



SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

UNIT 4 – Analysis of Insulators and Cables

CABLES



CONTENTS



– Cables

- Types of cables
- Parameters of cables
- Grading of cables
- Power factor and heating of cables
- Capacitance of 3 – core belted cables
- DC Cables

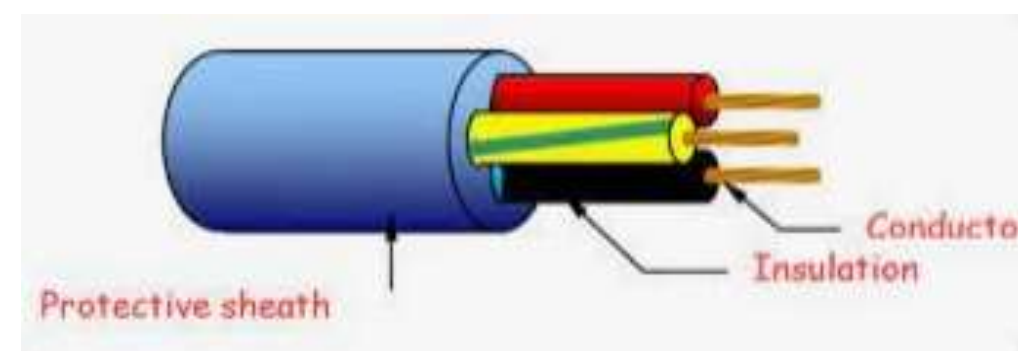


CABLE



A conductor or group of conductors for transmitting electric power or telecommunication signals from one place to another.









Electrical cables consist of a core of metal wire offering good conductivity such as copper or aluminum, along with other material layers including insulation, tapes, screens, armoring for mechanical protection, and sheathing.





CABLE – COLOUR CODE

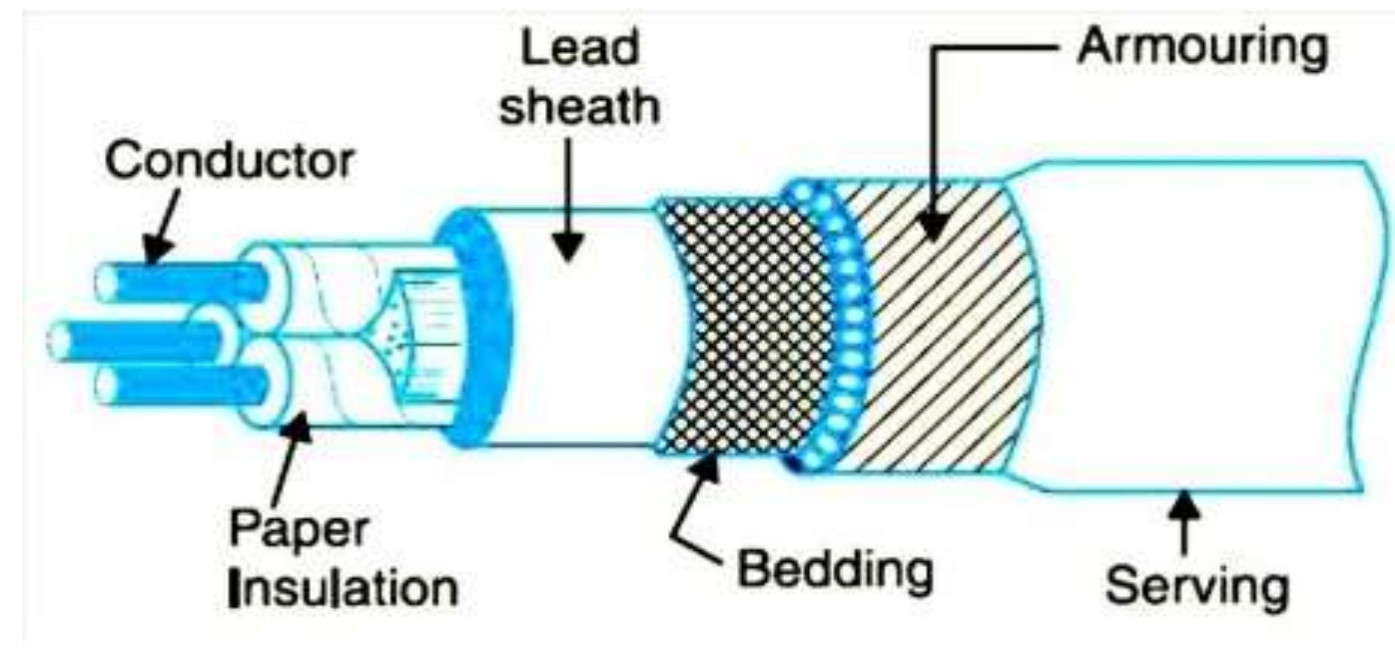
To enable wires to be easily and safely identified, we have colour scheme for the insulation on power conductors.

