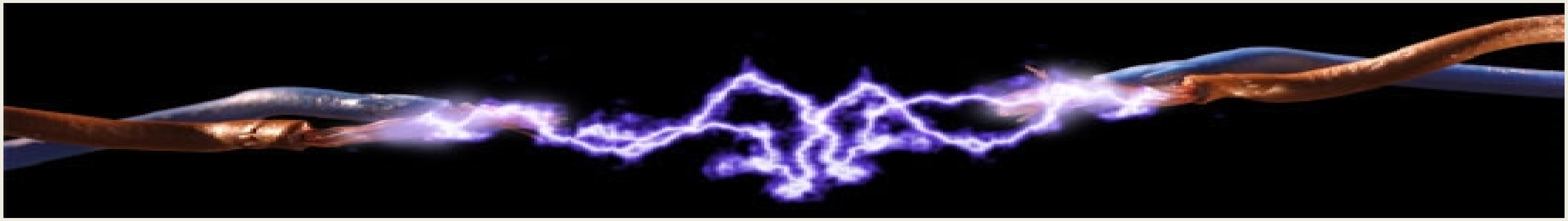
Electrical Shop Practice
EE-2200



Experiment No: 10

Study on Types and Installation of wiring systems

Course Teachers

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&
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Systems by which power is distributed to domestic consumers-

1. Single phase – two wire system(domestic)
2. Three phase -three wire system(industrial)
3. Three phase -four wire system(domestic & industrial)

Energy meter → Main Switch → Lighting & Power circuits

- Double Pole Iron Clad Switch(DPIC)
  (domestic wiring)
- Triple Pole Iron Clad Switch(TPIC)
  (Industrial Installations)
- Triple Pole Iron Clad Switch with neutral Link(TPNIC)
  (Industrial Installation)

Introduction

Factors that must be considered while selecting a system of wiring-

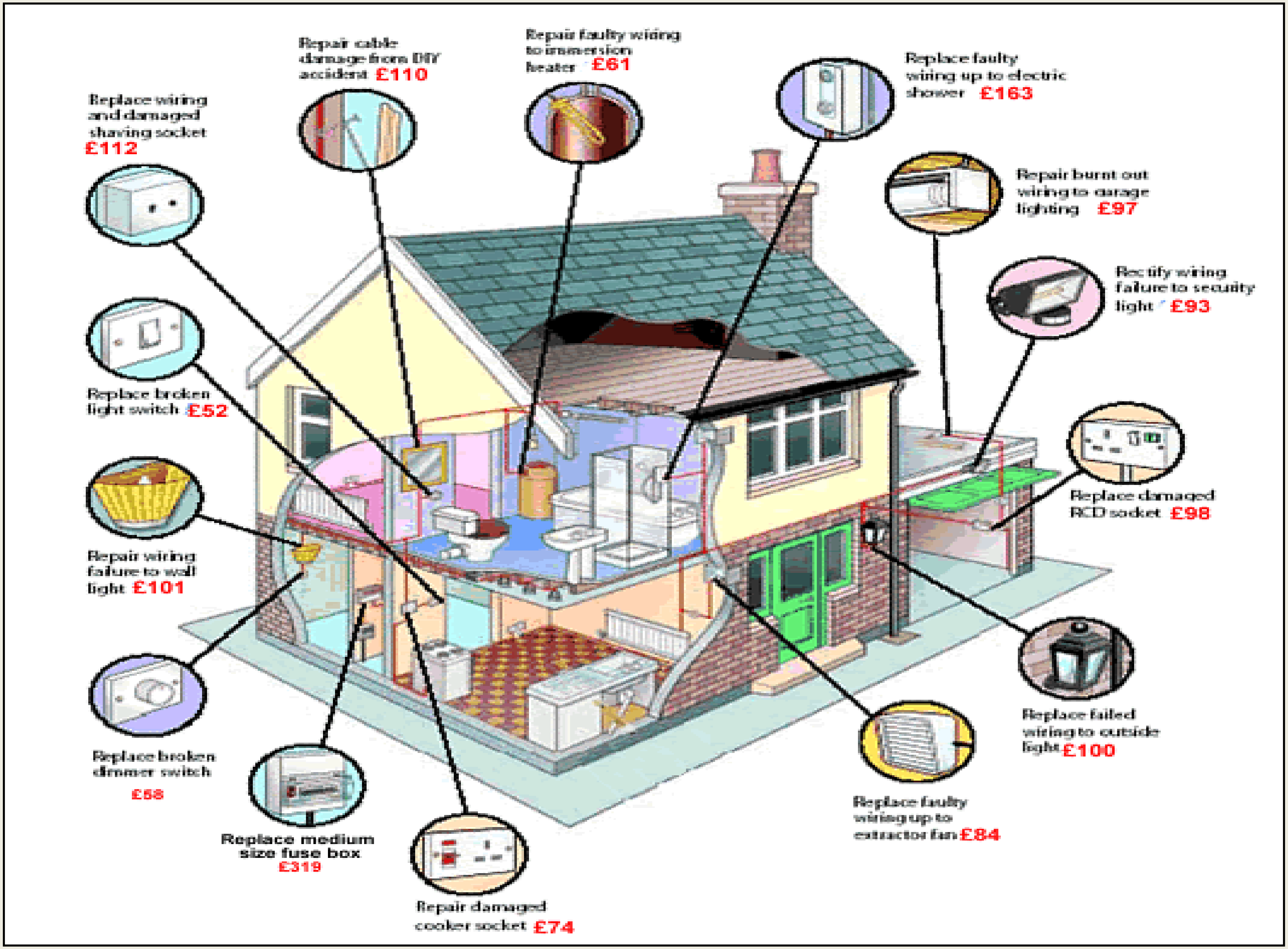
- Life of the installation
- Type of wire and material used
- Future extension or alternation
- Nature of load (light or power load)
- Construction of building
- Quality of wiring system
- Fire hazards or other special conditions
- Dampness
- Safety of the system
- Appearance of the wiring systems
- Cost of the wiring systems

Types of wiring

- ***Types of wiring as using.***
  1. Domestic Wiring
  2. Commercial Wiring.
  3. Industrial wiring.

