping pressure at any point. See fig. 10.



FOR EXAMLE
DIMENSIONS (FOR CABLE SIZE, D - 14.4 MM)

I. DIA OF EACH WIRE - 3.2 ± 0.1
II. NO. OF SETS - 3
III. NO. OF WIRE PER SET - 5
IV. LENGTH OF HELIX - 1400

DIMENTION DETAILS FOR OTHER CABLE SIZE SHALL BE INDICATED BY THE MANUFACTURER INCLUDING THE PITCH OF HELIX

NOTE : ENDS OF RODS SHALL BE DEBURRED TOLERANCE SHALL BE AS PER IS : 2102 (DETAIL AS PER GR, UNLESS UNTILL SPECIFIED)

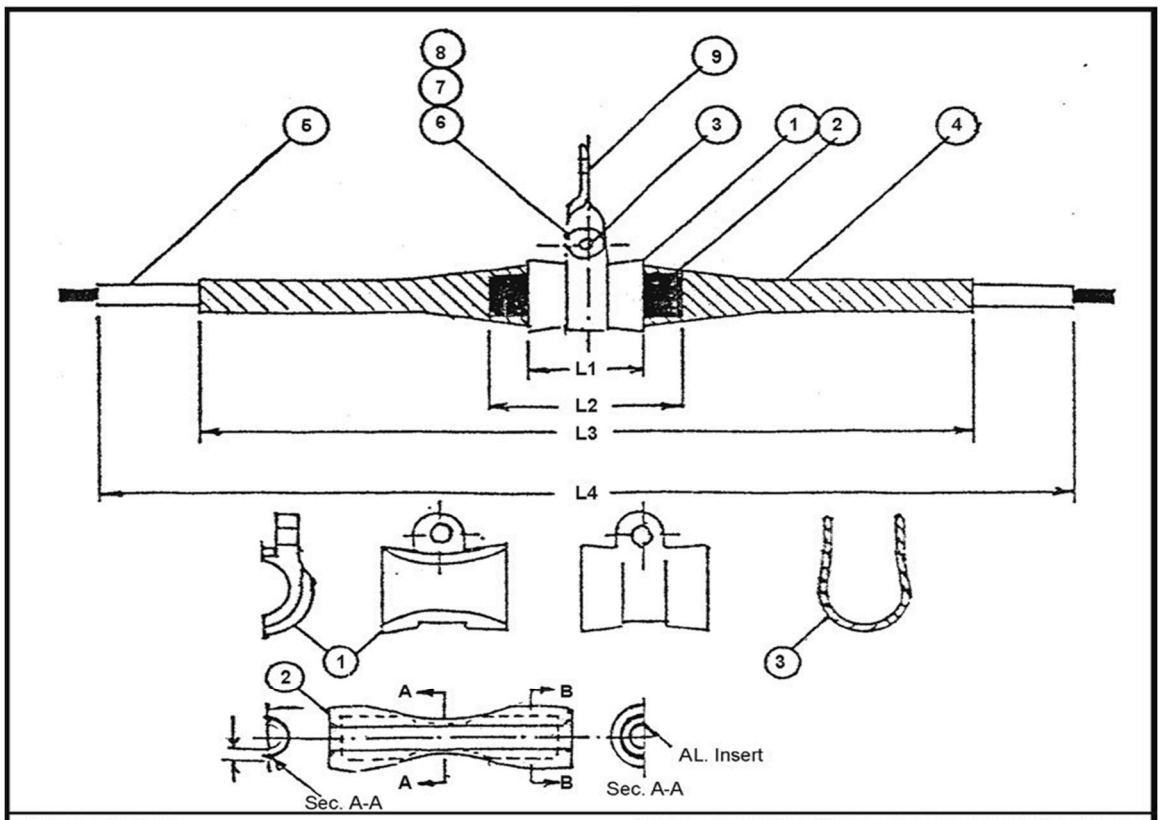
	DESCRIPTION	METERIAL	REF. Spec.	Qty.
1	PROTECTIVE HELIX	ALUMINIUM ALLOY 6061		

PROTECTIVE HELIX (S)	
NOT TO SCALE	UNIT - MM

FIG - 10

11.14 ARMOUR GRIP HELIX:

Set of aluminium alloy armour grip helix is used or fixing on the profile shaped elastomer pad for proper strut action, grip & bird caging as shown in fig, 3.



