



PROFESSIONAL GUIDELINES FOR  
**LAYING OF CABLES**

Handling | Storage | Installation

  
**POLYCAB**



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## 1 PRE INSTALLATION

### 1.1 Cable Inspection

- The cable marking or label shall be checked against the size/type of cable to avoid possible labeling/marking errors by the packers and also the cable selected is proper for designed application.
- While opening the packing, a careful watch should be made to ensure tools used in opening do not damage the layers of cable.
- The cable has not been damaged in transit or unloading or storage.

### 1.2 Cable Damages in Transit

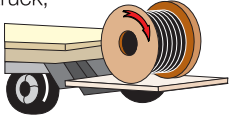
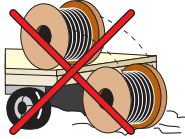
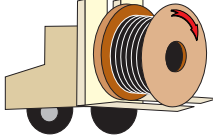

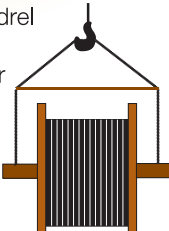

Transit Damage is a common problem which occurs during unloading /shifting of cable drums or during transshipment by transporter. Damages in factory generally do not occur as drums are packed with wooden planks and handled using overhead cranes / forklifts. To identify any such damage to cable drum and cable :

- Inspect visually every cable reel against transit damage such as packing, damage before accepting the shipment.
- Be particularly alert for cable damage if : I) A reel is lying flat on its side II) Several reels are stacked one over the other III) Other freight is stacked on a reel IV) Cable drums are without wooden planks or broken.
- A cable end seal is removed or damaged.
- Mechanical damages can cause: I) Tearing of Outer Sheath II) Bending / breakage of armour wires/ strips III) Damage of insulation
- If there are only small sheath damages and armour is found intact the cable can be considered for use, after doing necessary repair on sheath and testing the cable for High Pot test or insulation tests (Meggar test)
- If the test results of insulation resistance is found very less (Phase conductor to armour short) , the cable shall be cut at that portion and the two pieces are to be again tested. Cable lengths with good megger values can be taken for jointing and charging.
- In case of doubtful test results or major damages please refer the matter to Polycab Customer care cell. (customercare@polycab.com)

### 1.3 Cable Handling & Storage

- Great care is taken in the manufacturing of cable to ensure quality at every stage.
- Handling of cable at site is the next important factor to ensure that by mishandling the cable , the outer sheath and insulation shall not get damaged.

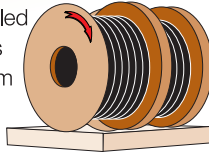
The handling is generally carried out by unskilled or semi-skilled men, strict supervision should be maintained so that the cables, which can be very easily damaged, is handled with great care.

DO	DON'T
<p>When off loading reels from a truck, lower reels carefully using a hydraulic gate, hoist or forklift truck.</p> 	<p>Never drop reels. If reels must be rolled, roll in opposite direction of the cable wraps to keep cable from loosening on the reel.</p> 
<p>If a forklift is used for handling and shifting the cable drum, the forks shall approach the reel from the flange side. The forks shall be positioned such that the reel is lifted with both reel flanges.</p> 	<p>Do not allow the lift forks to contact the cable. Care must be taken by the forklift operator not to make sudden turns or stops.</p> 
<p>When using a hoist, install a mandrel through the reel arbor holes and attach a sling. Use a spreader bar approximately 6 inches longer than the overall reel width placed between the sling ends just above the reel flanges.</p> 	<p>This may lead to the bending of the reel flanges and mashing the cable.</p> 

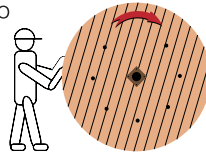
### DO

It is always safer to use a strong and well-drained surface for storing drums. If possible, the drums should be raised from the ground by the insertion of wooden planks, etc, below and on both sides of the drums : some check pieces should be placed so as not to allow the drums to be rolled loosely and easily. Cable drums should also be stored away from the direct sun and rains.

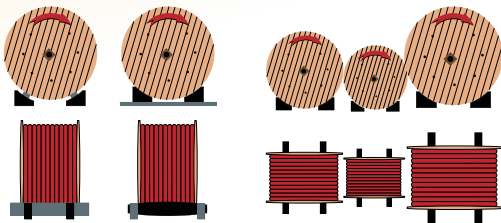
Reason : Direct sunrays can cause deterioration due to UV rays and rain can cause damage to wooden drum, resulting drum collapse after few months.