Types of wiring

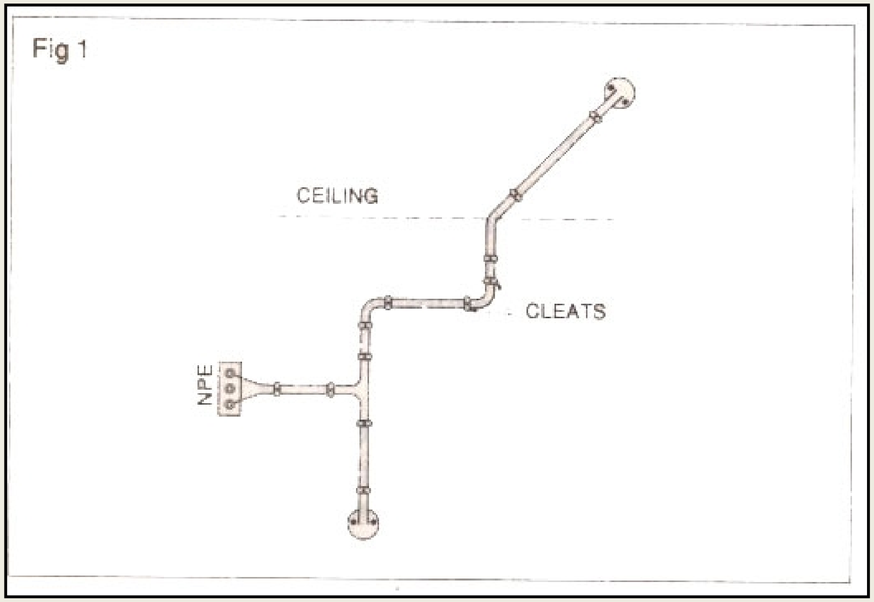
- Cleat wiring(Vulcanized India Rubber wire known as V.I.R. wire in porcelain cleat)
- Casing Capping(V.I.R. wire in wooden casing)
- T.R.S. wiring (Tough Rubber Sheath wires run over wooden battens)
- Metal Sheathed Wiring(V.I.R. wires covered with lead, run over wooden battens)
- Conduit wiring(V.I.R. conductors run in metallic conduits)

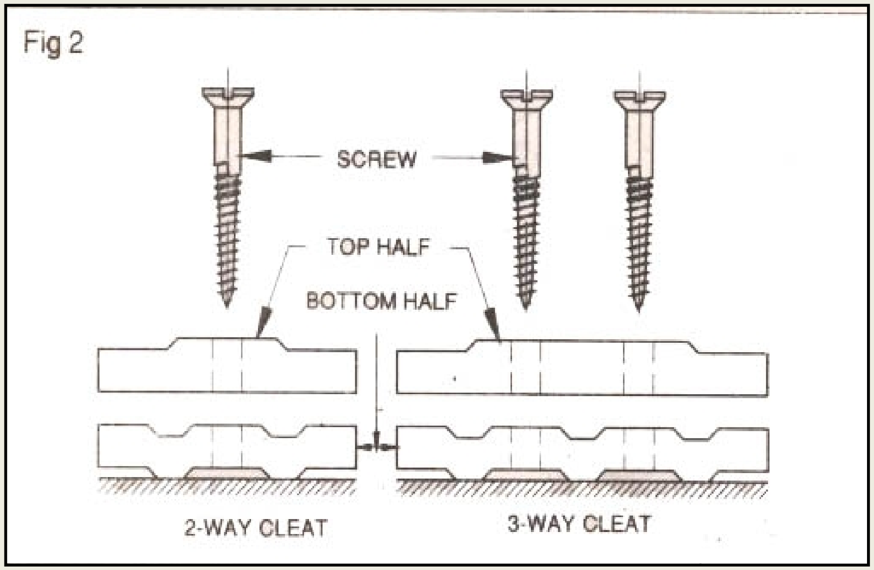

Repair cable damage from DIY accident £110
Repair faulty wiring to immersion heater £61
Replace faulty wiring up to electric shower £163
Replace wiring and damaged shaving socket £112
Repair burnt out wiring to garage lighting £97
Rectify wiring failure to security light £93
Replace broken light switch £52
Replace damaged RCD socket £98
Repair wiring failure to wall light £101
Replace failed wiring to outside light £100
Replace broken dimmer switch £68
Replace medium size fuse box £319
Replace faulty wiring up to extractor fan £84
Repair damaged cooker socket £74

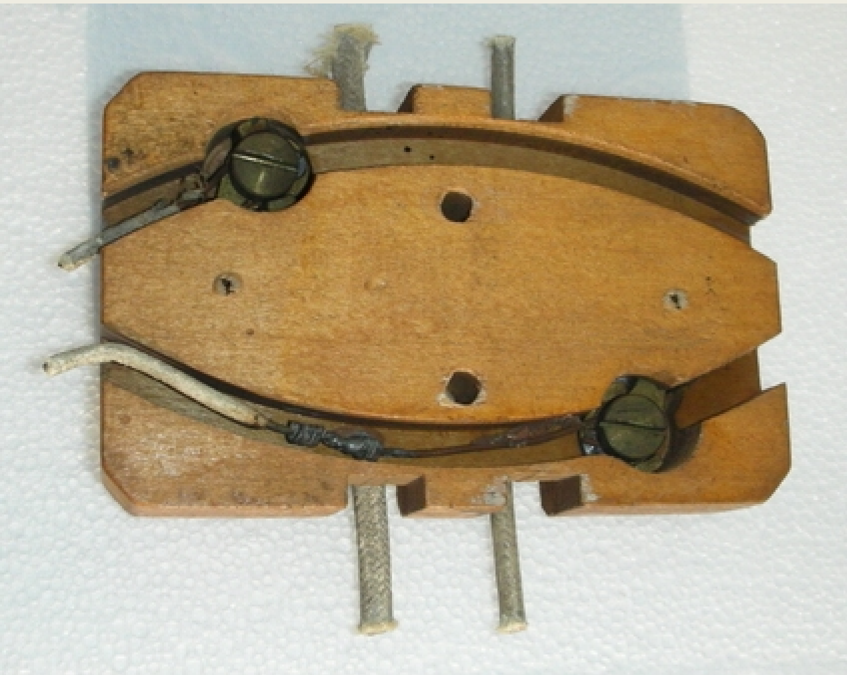
CLEAT WIRING

- Not used in the very early days of house wiring(1881 when Thomas Edison invented the incandescent lamp)

- They simply strung insulated-covered wires along the walls using wooden knobs and blocks of wood

