APPROACH CABLE INSTALLATION AND HANDLING DOCUMENT

Introduction: -

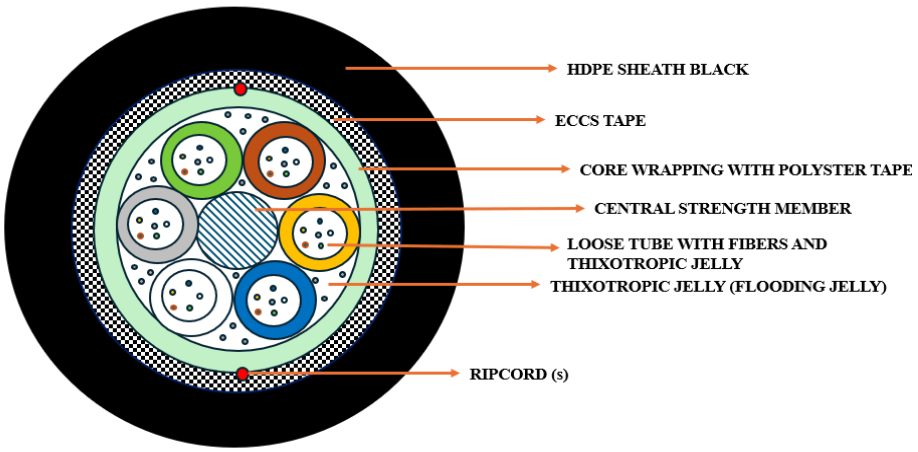
A fiber optic approach cable is defined as the Armored Underground fiber optic cable required to connect Overhead Fiber Optic Cable (OPGW) between the final in line splice enclosure on the gantry/ tower forming the termination of the fiber cable on the power lines and the fiber Optic Distribution Panel (FODP) installed within the building. The Supply and installation of optical fiber approach cable as required based on detailed site survey. The existing cable trenches/ cable raceways proposed to be used shall be identified in the survey report. Where suitable existing cable trenches are not available, suitable alternatives shall be provided after Employer approval. The approach cable shall be laid in the GI pipe in all conditions.

Overview: -

Optical fibers require special care during installation to ensure reliable operation. Installation guidelines regarding minimum bend radius, tensile loads, twisting, squeezing, or pinching of cable must be followed. Cable ends should be protected from contamination and scratching at all times. Violation of any of these parameters causes increased attenuation or permanent damage to the cable. Make sure you check the installation instructions of the module for the appropriate cable lengths to ensure proper operation.

Approach Cable Structure

Construction:



Technical Characteristics

Dimensions and Properties

Physical	Fibre Count	24 G652D	48 G652D	96 G652D
	No. of loose tubes	6	6	8
	No. of Fibre Per Tube	4	8	12
	Cable OD	11.5 ± 0.5 mm		13 ± 0.5 mm
	Nominal Cable Weight	130 kg/Km ± 10%		170 kg/Km ± 10%
	Operation Temperature Range	-30° C to + 70° C		-30° C to + 70° C
	Installation Temperature Range	-30° C to + 70° C		-30° C to + 70° C
	Transport and Storage Temperature Range	-30° C to + 70° C		-30° C to + 70° C
Mechanical	Max. Tensile Load	4.5 KN		4.5 KN
	Crush Resistance	3000 N/10 Cm		3000 N/10 Cm
	Minimal Installation Bending Radius	20 X OD		20 X OD
	Minimal Operation Bending Radius	10 X OD		10 X OD

HANDLING AND LAYING OF GI PIPE:

1. GI pipes shall be unloaded using a crane or any other suitable means with due care to prevent damage. The materials shall be handled properly and shall not be subjected to sudden impacts. All materials shall be adequately protected and stored at site until installation. GI pipes shall be stacked on level ground with adequate supports to avoid bending, deformation, or corrosion, and due care shall be taken to prevent any physical damage during unloading or movement.