Always use proper stoppers to prevent the drum from rolling.



Ensure stoppers for every drum, to prevent mishaps during storage. Place the wedges by the flanges/full width of the drum



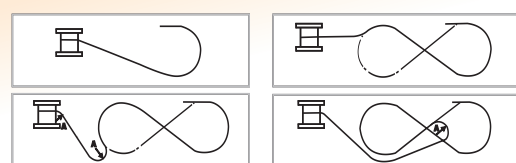
During transportation, fasten drums to the base through the central hole.



Use a winch, forklift or makeshift ramp.



### On The Ground Cable can be Flaked in a Figure of Eight Formation

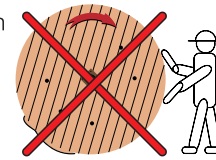


### DON'T

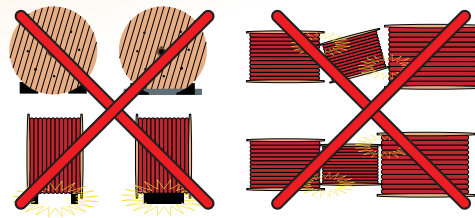
Multiple reels stacked on top of each other ("Pancake" storage) is not recommended for cable drums. The weight of the stack can total thousands of kgs. creating an enormous load on the bottom reel. Also, damage to the reel and/or cable will likely occur when the reel is flipped for transit. A concentration of stress on the reel flange may cause it to break and subsequently damage the cable.



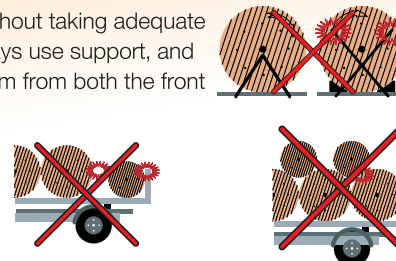
When rolling in the direction of the arrow, never roll for more than 5 metres. Otherwise the cable may become unfit for use.



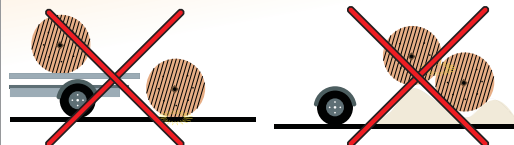
Allow the drums to roll at any cost. Stack the drums on non-triangular/non-square wedges .



Fasten without taking adequate care. Always use support, and tie the drum from both the front and rear.



Allow one drum to strike another.



### Do Not Attempt "coiling" Of Cable On The Ground



Note: R Minimum Permissible bending radius of cable.





## 2 INSTALLATION & LAYING

### 2.1 Unreeling (Cable Pulling)

- For unreeling cable from a drum it should be mounted on cable jack. The drum should be lifted above the ground with clearance of 50-100 mm so that while unreeling the drum flanges should not touch the ground and get damaged.
- The drum should never be kept flat on its side on the ground and the cable unreeled in coil from the same. This invariably leads to Kinking and bird-caging.
- "Bird-Caging" is a defect caused due to twist of cable during wrong unreeling. It results outersheath crack or cuts and armour swelling. Photograph of birdcaging.



- The technique of pulling cables is also an important, sub-standard and haphazard handling can cause damage to the cable which may weaken the cable components, and cause a failure in due course. Care must be taken to select a suitable position for the cable drum jacks in order to ensure that the drum may be raised and rotated with full safety. The jacks should therefore be placed on a firm support of thick boards.
- Care should be taken to exert a steady pull avoiding any jerks. Twisting or kinking of cable is very dangerous as this may cause damage to the small size of cable conductors, insulation and sheath, shifting and knife-edging of the armouring and damage to the serving, etc. Care should be taken to avoid short bends and consequent straining of conductors.
- Proper handling of cables is very important both for safety as well as long life of the installation.
- The most common causes of cable failure are due to mishandling of the product at installation stage
- This can be prevented by unwinding the cable by loading the drum on jacks & pulling in the proper direction with stocking or pulling eye.
- For pulling longer lengths and higher diameter of cables Pulling Eyes can be used..
- In case of smaller lengths, pulling is carried out by manual labour and when the length is longer by means of winches or other mechanical means.
- While pulling with a rope, care is necessary to avoid bending of the cable a close watch should be maintained to ensure the cable runs freely over the cable rollers and passes smoothly without rubbing against any surface.