| | Single Phase | Three Phase |
|------------------------------|---|--|
| Phase Conductor (Line) |  Red or  Yellow or  Blue |  Line 1 Red  Line 2 Yellow  Line 3 Blue |
| Neutral Conductor |  Black | |
| Protective Conductor (Earth) |  Green-and-Yellow | |

Construction of a 3 conductor cable

Parts of a cable

- Cores
- Insulation
- Metallic Sheath
- Bedding
- Armouring
- Serving





INSULATION:

Suitable thickness of insulation. The thickness depends upon the voltage to be withstand by the cable.

Materials: Rubber, Impregnated paper

METTALIC SHEATH :

In order to protect the cable from moisture , gases or other damages like acids.

Bedding:

It is provided over the metallic sheath. Protects against corrosion.

Material : Jute



ARMOURING:

It is provided over the bedding to protect the cable from mechanical injury.
It consists of two layers of galvanised steel wire.

SERVING:

It provides from atmospheric conditions.



Classification of Cables



Classified in two ways

- 1) Types of insulating material used
- 2) The voltage for which they are manufactured
 - Low - tension LT cables upto 1000V
 - High - tension HT Cables upto 11000V
 - Super - tension ST Cables from 22KV to 33KV
 - Extra high tension EHT Cables from 33KV to 66KV
 - Extra Super Voltage Cables beyond 132 KV



Based on service



It has four types

- Single – core
- Two – core
- Three – core
- Four – core



Single core LT Cable



- Has ordinary construction
- Low voltage upto 6600 V
- One circular core of standard copper, insulated by impregnated paper.
- Surrounded by lead sheath which prevents from moisture into the inner parts.
- Protect from insulation - serving