2. GI pipes shall be transported and handled manually or mechanically without dragging on the ground. Proper lifting methods shall be adopted to avoid dents, bends, or damage to the pipe surface. Stacking and shifting shall be carried out in a controlled manner to maintain pipe integrity.

3. All necessary precautions shall be taken during handling to ensure the safety of both the material and the personnel. GI pipes shall be handled carefully to prevent slipping, rolling, or accidental impact. At all stages of handling and transportation, due care shall be taken to avoid damage to the pipe surface, ensuring its suitability for cable installation.

INSTALLATION PROCEDURE OF GI PIPE:

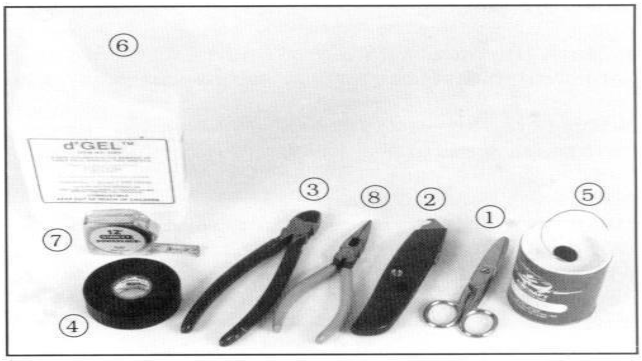
1. The trench shall be inspected prior to laying, and its bottom shall be smooth, clean, and free from stones or sharp objects. Where required, a 100 mm thick layer of sieved soil shall be provided as bedding, and the GI pipes shall be brought close to the trench and handled carefully to avoid damage.
2. GI pipes shall be placed carefully with proper alignment, avoiding bending, impact, or deformation. Adequate manpower shall be deployed, and dragging of pipes shall not be permitted.
3. Continuous inspection shall be carried out during laying to identify any damage or defects, and any damaged portion shall be replaced before completion of installation. The joints shall be executed using suitable threaded couplers & elbows, ensuring proper sealing, and necessary corrosion protection shall be provided at joints.GI flexible conduits shall also be securely connected to maintain continuity and protection of the cable.
4. After completion of laying, the continuity and integrity of the pipe shall be verified, and a suitable arrangement shall be made to facilitate subsequent cable installation.

PREPARATION FOR CABLE PULLING GRIP

1. Methods used for placing fiber optic cables in GI pipe are essentially. However, fiber optic cable is a high capacity data transmission medium which can have its communication characteristics degraded when subjected to excessive pulling force, sharp bends, and crushing forces. These losses may not be revealed until long after installation is complete. For these reasons extra care must be taken during the entire installation procedure.
2. Cable manufacturers install special strength members, usually aramid yarn, to absorb the stress of pulling the cable. Fiber optic approach cable should only be pulled by these strength members unless the cable design allows pulling by a grip on the jacket. Any other method may put stress on the fibers and harm them. Swivel pulling eyes should be used to attach the pulling rope or tape to the cable to prevent cable twisting during the pull.

3. A Cable pulling grip is installed on fiber optic cable to provide optimum load distribution during cable pulling. When correctly installed, the cable-pulling grip distributes the pulling force equally along the cable strength members. To prevent dangerous cable twisting during the pulling operation.