(FOR EXAMPLE)
DIMENSIONS :- CABLE SIZE - 14.4 MM DIA.

CABLE DIA	L1	L2	L3	L4	COLOUR CODE	DIA AGS.ROD
14.4	115	200	800	1400	BROWN	4.25± 0.1

NOTE :- DIMENSIONS FOR DIFFERENT CABLE SIZES TO BE DECIDED AFTER TYPE TEST APPROVAL
INSERT DIMENSIONS IN MM

INNER DIA.	AT - A - A 22	AT - B - B 22
OUTER DIA.	33	60

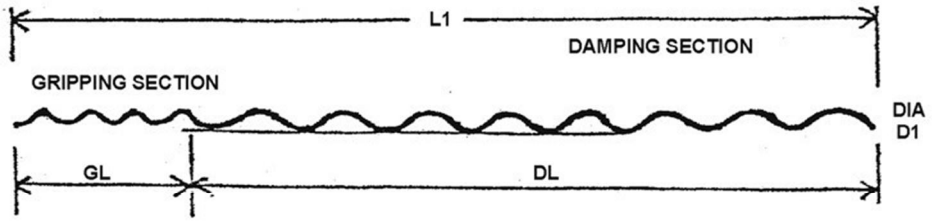
	DESCRIPTION	METERIAL	REF. Spec.	Qty.
1	CLAMP)	ALUMINIUM ALLOY GDC	1S : 617	1 SET
2	INSERTS) SUSPEN. CLIPPER	POLYCHLOROPRENE COMPOUDED	1 PAIR	1 PAIR
3	STRAP)	ALUMINIUM ALLOY	IS : 617	1
4	AGS HELIX	ALUMINIUM ALLOY 6061		1 SET
5	PROTECTIVE HELIX	ALUMINIUM ALLOY 6061		1 SET
6	RIVET M 16	MILD STEEL GAVLVANISED	IS : 2062	1
7	FLAT WASHER	MILD STEEL GALVANISED	IS : 2016	1
8	SPLIT PIN	STAINLESS STEEL	IS : 2549	1
9	TWISTED EYE	MILE STEEL GALVANISED	IS : 2062	1

ARMOUF GRIP SUSPENSION SET	
NOT TO SCALE	UNIT - MM

FIG - 3

11.15 SPIRAL VIBRATION DAMPER (SVD)

Helically formed spiral vibration dampers are used on both sides of suspension fittings as shown in fig. 13.



DIMENSIONS IN MM

L1	GL	DL	D1
1346	446	900	12±1

NOTE : TOLERANCE SHALL BEAS PER IS : 2102
(DETAIL AS PER GR, UNLESS UNTILL SPECIFIED)

	DESCRIPTION	METERIAL	REF. Spec.	Qty.
1	SPIRAL VISRATION DAMPER	POLYVINYL COKPOUNDED		

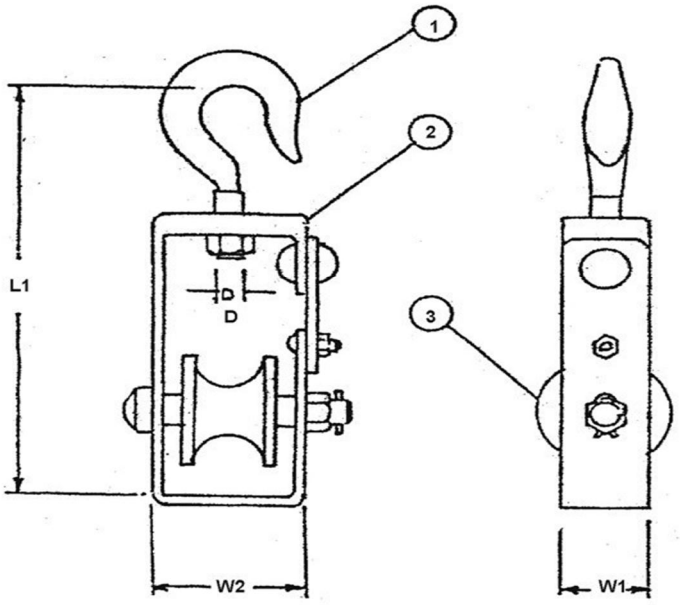
SPIRAL VIBRATION DEMPER	
NOT TO SCALE	UNIT - MM

FIG - 13

11.16 DEMOUNTABLE PULLEY:

Demountable pulleys are used during the installation of aerial optical Fiber cables see fig.16.