Cables for 3 - Phase service



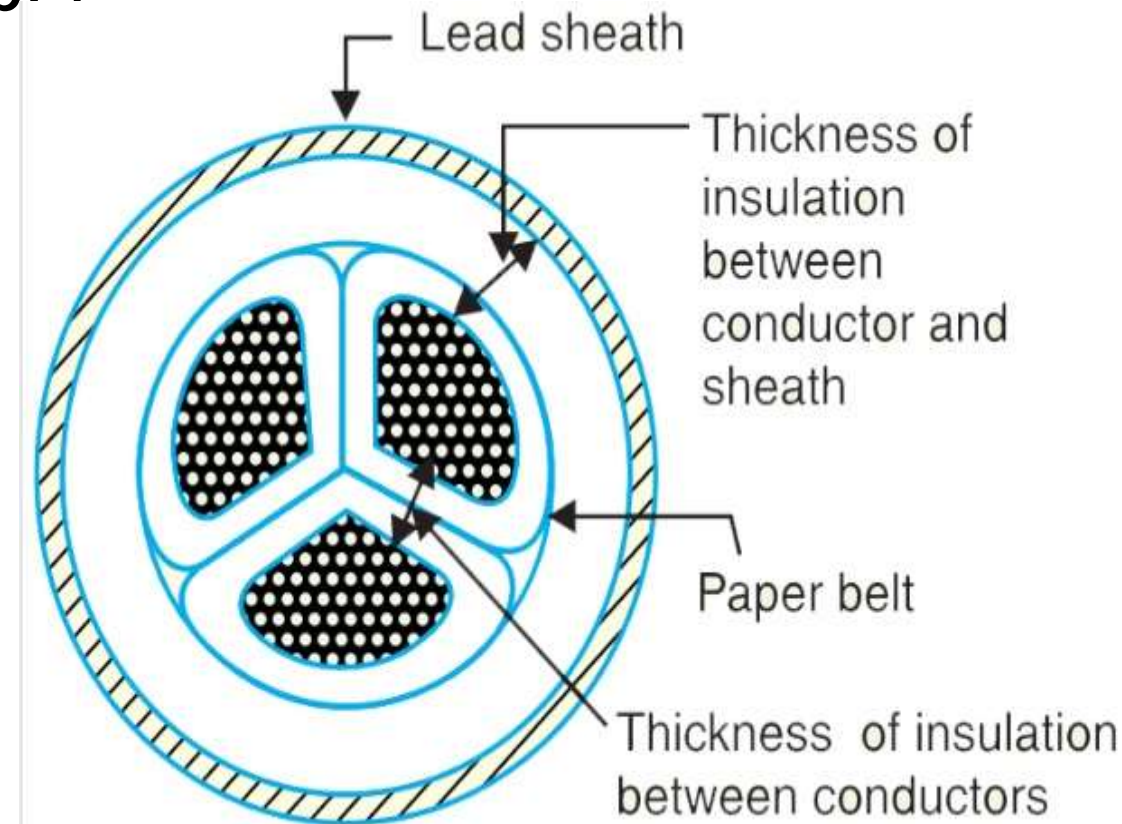
- Deliver 3 phase power – three core cables or three single core cables may be used.
- Upto 66KV
- Beyond 66KV – too large and bulky
- Single core cables are used.

Types of Cables

- Belted Cables – upto 11KV
- Screened Cables – from 22KV to 66KV
- Pressure Cables – Beyond 66KV
- Gas Pressure Cables – upto 230KV