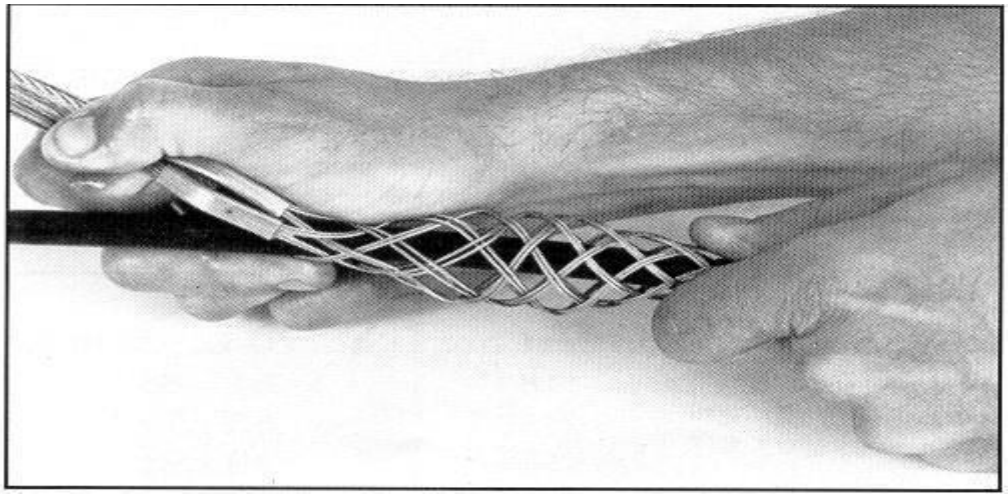
4. Tools and Materials Required
    - Scissors
    - Utility Knife/Hook Blade
    - Diagonal Pliers/Wire Cutters
    - Vinyl Tape
    - Stainless Steel Wire
    - Cable Cleaner or Approved Solvent
    - Tape Measure
    - Needle Nose Pliers



5. Prior to installation, the proper size grip must be chosen for the cable to be pulled. Grip selection is based on cable inner-outer jacket diameter. Generally, use the smallest grip that will fit over the inner jacket without excessive difficulty. Measure the cable inner jacket diameter and determine the proper grip.

- Remove 1.25 meters (48 inches) or outer sheath exposing the polyethylene jacketed cable core. The length removed depends on pulling grip and should be roughly the length of the grip plus 12-16 inches.
- Mark the outer sheath 48 inches from the cable end with a piece of PVC tape or marking pen.

- Ring cut the outer jacket and armor at the tape mark with utility knife or hook blade.
- Flex the cable to completely server the jacket and armor sheath. Remove the cable sheath carefully.



- Slide the grip over the end of the cable core and push the cable out through the tape of the mesh leaving about 12 inches of core exposed. (Figure 4)

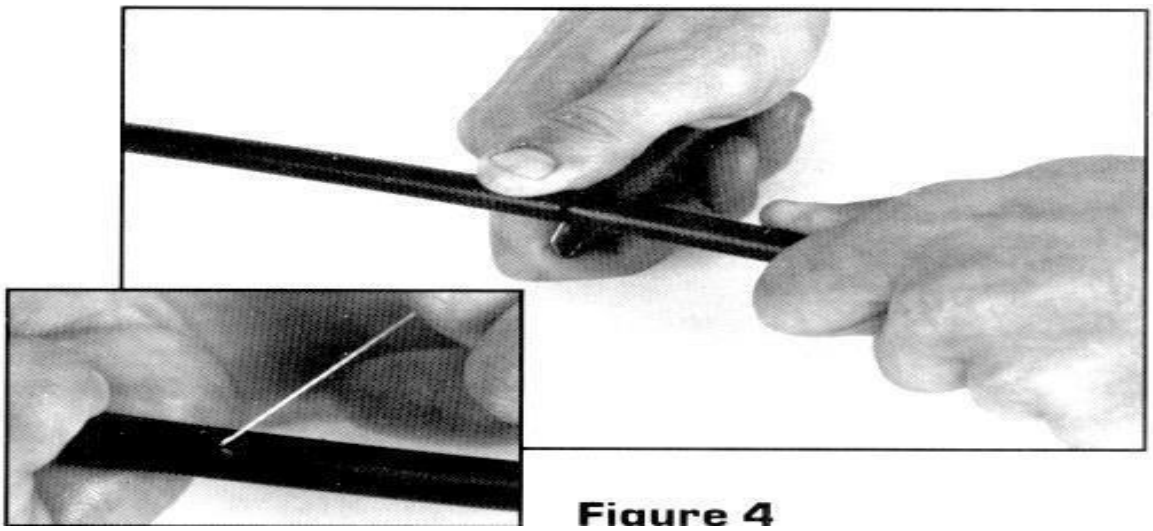


Figure 4

- Remove approximately 12 inches of cable inner sheath from the cable end Cut away all cable Components except the yellow aramid yarn. (Figure 5)