#### Recommended Minimum Bending Radius For HT Cables / LV Cables / Single Core Unsheathed.

HT Cables:	Single Core : 20 x D	Multicore : 15 x D
LV Cables:	Single Core : 15 x D	Multicore : 12 x D
Single Core Unsheathed:	Single Core : 8 x D	(Where D= Diameter of cable in mm)

#### Recommended Safe Pulling Force With Stockings

- For Unarmoured Cable :  $P = 5 D^2$  (Where P=Pulling force)
- For Armoured Cable :  $P = 9 D^2$  (Where D= Diameter of cable in mm)

#### Recommended Safe Pulling Force When Pulled With Pulling Eye

- For Aluminium Conductors : 30 N/mm<sup>2</sup>
- For Copper Conductor : 50 N/mm<sup>2</sup>

**Do not hammer metallic objects like nail on the cable for fixing it. This leads to direct shorting and failure of cable.**

## 2.2 Special precautions for unreeling and installation of Helogen free low smoke sheathed cables.

Cables having Low helogen polymer (LSOH) sheath needs to be handled with more care during installation. While special additives are used in formulation of LSOH compound to give the typical flame retardant characteristics of Zero halogen polymers some mechanical properties deteriorate. The following basic precautions are necessary:

- Cables should not be exposed to sunlight for considerable period before installation. i.e. the temperature of cable sheath should be below 40o celsius.
- Preferably installation shall be done when the ambient temperature is +5 Deg.C to 30 Deg.C,
- Unreeling at low temperature below 5 Deg.C and High temperature above 40 Deg.C. can cause sheath crack at bends.
- Wire/ Rope should not be used directly on the cable sheath for pulling.
- When pulled on cable trays/or any uneven surface, special attention is needed to welding or unusually rough terrains.
- Rollers and bends should not have any sharpness which may damage sheath.

## 2.3 Laying Methods

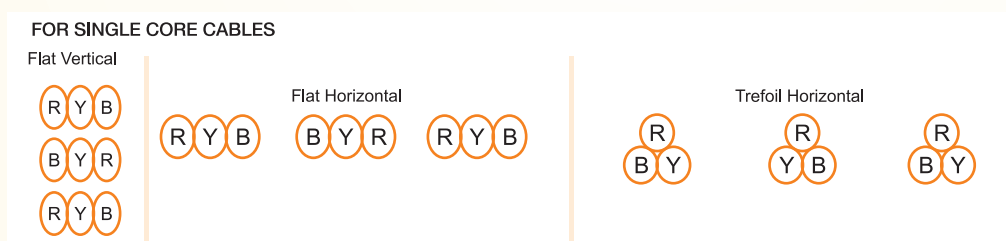
For more details refer IS 1255 . for Indian conditions and detailed catalogue of manufacturer.

### Single Core Cables — Installed in Parallel

The Following rules must be observed.

- Cable should have the same cross-sectional area.
- Cables should have the same type & construction.
- They should follow the same path.
- They must be of the same length substantially.
- They cannot be made to operate individually.
- They must not include any branch circuits along their route.

Cable pertaining to the same phase should be as far as practicable alternated with those cable of the other phase so that unequal division of current is avoided For three single core cables per phase, the correct dispositions are:



## 2.4 Bonding Methods :

### Multicore cables.

- All multicore cables shall be bonded with both end bonding, as the phenomenon of circulating current and sheath voltage is related to single core cables only.

### For Single core cables: Single point bonding

- Screens connected and earthed at one end.
- No closed circuit, hence screen circulating current is eliminated.
- Normally used for long route lengths (above 1.2 kM). ‘
- The maximum allowable sheath voltage shall be 65 volts, for cables with single point bonding.

### Both end bonding

- Cable screen bonded and earthed at both end.





- Results circulating current in cable which is directly proportional to current carried by conductor.
- No Sheath voltage
- Losses can be minimized by laying cable in TREFOIL formation.

## 2.5 Lugs & Glands

- It is seen as a practice of few of the users that they insert the conductor in the lugs or the cable inside a gland and if found loose they complain that the conductor/cable is undersized
- Cables of same size has so many types of conductor constructions with which the OD can vary to great extent i.e. cables with round stranded conductors, bunched conductors, compact and shaped conductors etc.
- Sector shaped conductors and compact round conductors are the types which have minimum possible conductor diameter. When cables are made with this conductors the OD will be minimum.
- When such Conductors are used for making XLPE insulated cables, the OD will be further reduced as the thickness of XLPE insulation is further less than that of PVC.
- In such cases it may experienced that lugs and glands etc are much loose to the conductors/ cables.
- This practice is not the method to asses the size of the conductor or cable. Capacity of the conductors can be confirmed by measuring conductor resistance of the cable.