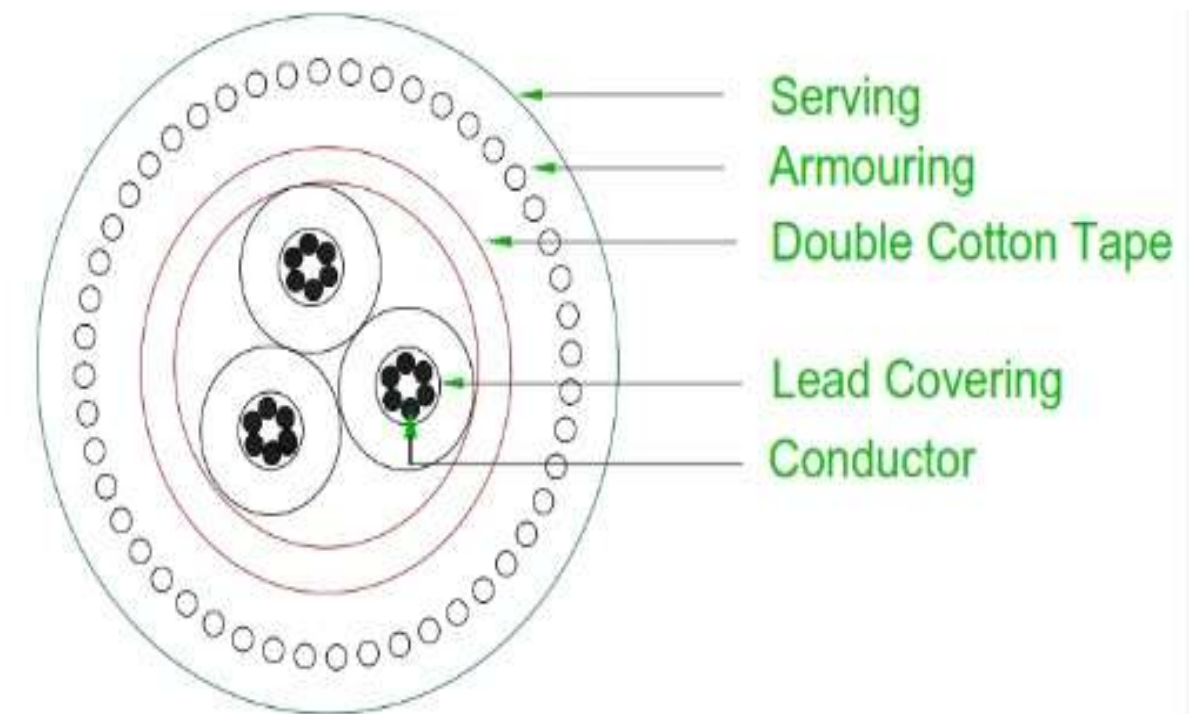
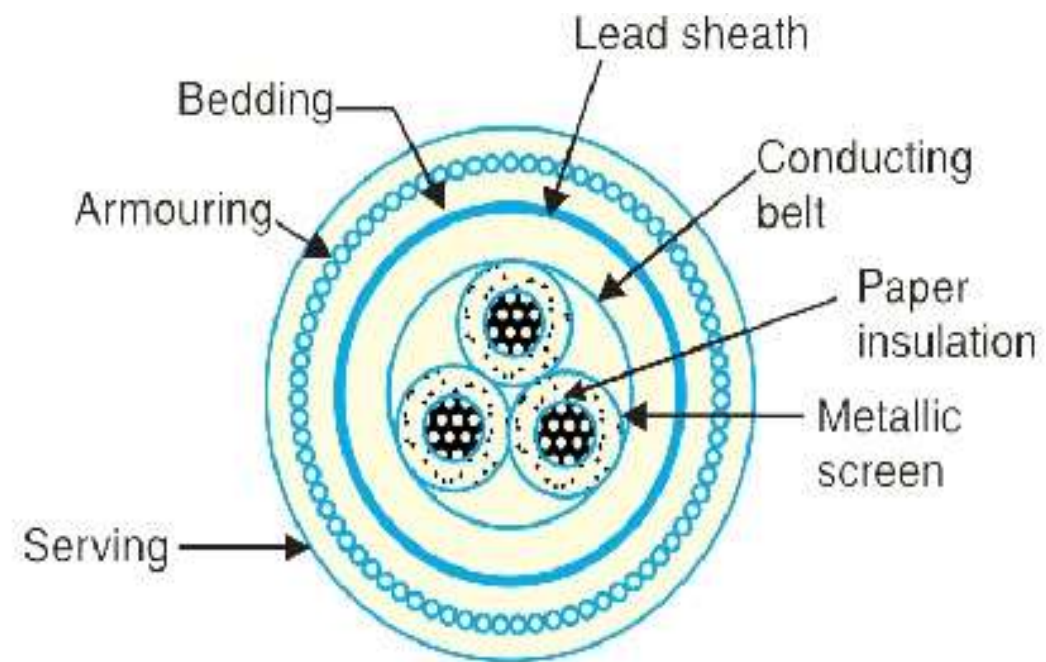
Belted Cables

- The conductors (usually three) are bunched together and then bounded with an insulating paper 'belt'.
- Cores are insulated from each other by layers of impregnated paper
- Paper belt is wound round the grouped insulator cores.
- Suited for low and medium voltages
- Beyond 22KV, affects the paper insulation.
- Set up the leakage current.
- Which causes local heating , resulting in breakdown of insulation
- To overcome – Screened Cables.