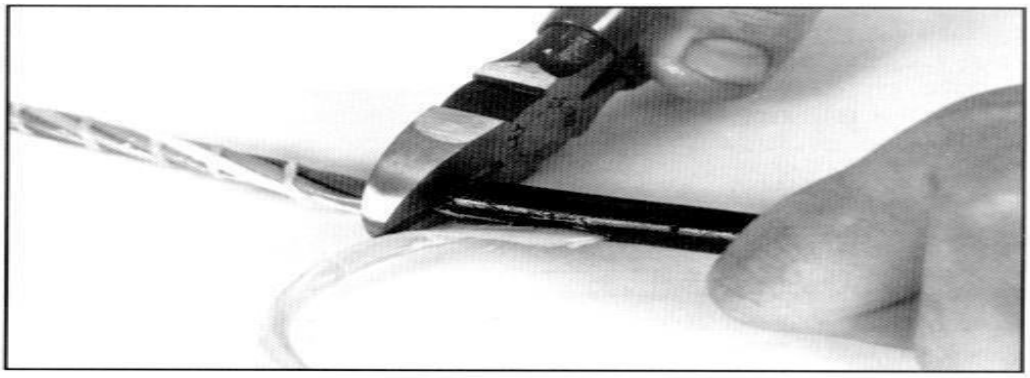


Figure 5

- Secure the yarns to the inner loop of the pulling grip using a square or bowknot. The yarn should be the same length as the pulling grip to insure that pulling forces are equally distributed. (Figure 6)

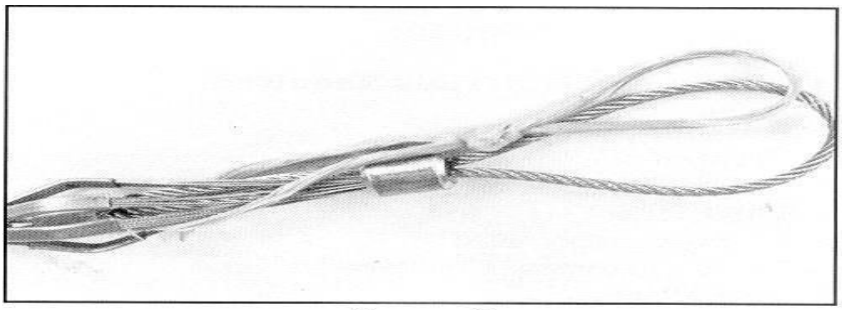


Figure 6

- Adjust the grip position on the inner sheath such that the wire mess section is completely over the cable. Anchor the grip into position by binding with stainless steel wire. (figure 7)