These are made from mild steel & the contour of the wheel is coated with rubber or any other suitable material for free movement of cable.



DIMENSIONS IN MM

L1	W1	W2	D
280	50	92	12

NOTE : TOLERANCE SHALL BE AS PER IS : 2102
(DETAIL AS PER GR, UNLESS UNTILL SPECIFIED)
FEFFOUS PARTS ARE HOT DIP GALVANISED AS PER IS : 2629

	DESCRIPTION	METERIAL	REF. Spec	Qty.
1	HOOK	GALVANISED STEEL		
2	BODY	GALVANISED STEEL		1 SET
3	SPOOL	ALUMINIUM COATED NEOPRENE		

DEMOUNTABLE PULLEY	
NOT TO SCALE	UNIT - MM

FIG - 16

12. Joint Enclosure and Splicing:

The ADSS cables would be required to be spliced at every joint, normally at a distance of every 2 kilometre. Splicing can be placed overhead or underground. The choice of placement of joint as overhead or underground buried would depend upon the field conditions & the decision of the executing agency based on the suitability as indicated below.

12.1 Overhead placement of joint:

i. The placement of joint overhead on the poles may be preferred choice of splicing in cases where power utilities are carrying out the work as most Power distribution companies may be more comfortable with aerial joint placement as compared to underground.

ii. The overhead joints shall be placed with proper mounting arrangements on the poles.

iii. Proper tool/arrangement should be made available during maintenance for overhead joints.

12.2 Underground buried joint (Wherever applicable):

i. Underground buried joint is an established and field proven practice and is being used by BSNL since very long.

ii. This would be safer and better suited methodology in cases where the workmanship of overhead joints may not be of desired quality and that chances of damage due to this may be higher.

iii. During maintenance, the handling of underground joints would be easier as compared to Aerial placement of joints.

13. Features

- Standard fiber count 24/48 F
- Universal type i.e. suitable for all type of cable (ADSS OFC, Armoured and metal free cable)
- Provide scope for straight / branch joints
- Resistant to chemicals and corrosive atmosphere.
- Easy re-entry and closing with mechanical plastic clamp.
- Shall be water and air proof.
- Ribs on the body for extra strength
- 6 Cable entry port & 1 oval port
- Suitable for cable size upto-30mm
- Mounting Bracket for erecting on pole vertically straight.
- Dome type

14. Dimensions

- Length-395mm ±5%
- Outer diameter-273mm ±5%

15. MATERIAL REQUIREMENT OF INSTALLATION ACCESSORIES AND FIXTURES:

15.1 FOR DOUBLE TENSION POLES:

DESCRIPTION	QUANTITY
1. J-shaped tension hook (For C-bracket)	2
2. Turn buckle	2
3. Extension link	2
4. Clevis thimble	2
5. Protective helix (T)	2 sets

6.	Terminating helix	2 sets
7.	Jumper cable clamp	
8.	a) Pole mounted stay clamp (Tubular)	1 (Pole having C-bracket)
	b) Pole mounted stay clamp (Tubular)	2 (Pole without C-bracket)
	OR	
	a) Pole mounted stay clamp (Rail)	1 (Pole having C- bracket)
	b) Pole mounted stay clamp (Rail)	2 (pole having C-bracket)

15.2 FOR SUSPENSION (INTERMEDIATE POLES)

	DESCRIPTION	**QUANTITY**
1)	a) Pole mounted stay clamp (Tubular)	
	b) Pole mounted stay clamp (Tubular)	
	OR	
	a) Pole mounted stay clamp (Rail)	
	b) Pole mounted stay clamp (Rail)	
2)	Twisted eye link	
3)	Suspension clamp consisting of the following:	
	i) Protective Helix (S)	1 set
	ii) Armour grip helix	1 set
	iii) Suspension clipper with Elastomer pad etc.	1 set
	iv) Spiral vibration damper	2
	v) J-shaped tension hook	1 (Pole with C-bracket)
4)	Demountable pulley section	One per pole in the splice

16. ENTRY OF THE O.F. CABLE IN THE BUILDING:

Normal methods for leading in and precautions recommended for leading-in of the optical Fiber cable should be followed. A conduit pipe should be laid for leading-in the O.F. cable.