Screened Cables

- Two types
 - H Type cable
 - S.L Type cable

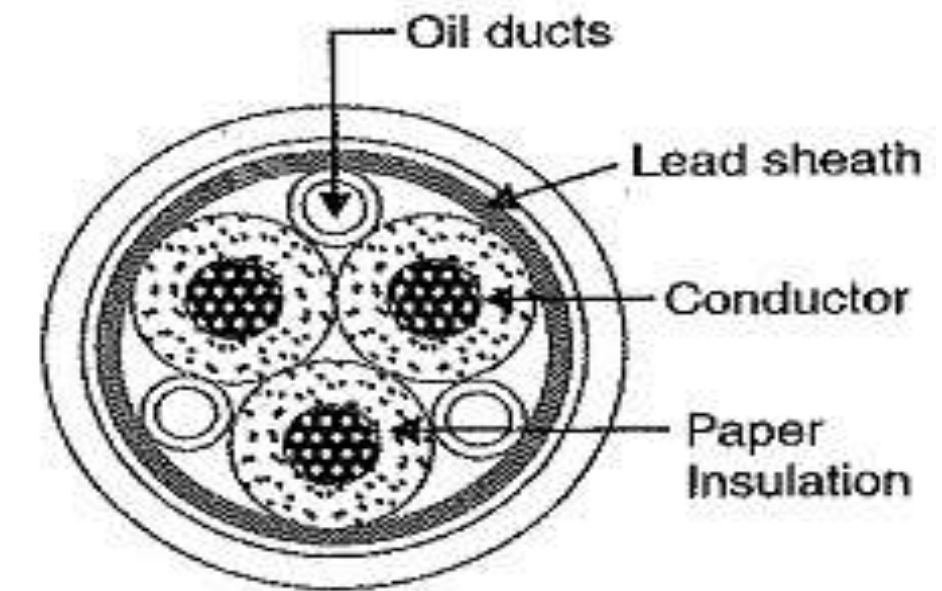
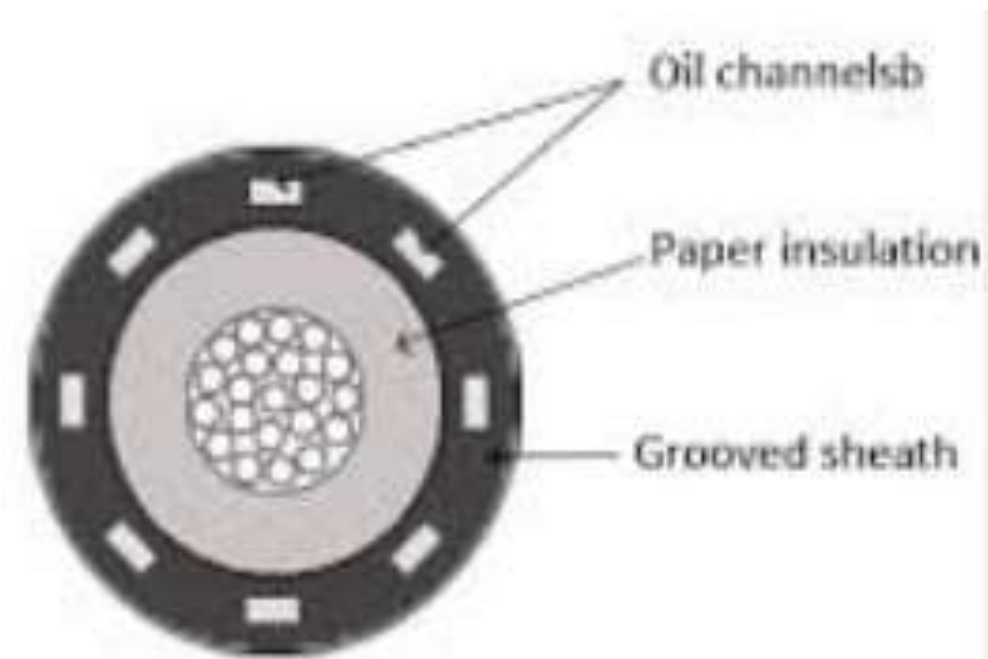
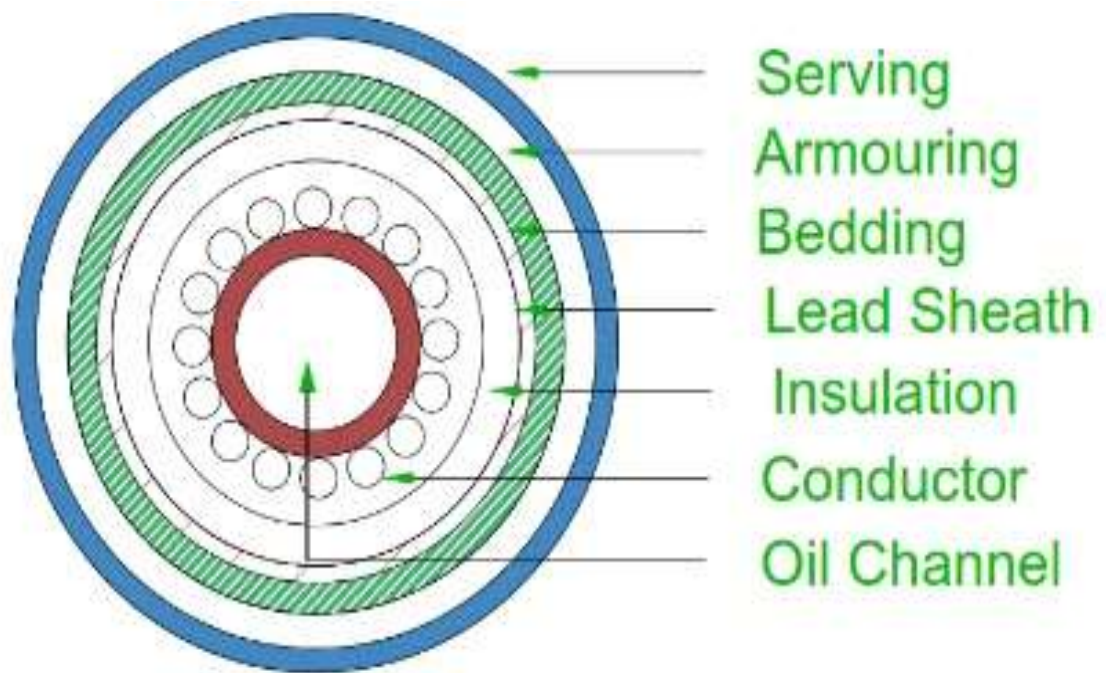