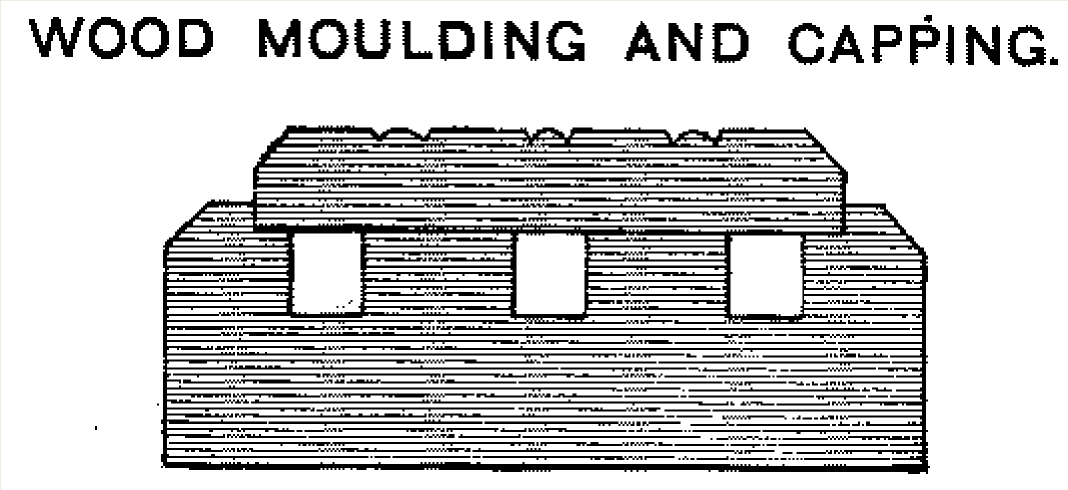




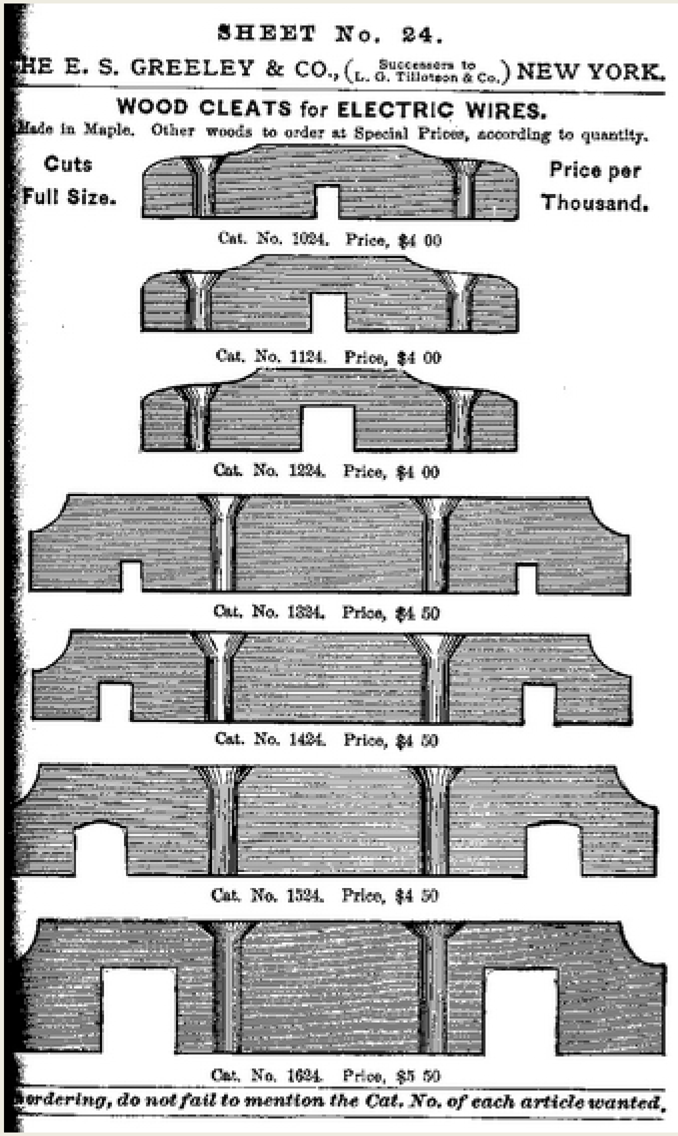


Old wooden light socket showing two top and bottom.

The cleats are of three types having one, two, or three grooves, so as to receive one, two or three wires.



In more wealthy homes and offices, house wiring was hidden behind moldings. Grooves were cut in the base molding for the wires and simply covered with a decorative cap



SHEET No. 24.

THE E. S. GREELEY & CO., (Successors to L. G. Tillotson & Co.) NEW YORK.

WOOD CLEATS for ELECTRIC WIRES.

Made in Maple. Other woods to order at Special Prices, according to quantity.

Cuts Full Size. Price per Thousand.

Cat. No. 1024. Price, $4 00

Cat. No. 1124. Price, $4 00

Cat. No. 1224. Price, $4 00

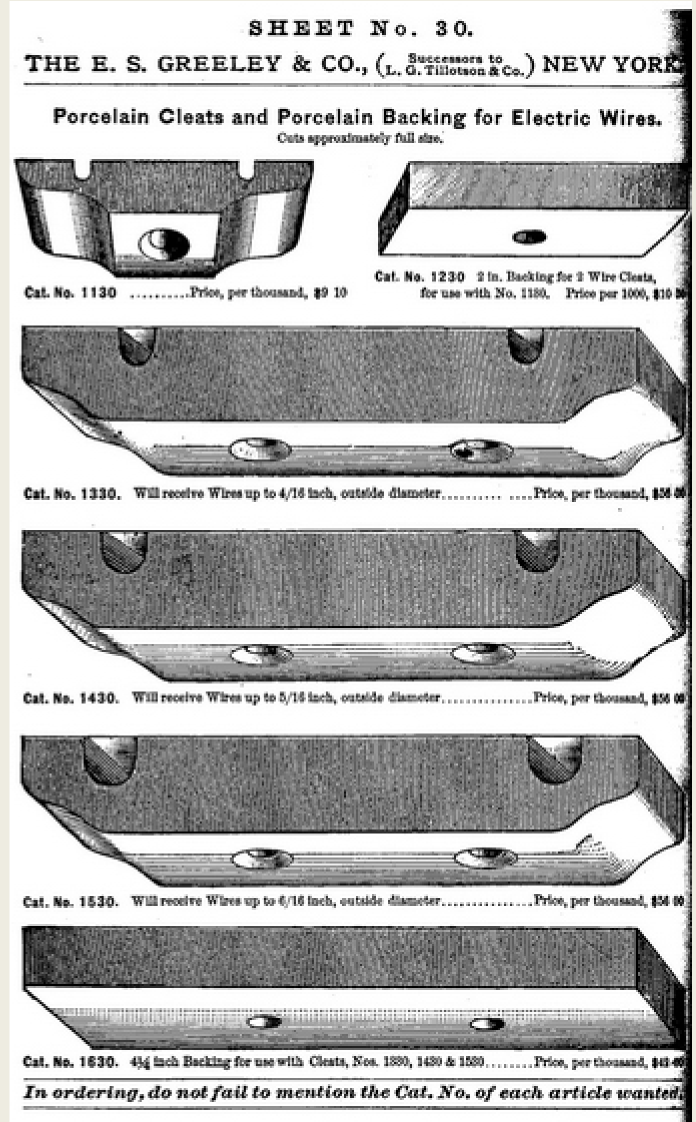
Cat. No. 1324. Price, $4 50

Cat. No. 1424. Price, $4 50

Cat. No. 1524. Price, $4 50

Cat. No. 1624. Price, $5 50

In ordering, do not fail to mention the Cat. No. of each article wanted.



SHEET No. 30.