Inside the building; the cable may also be taken directly from the nearby overhead pole to inside of the building for termination.

17. PREPARATION:

17.1 Before the installation the O.F. cable should be tested.

17.2 As per requirement install the additional new poles.

17.3 Each pole should be checked for its strength. Provide extra stays if more strength is required.

17.4 The Aerial O.F. Cable is recommended to be installed on the outermost hole of bracket towards road on the existing bracket/new bracket on the poles.

17.5 Replace weak and other poles for clear ground clearance and strength as per the field conditions.

17.6 Provide ground clearance of 12 feet in non-obstructing areas.

17.7 Raise the height to minimum 16 feet at all the road crossings.

17.8 Maintain the alignment as straight as possible.

17.9 Construct splice chambers.

18. SPLICE LOCATIONS:

For the cases, where field splices are to be buried underground, the cable should be brought down through a 40mm diameter GI pipe clamped on the pole. Proper bends (120-135 degree) are recommended for negotiating the bend. Wooden/hard rubber bushes shall be used at the entry and exit points of the GI pipe to avoid damage to the cable. A splice chamber as per the standard practice shall be made.

The selection of the splice point shall depend upon the availability of space and the cable length.

19. CALCULATION OF SECTION LENGTH:

Aerial O.F. cable is supplied as per TEC GR in a length of 2 Kms $\pm$ 10%.

To arrive at the section length and allocating a particular reel of the cable to a particular section following consideration are required.

20. SECTION LENGTH:

1) Actual section length measured.
2) Allowance for sag 2% for each span length.
3) Cable at each through tension pole (4 meters).
4) Drop length.
5) Extra spare cable for coiling at the splice location (10 meters).

21. INSTALLATION MATERIAL REQUIRED DURING INSTALLATION:

1. Demountable pulleys	:	1 each for each pole in the installation section
2. Jack for cable drum	:	1 set
3. Ladders	:	For each pole
4. Tools	:	Screw drivers C&T pliers Spanner set & hammer etc.
5. Manila rope 12 mm diameter	:	250 meters
6. Cable pulling winch machine with tension monitoring device	:	1
7. Anti-twist device	:	1
8. Cable pole fork	:	10
9. Flat twin open type cable grip	:	2

- Communication link to connect feeding, pulling and intermediate points.
- 40 mm 61 pipe, bends, bushes & clamps for fixing the pipe at the splice location.
- First aid box.

22. INSTALLATION OF AERIAL OPTICAL FIBER CABLE:

The following steps are recommended:

1. Install the accessories and fixtures as per the requirement of the individual poles it tension and suspension fittings.
2. Install the demountable pulley on all the poles in the section before pulling the cable.
3. Keep the cable drum over the jack near the 1st pole at the beginning of the section.
4. Attach anti twist device and the shackle hook along with the rope to the front and of the cable on pulling eye or on the cable grip. Carry the attached rope over the demountable pulleys for pulling the cable.
5. Depute one person at each pole to monitor and in case it is required to guide the cable over the demountable pulley during pulling operation.
6. The cable should be pulled till the cable reaches the last pole of the section.
7. Wherever in the pulling section; through pulling is difficult; half section or one fourth, action pulling method may be adopted by using figure of a techniques.
8. The feeding and pulling of the cable should be synchronized by using communication link. Care is required to be taken so that the cable is not accumulated at any one point during pulling operation and sharp bends are avoided.
9. Once the cable reaches the other end actual tensioning of the cable and fixing the installation of the accessories and fixtures shall be taken up with the help of cable pulling winch. The pulling tension must be monitored during tensioning.
10. Install the tension fittings and accessories at the 1st pole.
11. Fix a flat twin open type cable grip on the cable after tension pole for tensioning the cable in the preceding tension section.
12. The cable shall be tensioned to a tension of 1-3 to 1-6 times of the cable weight. The Sag shall be Monitored and kept between 0.25 to 0.5% of the span length.
13. The cable should be lifted between two poles by using cable pole fork during tensioning and fixing of the cable.
14. During the fixing operation the cable shall remain under required tension for minimizing the sag in the splice section.
15. Now install tension fitting and accessories at the all tensioned pole at the end of the tension section.
16. Install the suspension fitting and accessories on the intermediate poles in the tensioned section.
17. Similarly installation should be carried out in each tension pole in the entire section and the tension and suspension fittings are installed.
18. At the Through tension poles the cable shall be kept loose and shall be supported by cable jumper clamp.
19. At the end pole where the cable reel is kept; the cable to be taken through GI pipe (fixed to the pole) to the splice location in case of underground splicing.