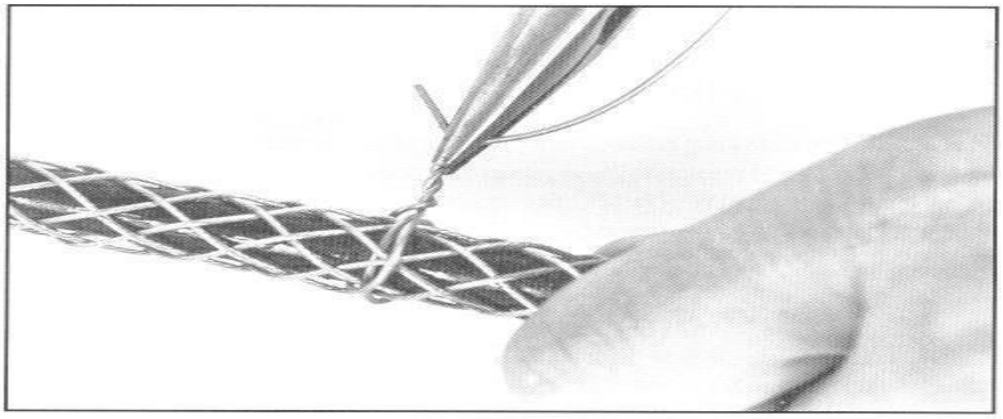
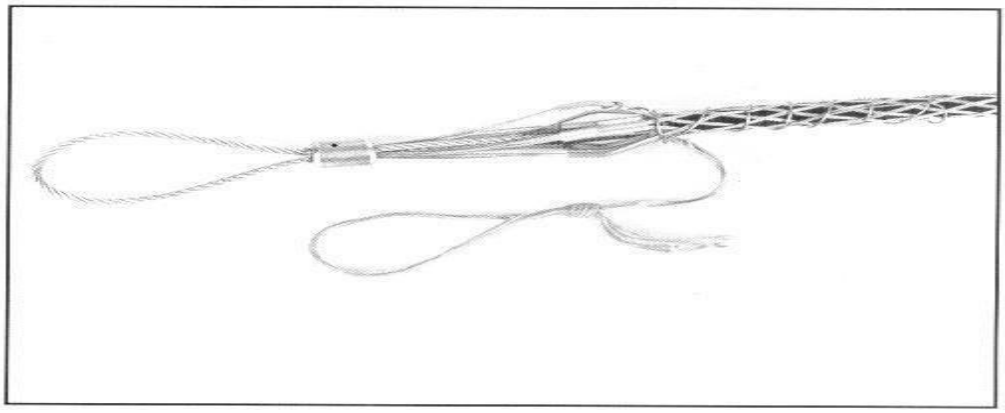
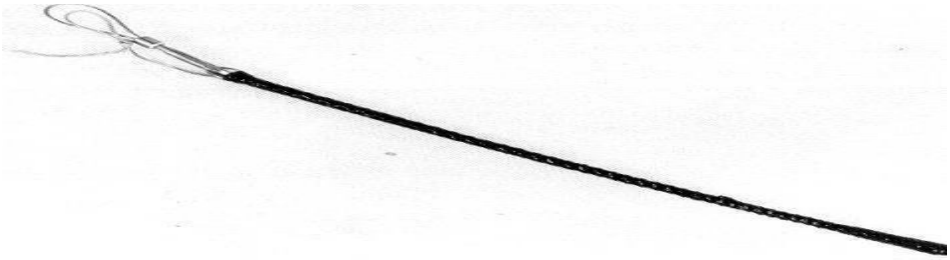


Figure 7

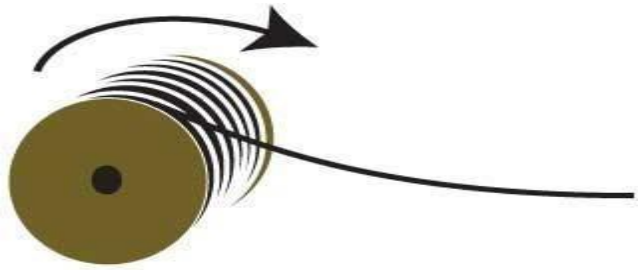
- Place PVC tape over the entire grip and over the junction of the outer sheath to inner sheath. The transition from inner to outer sheath should be smooth. Additionally, the grip ribbing and wire should not be exposed below the tape. The spiral wrap tape should lay from the pulling grip toward the cable to insure smooth pulling. (figure 8)



- Place PVC tape over the entire grip and over the junction of the outer sheath to inner sheath. The tape should lay from the top of the pulling grip toward the cable to insure smooth pulling without snags.
- If applicable, secure the aramid yarns to the inner loop of the pulling grip using a square or bowknot. The yarn should be the same length as the pulling grip to insure that pulling forces are equally distributed.