THE E. S. GREELEY & CO., (Successors to L. G. Tillotson & Co.) NEW YORK.

Porcelain Cleats and Porcelain Backing for Electric Wires.

Cuts approximately full size.

Cat. No. 1130 ....Price, per thousand, $9 10

Cat. No. 1230 2 in. Backing for 2 Wire Cleats, for use with No. 1130. Price per 1000, $10 50

Cat. No. 1330. Will receive Wires up to 4/16 inch, outside diameter.......... ....Price, per thousand, $56 00

Cat. No. 1430. Will receive Wires up to 5/16 inch, outside diameter...............Price, per thousand, $56 00

Cat. No. 1530. Will receive Wires up to 6/16 inch, outside diameter...............Price, per thousand, $56 00

Cat. No. 1630. 4½ inch Backing for use with Cleats, Nos. 1330, 1430 & 1530........Price, per thousand, $43 40

In ordering, do not fail to mention the Cat. No. of each article wanted.

Figures showing wooden cleats and early porcelain cleats with optional porcelain backing

Wooden wiring knobs

This old wooden cleat still has the original paint and square nails.

- Distance apart of wires

  For pressure up to 250 volts, cleats shall be of such dimensions that in the case of branch loads, conductors shall not be less than 2.5 cm apart, centre to centre, and in the case of sub-mains not less than 4 cm apart, centre to centre. Care shall be taken in selecting the size of cleats particularly for branch distribution wiring where two-way and three-way porcelain cleats are essential and the difference in size shall be reasonable. Care should also be taken ensure that grooves of porcelain cleats are essential and the difference in size shall be reasonable. Care should also be taken ensure that grooves of porcelain cleats do not compress the insulation nor be too wide for a loose fit. Under no circumstances two wires shall be placed in one groove of the porcelain cleats.

Protection near the floor

No cleat wiring shall be left unprotected up to 1.5 m above the floor level. When brought through the floor it shall be enclosed in a conduit.

Advantages

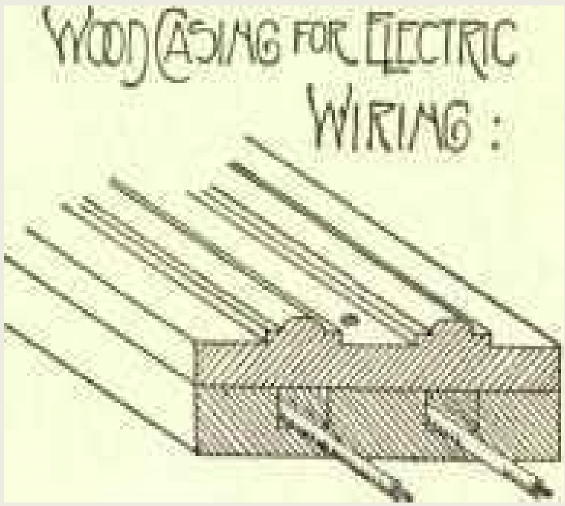
- Cheapest method
- Suitable for temporary wiring(quickly installed and recovery)
- Inspection, alternation and addition can easily made

Disadvantages

- Not permitted for permanent job
- Sags some places after certain period
- Dust and dirt collect over them
- Increased maintenance cost
- Oil and Smoke are much injurious to V.I.R.(Blacksmith shop or similar place)
- For long life, cleats should be 30 cm apart.

Wooden casing capping

- Most commonly adopted for residential building
- Rectangular woodblocks made from first class season teak wood or any other wood free from knots, shakes or shaps etc. called casing.
- Casing is covered at the top by means of a rectangular strip of wood of same width called capping is screwed to it.
- Double bed in capping to show the position of wire.