## 3. SITE TESTING

### Recommended procedure for testing cables at site after laying and commissioning.

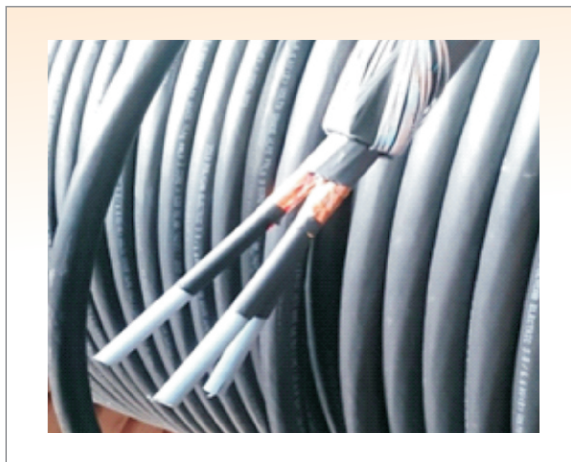
1. The cables shall be visually checked for any handling damages.
2. After unreeling the cables from drum and laying it to the desired location, prepare both the ends of cables for testing.
3. Remove approx 300 - 400 mm length of outer covering PVC Sheath Armour, Bedding etc., separate the cores and remove conductor insulation for applying the voltage.
4. For cables up to 1000 volts rating, Insulation resistance shall be measured with 1000 volts megger and values of each core shall be recorded. These values shall not differ from each other more than 10% to 15%.
5. For cables 6.6 kV and above - DC High voltage testing shall be carried out before making terminations in order to find any laying / handling damages.
6. For screened cables, the copper screen, semi-conducting layers shall be removed approximately 150 mm, from both ends of the cable.

The demo is as below :

LV Cable



HV screened cable



Following Test / Test Voltages shall be applied:  
 Test requirements after installation (Before Charging)\*\*

Sr. No	Voltage Grade of cable	Insulation Resistance Test (Megger Test)	Observation	HV test * (HV DC Test )	Remarks
1	Up to 1,1 kV	1000 Volts	Values of each core /Armour and core to core shall be recorded.	Not Recommended	Core to armour IR values shall be generally same for all cores tested for the cable drum or length.
2	3,3 kV and 3,8/ 6,6 kV	2,5 kV	Values of each core to screen or armour and core to core shall be recorded.	5kV for 3,3 kV and 10,5 kV for 6,6 kV Cable. Duration 15 Minutes	Core to screen/armour IR values shall be generally same for all cores tested for the cable drum or length. And shall withstand HV test.
3	6,35/11 kV	5 kV	Values of each core to screen or armour and core to core shall be recorded.	18 kV Duration 15 Minutes	Core to screen/armour IR values shall be generally same for all cores tested for the cable drum or length. And shall withstand HV test.
4	11/11 kV	5 kV	Values of each core to screen or armour and core to core shall be recorded.	30 kV Duration 15 Minutes	Core to screen/armour IR values shall be generally same for all cores tested for the cable drum or length. And shall withstand HV test.
5	12,7/22 kV	5 kV	Values of each core to screen or armour and core to core shall be recorded.	37,5kV Duration 15 Minutes	Core to screen/armour IR values shall be generally same for all cores tested for the cable drum or length. And shall withstand HV test.
6	19/33 kV	5 kV	Values of each core to screen or armour and core to core shall be recorded.	60 kV Duration 15 Minutes	Core to screen/armour IR values shall be generally same for all cores tested for the cable drum or length. And shall withstand HV test.

\* DC HV Test voltage as per IS 1255. \*\* for Cables above 33 kV ,Please refer manufacturers Data sheet or specific guidelines.

\*\* The cables should be preferably tested before charging to avoid any damages in time interval of laying & charging.

\*\*\* In some cases VLF Testing (A.C. HV Testing) is also recommended.

\*\*\*\* After DC test, the conductor of cable shall be earthed for 2 minutes or for a suitable time in order to remove any residual charge for the XLPE Insulation.



#### CORPORATE OFFICE

POLYCAB WIRES PVT.LTD.

Polycab House, 771, Pandit Satwalekar Marg, Mahim (W), Mumbai 400 016.

Tel. : 91-22-2432 7070 - 4, 6735 1400 • Fax : 91-22-2432 7075

Website : [www.polycab.com](http://www.polycab.com) • E-mail : [enquiry@polycab.com](mailto:enquiry@polycab.com)

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