6. Cables should not be pulled by the jacket unless it is specifically approved by the cable manufacturers. These grips are usually tied to the strength members also. Tight buffer cable can be pulled by the jacket in premises applications if a large (~40 cm, 8 in.) spool is used as a pulling mandrel. Wrap the cable around the spool 5 times and hold gently when pulling. Do not exceed the maximum pulling tension rating. Consult the cable manufacturer and suppliers of conduit, innerduct, and cable lubricants for guidelines on tension ratings and lubricant use. If possible, use an automated puller with tension control and/or a breakaway pulling eye. When laying loops of fiber on a surface during a pull, use “figure-8” loops to prevent twisting the cable.
7. Twisting Cable :- Do not twist the cable. Twisting the cable can stress the fibers. Tension on the cable and pulling ropes can cause twisting. Use a swivel pulling eye to connect the pull rope to the cable to prevent pulling tension causing twisting forces on the cable.



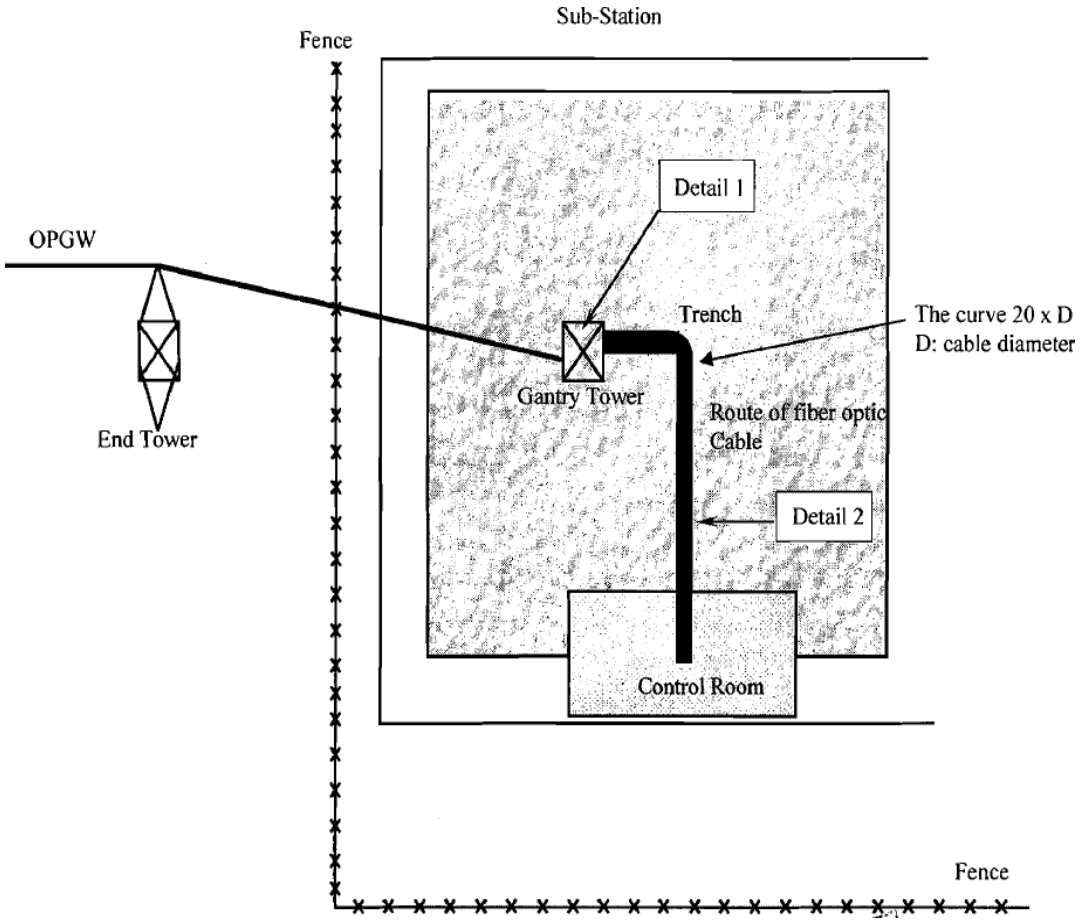
Roll the cable off the spool instead of spinning it off the spool end to prevent putting a twist in the cable for every turn on the spool. When laying cable out for a long pull, use a "figure-8" on the ground to prevent twisting. The figure 8 puts a half twist in on one side of the 8 and takes it out on the other, preventing twists.