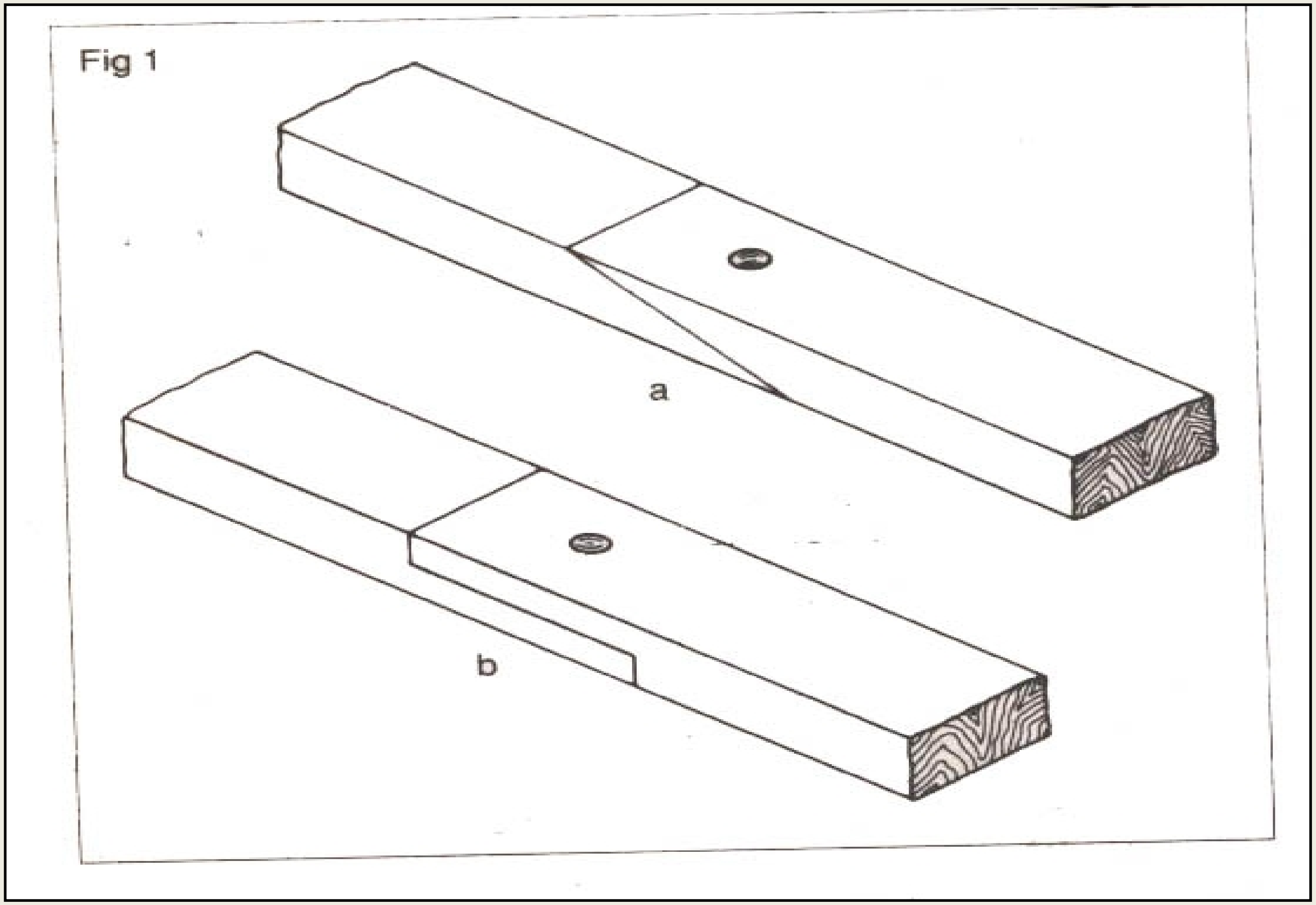
<u>Two main disadvantages-</u>

- Highly skilled carpenters are required
- Very risk of fire

Joints in casing capping

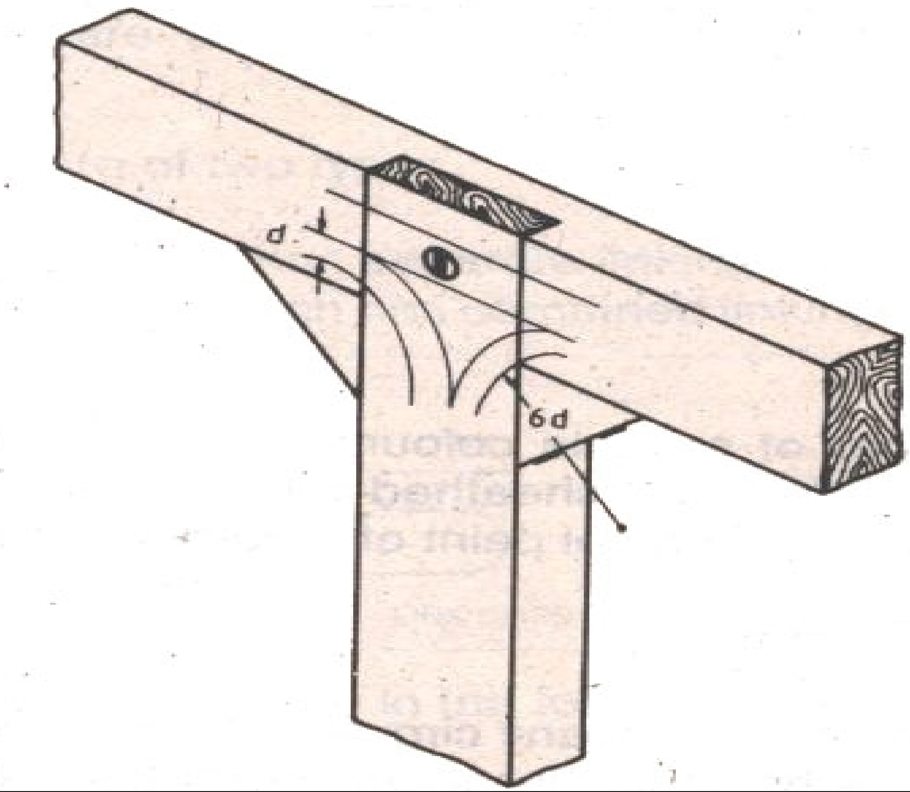
- Types of Joint
  1. Straight joint.
  2. Tee joint.
  3. Right- angled joint.
  4. Corner joint.
  5. Tee-bridge joint.
  6. Cross- bridge joint.

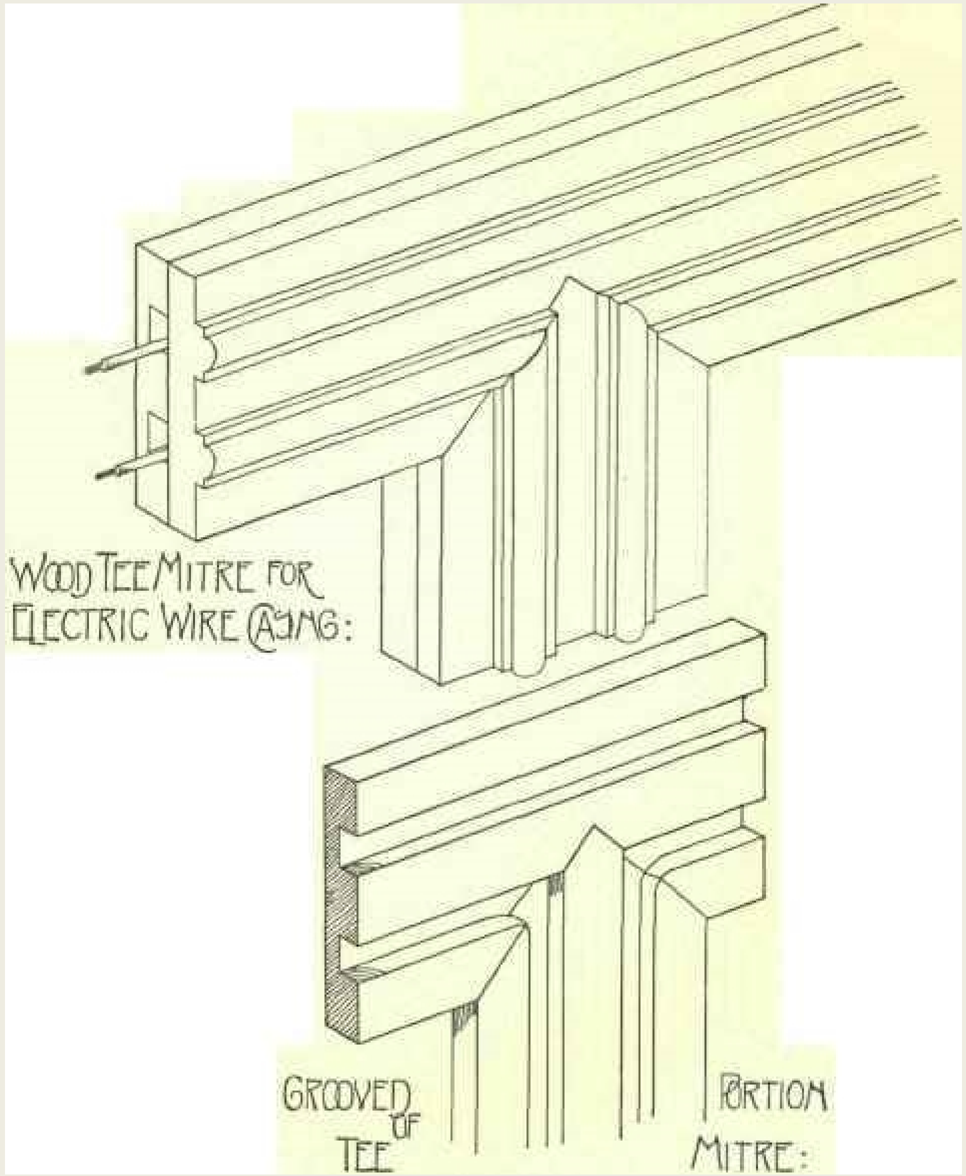
1. Straight joint.