20. Extra care for the aerial O.F. Cable may be taken at the bends and at entry and at the exit of the pipe. About 10 meters of cable shall be kept at the splice location for coiling (spare cable) and jointing requirement.
21. Test the installed OF Cable.
22. Coil the OF Cable and keep it safe in the splice location for splicing.

23. PRECAUTIONS:

1. Provide display boards.
2. Provide sufficient number of road sign and traffic cones.
3. Avoid sharp bending of the OF cable during installation.
4. The OF cable should not be given extra tension than the permissible tension limits.
5. While crossing the overhead electric installations, safety measures should be taken. Also provide guard wire.
6. To avoid man made damages, safety measures should be taken for each pole.

24. REFERENCE:

- TEC GR on Planning Guidelines and the Installation Practices for the installation of self-supporting metal-free Aerial optical Fiber cable.

25. ABBREVIATION:

Aeolian vibration: Wind induced (Aeolian) vibrations of conductors and overhead shield wires (OHSW) on transmission and distribution lines can produce damage that will negatively impact the reliability or serviceability of these lines.

C-Bracket
D-Dia of cable,
degree C : Degree Centigrade
EI : Engineering Instruction
OF cable : Optical Fiber Cable
SVD : SPIRAL VIBRATION DAMPER
TEC GR : Generic Requirements issued by the Telecommunication Engineering Centre New Delhi.

26. GUIDELINE FOR INSTALLATION OF ADSS AERIAL OPTICAL FIBER CABLE

1) Scope

This document is intended to provide guidelines for selection of appropriate methodology for aerial installation of ADSS optical Fiber Cable on Existing Electrical Poles of 33/11 KV Lines and LT lines as per the route map and network design.

2) Installation Techniques

The techniques used in installation of Aerial ADSS Optical Fiber Cables are described here. With the proper installation hardware and skilled resource, any of these methods can be used to install ADSS cable. Many a times, it will become necessary to use a combination of these methods to achieve full installation.

Selection of the specific technique (i.e. Moving Drum method, Stationary Drum method or Manual Installation method), or a combination thereof, shall largely depend on the actual site conditions. The PIA shall select the most appropriate installation technique suitable to the site conditions.

3) Moving Drum method

In this method the cable is pulled directly from the cable drum mounted on a moving vehicle as it

drives along the pole line. The cable drum must be mounted on a proper support to allow easy cable pay off. At the dead-end point, the cable is terminated using Termination Assembly sets and tensioned using turnbuckles to maintain cable sag within permissible value.

To start installation, park the vehicle with the cable drum approximately 15 - 20 meters away from the pole facing away from it down the pole line. The cable must pay off from top of the drum towards the rear of the vehicle.

Install the termination supports and temporary hooks on the poles at the starting point and subsequent poles. Pull off the necessary amount of slack, lift the dead-end to the top of the pole and mount on the termination assembly.

Once the cable is fixed at both ends with at the terminating assemblies, carry out tensioning. After the cable section is properly tensioned and secured at both ends lift the cable out of the hooks at each of the intermediate pole and support it with the suspension set assemblies.

4) Stationary Drum Method

In this method of aerial cable installation, the cable is pulled along the cable route through temporary support hardware. Stationery drum installation method requires installation of temporary support hardware such as pulley blocks.

A rope wound on the tension limiting winch is passed through the pulleys and connected to the cable on the drum installed on a stand which allows free rotation of the drum. The pulling load should normally not exceed 60% of the maximum permissible cable tension recommended by cable supplier.