Pressure Cables



- 66kV to 230kV
- Three types
 - Oil filled cables
 - Single core conductor channel
 - Single core sheath channel
 - Three core oil filler cable
 - Gas pressure cables





ASSESSMENT



1. Low tension and High tension cables can be used respectively for voltage below

- 33 kV and 66kV
- 11kV AND 33kV
- 1kV and 11kV
- 400V and 1000V



| S.No. | Overhead Line | Underground Cable |
|-------|---|---|
| 1 | Only bare conductors are used in open space | Insulated conductors are placed safely in underground |
| 2 | Its not very safe | Its safe |
| 3 | Conductor Size is small | Conductor Size is large |
| 4 | Insulation cost is less | Insulation cost is more |
| 5 | Lifetime is less | Lifetime is 2 times more |
| 6 | Used for long transmission | Not used for long transmission |
| 7 | Appearance is not good | It gives better appearance |



| S.No. | Overhead Line | Underground Cable |
|-------|--|---|
| 6 | It can work upto 400kV | It can work upto 66kV |
| 7 | It creates inference with communication systems | No inference with communication systems |
| 8 | Erecting cost is much less comparatively | Erecting cost of HV cable is quite high |
| 9 | It is more flexible as new conductors can be easily laid along the existing conductors | It is not flexible , as new conductors are to be laid in new channels |
| 10 | More chances of accidents | Little chances of accidents |