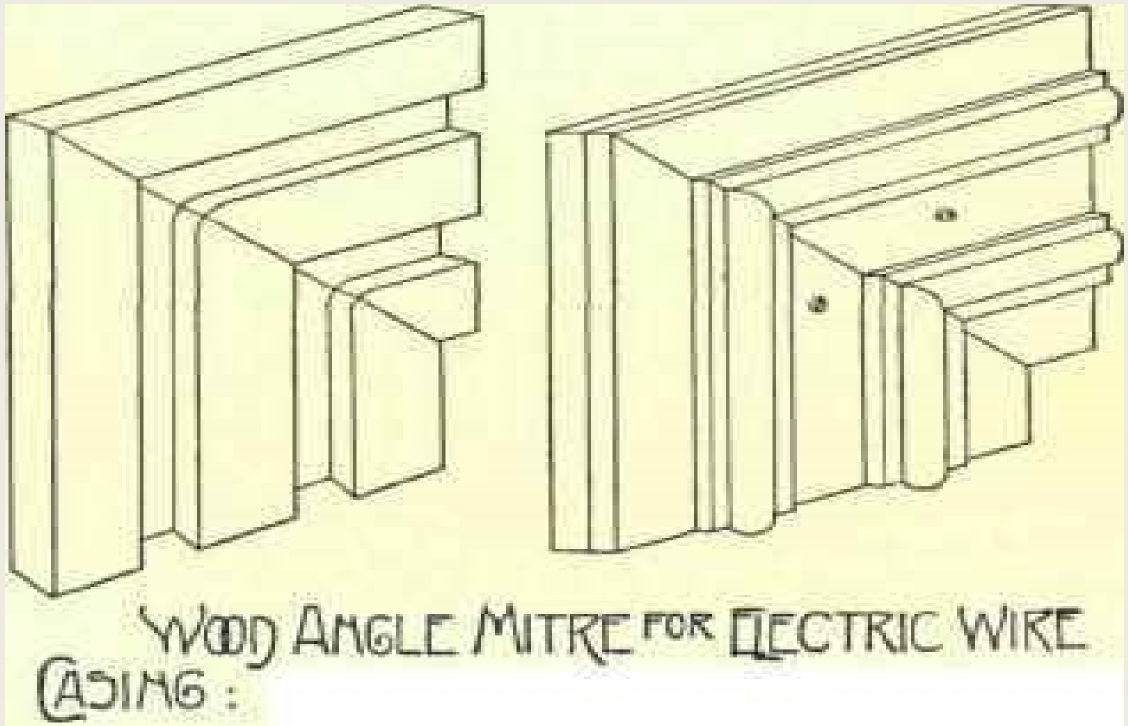
1. Tee joint.

Fig 3

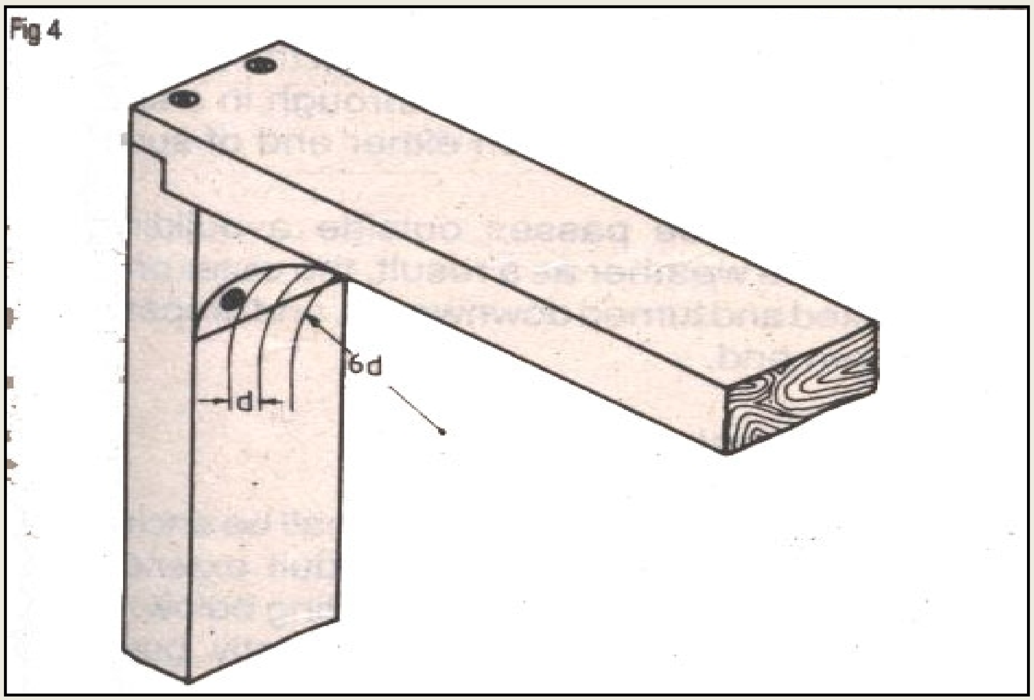



WOOD TEE MITRE FOR
ELECTRIC WIRE CASING:
GROOVED PORTION
OF
TEE MITRE:

Right-angle Joint



1. Corner joint.



- Cross- Joint

Fig 5

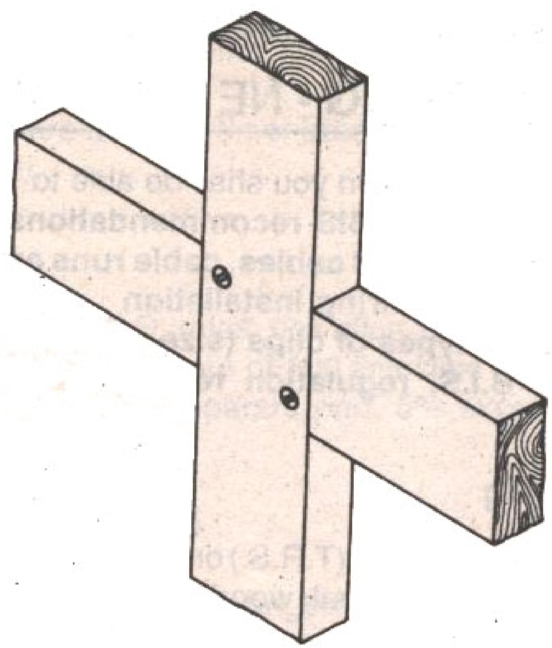
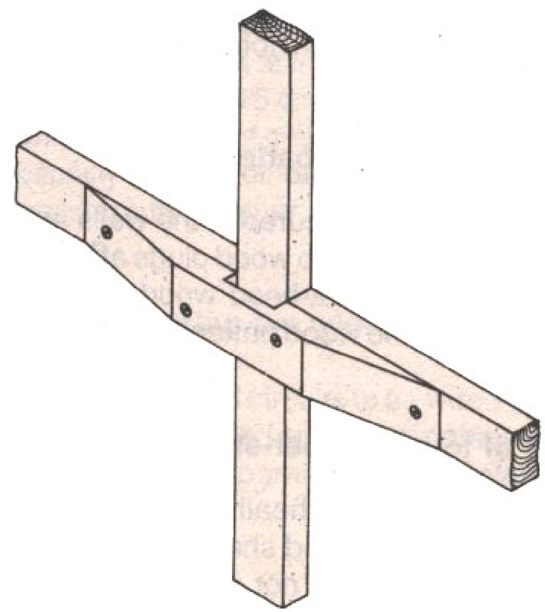
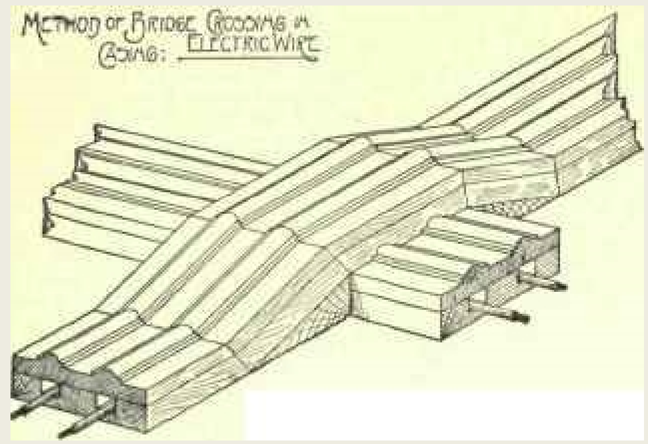


Fig 6





Tough Rubber Sheathed/Batten wiring

- TRS wires are suitable for rough use, moisture, climate variations, acids alkalis but is slightly affected by lubricating oil
- Tough rubber-Sheathed (T.R.S.) or PVC- Sheathed cables are suitable to run on teak wood battens which is fixed on the wall

Following considerations should be maintained-

- For damp place
  - -take care for earth switch, lamp holders and other metal fittings.
  - -fibre clips should not be used
- Provide a layer of neat cement over the cable(under the plaster)
- Should not put under stress
- Provide conduit with rubber brushing at both ends (through wall)
- Wires should be properly tightened(clips should not be more than 6 cm)
- Bends should have longer radius

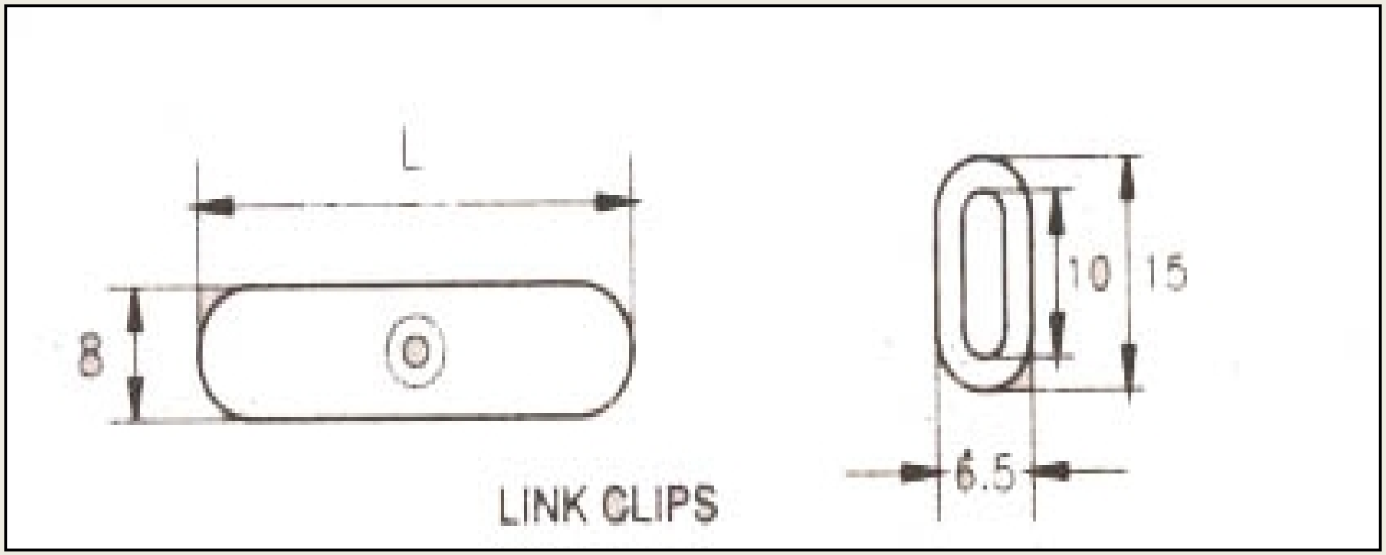
- Link Clips

  Link clips are used for family clipping the cables in position.

Link clips are of two types.

- Link clip which has separate linking eye.
- Joint link clip which has combined linking eye.

Link clip are available in the following size.

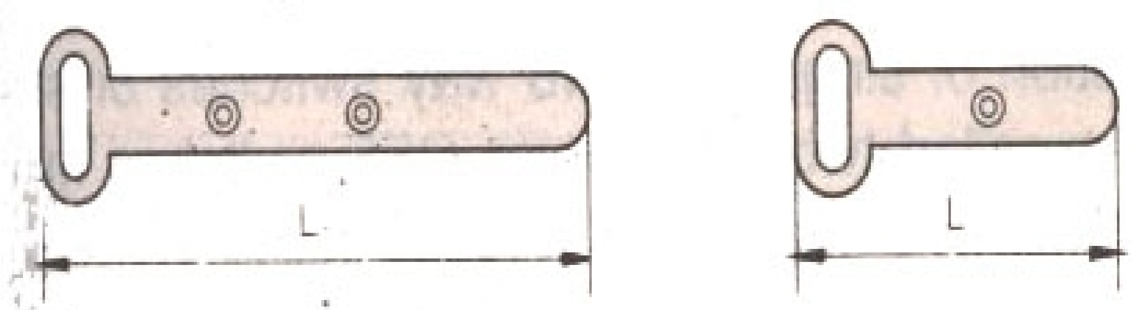


25mm, 32mm, 40mm, 50mm, 63mm, 80mm, out of which up to 40mm clips have one hole, while above that they have two holes for fixing.

Fig2 shows the joint link clips. These are available in the sizes 16mm, 25mm, 32mm, 40mm, 50mm, 63mm, 80mm with a thickness of 0.32mm and have one hole up to 40mm while above that they have two hole for fixing.