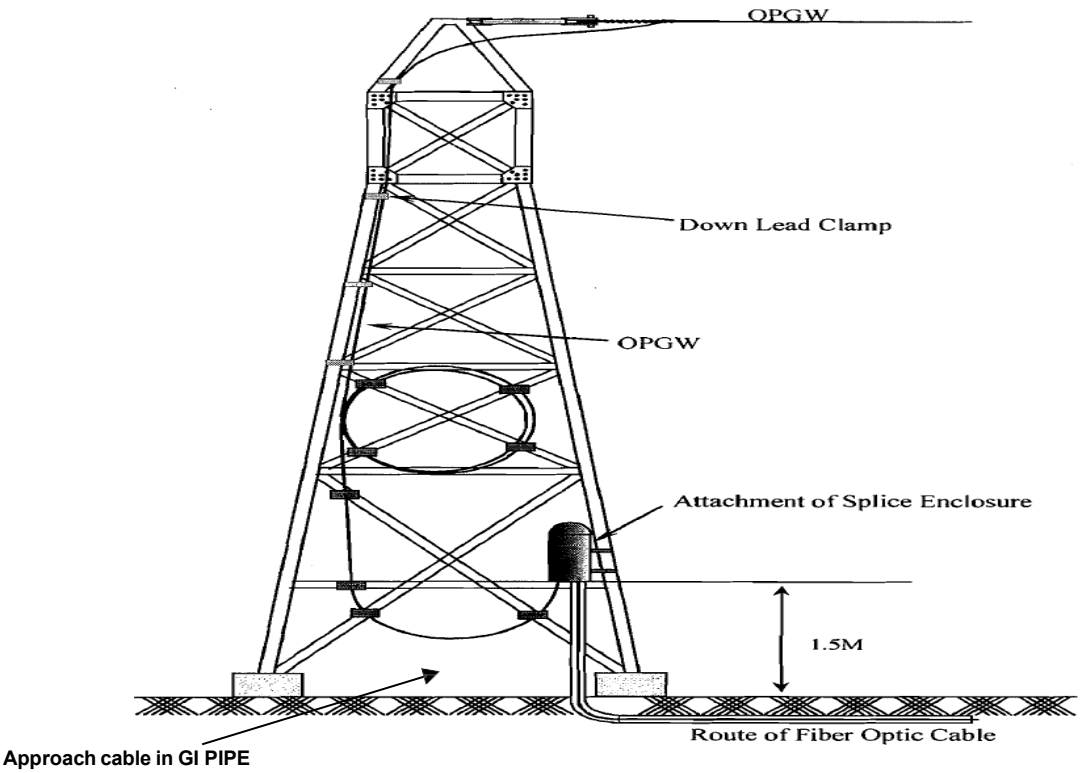
PROCEDURE FOR PULLING OF OPTICAL FIBER CABLE:

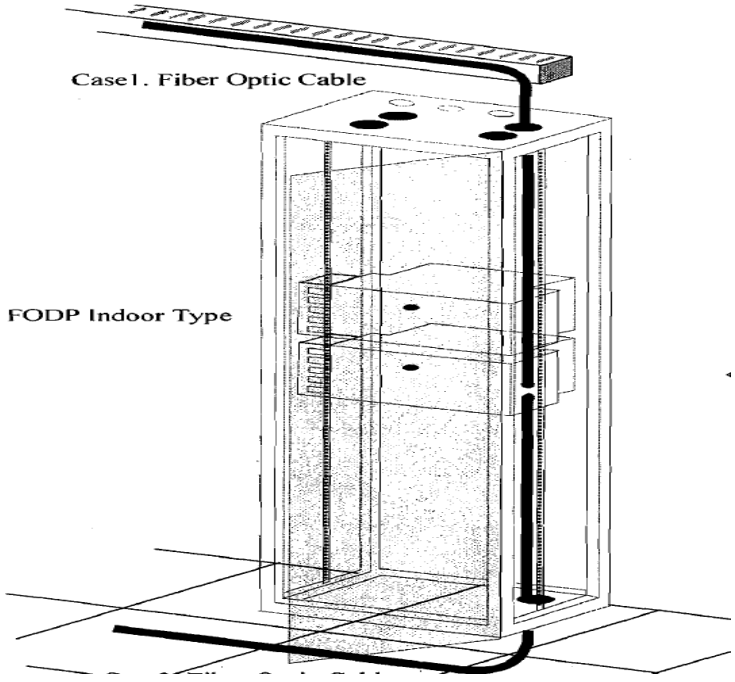
1. Use pulling grip designed for pre-connected fiber optic cables. Grips with a fixed pull ring should use a swivel to attach the pulling rope.
2. Monitor pulling tension. Do not exceed the maximum pulling load rating. On long runs, use proper lubricants and make sure they are compatible with the cable jacket. On really long runs pull from the middle out to both ends. If possible, use an automated puller with tension control or at least a breakaway-pulling eye.
3. Always use a straight pull. Use cable guides to maintain the recommended bend radius. Do not exceed the cable bending radius otherwise it will harm the optical fibers. It may not be immediate but it may even take a few years but eventually by exceeding the recommended bending radius of the cable you reduce life of the cable.
4. Do not twist the cable; putting a twist in the cable can stress the fibers.
5. Roll the cable off the spool. Use the device to aid in uncoiling long cables. Do not spin it off the spool end. This puts a twist in the cable for very turn on the spool. Figure 8 for a long pull. If you are laying cable for a long pull, use a figure 8 on the ground to prevent twisting.

6. Bend Radius: - Do not exceed the cable bend radius. Fiber optic cable can be broken when kinked or bent too tightly, especially during pulling. If no specific recommendations are available from the cable manufacturer, the cable should not be pulled over a bend radius smaller than twenty (20) times the cable diameter. After completion of the pull, the cable should not have any bend radius smaller than ten (10) times the cable diameter.
7. Vertical Cable Runs: - Drop vertical cables down rather than pulling them up whenever possible. Support cables at frequent intervals to prevent excess stress on the jacket. Support can be provided by cable ties (tightened snugly, not tightly enough to deform the cable jacket) grips. Use service loops can to assist in gripping the cable for support and provide cable for future repairs or rerouting.

The route for the fiber optic cable and FODP Lay out in control room. Planned route for approach cable at switchyard of sub-station







Gantry Tower in Sub-station

FODP (Fiber Optic Distribution Panel in Control Room

Protect cables from excessive or frequent bending. Routing on a cabinet door should be used as a resort and special care must be taken to protect the cable and avoid exceeding the bending radius of the cable.
When routing the cable proper pulling techniques should be used earlier in this manual. When attaching cables with clamps use plastic clamps with large surface areas and avoid pinching or squeezing cable. Cable should be installed manually with gentle pressure.

Cleaning Fiber Optic Connections

We recommend always keep dust caps on connectors, bulkhead splices, patch panels or anything else that is going to have a connection made with it. Not only will it prevent additional dust buildup, but it will prevent contamination from being touched or damaged from dropping.

When testing, we recommend that connectors on both the reference and tested cables be cleaned before every test, as every time the connector is exposed to air, it can accumulate dust.