The cable drum and winch locations must have vehicular access. The cable drum should always be placed on levelled ground so that its flanges are vertical thus avoiding rubbing of cable against flanges. The orientation should be such that the cable pay-off is directly in the direction of pull. Always pay-out the cable from top of the drum and not from bottom. The drum should have provision to allow controlled pay-out of cable. Cable pay-out needs to be controlled to prevent free running or jerking.

Once the cable is completely pulled end to end, it is then ready for installation of permanent supporting system of terminating and suspension set assemblies at required locations and tensioning for sag control.

5) **Manual Installation method**

Manual installation method technique is similar to stationary drum method, except that in this case the cable is uncoiled from the drum and placed on the ground in the shape of 8.

The pulling operation is same as in stationary drum method. The hardware requirement and pulling equipment also remains same.

For pulling in both directions, two loops of shape of 8 can be made and each can be pulled in separate directions. Loops of size 4 to 5m x 1.5m should be sufficient in most cases.

6) Installation of Accessories

6.1 Pole Clamp

Prior to fixing any temporary supports / stringing blocks or permanent cable suspension / termination assemblies, it is necessary to fix pole clamps. Appropriate type of pole clamps will be required depending on the shape of the pole. The two halves shall be opened and fixed at the specified height using tightening bolts.

6.2 Terminating (or dead End) Assembly

Termination assemblies are required at dead ends locations where:

i. Cable needs to be terminated at the end facility

ii. loops are to be kept for future maintenance activities

iii. For double sided termination assembly 2 sets would be required.

iv. To fix a termination Assembly following accessories are required:

v. Protective Helix on the cable,

vi. Terminating Helix with a thimble,

vii. Clevis Thimble,

viii. Spiral Vibration Damper

6.3 Suspension Assembly

ADSS optical Fiber cable shall be supported on all intermediate poles between two terminating poles using the pole clamp and a suspension assembly set.

To fix a suspension Assembly following accessories are required:

i. Protective Helix on the cable,
ii. Suspension Helix,
iii. Clevis Thimble,
iv. Spiral Vibration Dampers

6.4 Installation Cable Loop / storage / Joint Closure

Cable loops are to be provided for future maintenance purposes at regular spacing. A fixture is required to be installed. Excess cable is then wound & kept on support. The fixture provides a means to ensure Proper bend radius is maintained. Separate clamp is required for installation of Joint Closures.

6.5 Supporting Jumper Cable Clamp

Jumper cable hanging between a pair of Termination Assemblies installed at locations where there is sharp change in direction need to be supported with a special twisted link. To support jumper cable, use already installed clamp.

6.6 Cable Tensioning

After the required Length of cable has been placed, the cable shall be properly tensioned before it is permanently secured into suspension assemblies.
The temporary dead end should be installed 4 to 5 m from the pole so that after complete tension is applied, appropriate permanent termination assembly set can be installed while the cable is in tension. The chain hoist will also need to be tied to the pole directly using a sling and on to pole clamp.
Once the cable sanction are under the required tension and the sag is within limits (i.e. less than 1% of span), the ñfreeò end of the cable used for tensioning is fitted with termination assembly set and terminated. Once the load is transferred on to permanent termination end, the temporary arrangement shall be removed.

6.7 Machinery / Equipment / Tools

i. Ropes and Light weight ladder for installation of termination / suspension assemblies, clamps etc.
ii. Temporary supports, dynamometer, chain hoists, temporary dead ends steel cables, etc. required during cable laying and / or cable pulling and cable preparation kits, etc. as applicable will have to be arranged by the PIA.
iii. Van with portable splicing machines and OTDR, power meter, cable preparation kits, etc. for splicing and testing of installed ADSS Optical Fiber Cable.
iv. Other tools and tackles shall include wrenches, spanners, screwdrivers, hummer, ropes etc.
v. All safety equipment such as safety belts, insulating and cotton gloves and hard hats, fluorescent vests etc. as required.

Annexure B (2) –
Penalty for Deviation from Standard Engineering Instructions

Aerial Laying:

The pole installation and alignments will be recorded as per the Engineering Instruction. The Successful Bidders shall be required to provide all articles used for Aerial OFC laying. In case the Successful Bidder does not use any mandatory article, he shall be required to implement the articles mentioned in EI (as per Annexure B) and the payment will be not processed until the proper rectification has been completed.