Link clips are made of tin or brass- coated tin or aluminum.

Fig 2



JOINT LINK CLIPS

Metal Sheathed or Lead Sheathed Wiring

- Rubber insulated conductor covered with an outer sheath of lead alloy containing about 95% lead which provides a protection to the cable from mechanical injury

- Must be earthed, which will

  -reduce the electrolytic action due to leakage current

  -provides safety
- Costlier than TRS

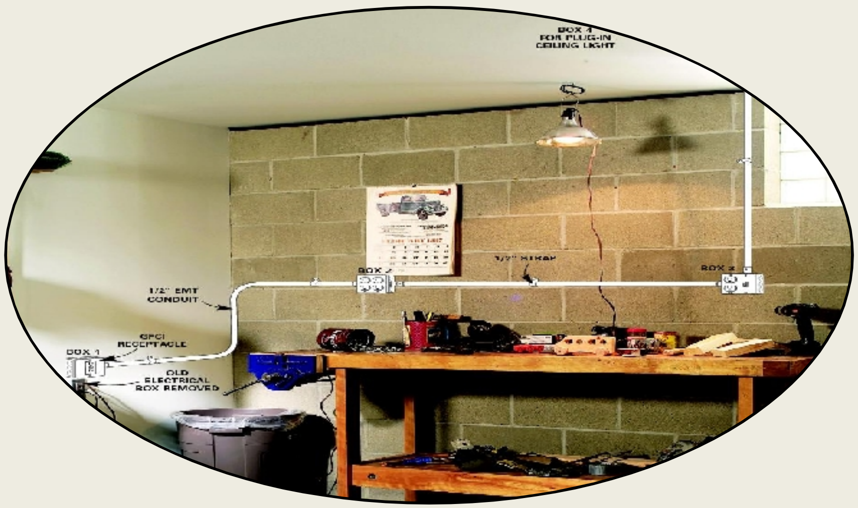
Following points should be kept in mind for installation of metal sheathed wiring-

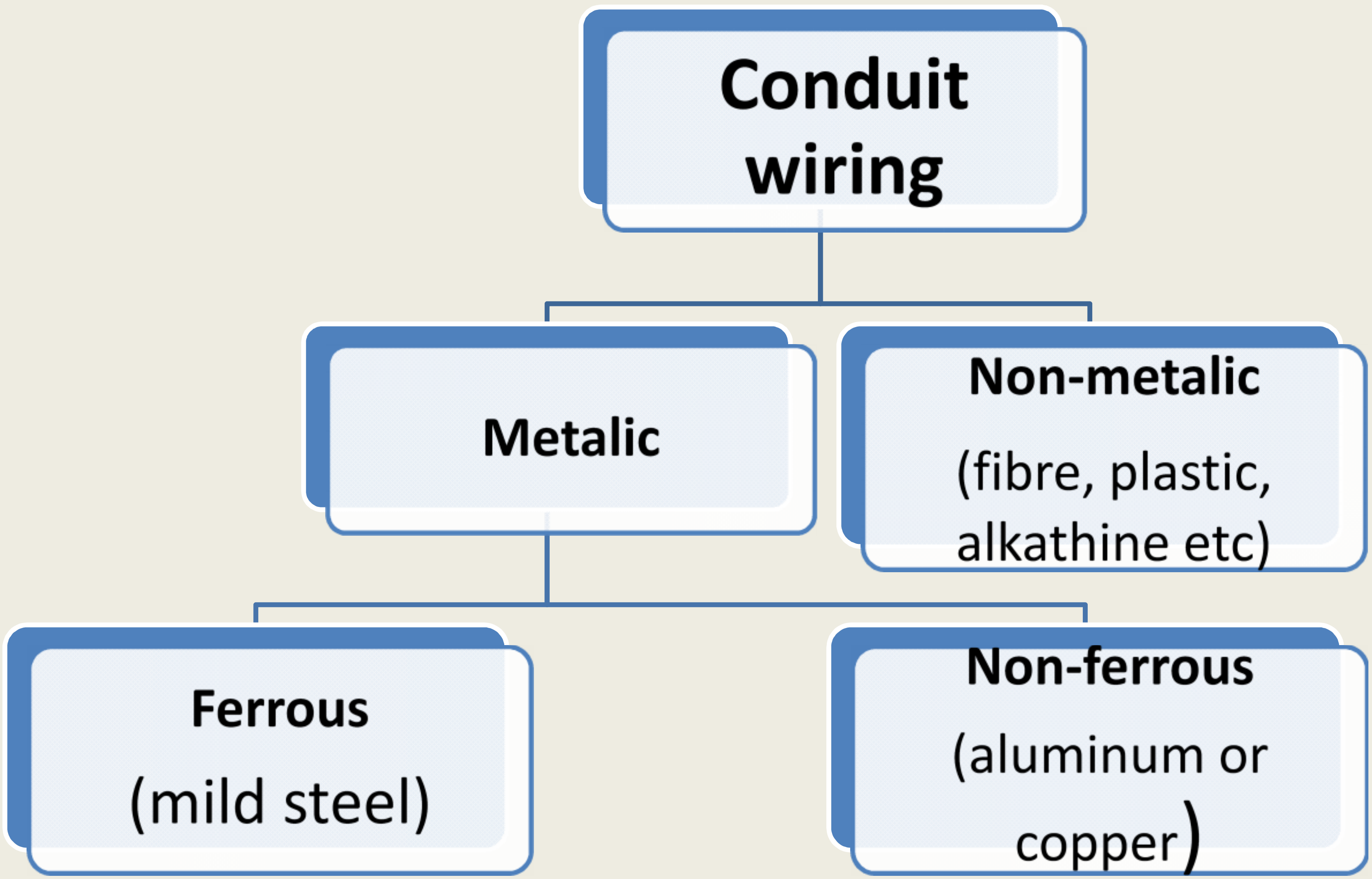
- Supported by proper metal clips, which must not be more than 30 cm apart(both horizontally and vertically)
- No chemical action by supports with the sheath.
- Avoid sharp bend and for a change of direction make round bend (with radius > 10 cm)
- Lead sheathed must be earthed and have a continuous electrical contact
- Not run over a damp place
- When crossing wall, use conduit with brushings at both ends

CONDUIT WIRING

- *Introduction*

  In general, a conduit is defined as a tube or channel. Tubular conduit is the most commonly used material in electrical installations. When cables are drawn through the conduit and terminated at the outlet or switch points, the system of wiring is called conduit wiring. (Best wiring system)




Conduit wiring
Metalic
Non-metalic
(fibre, plastic, alkathine etc)
Ferrous
(mild steel)
Non-ferrous
(aluminum or copper)

There are three types of conduits used for wiring

1. **Thin wall conduit**
2. **Rigid conduit**
3. **Flexible conduit**

<u>Thin wall conduit</u>

-close joint conduit(cheapest form of conduit, made out of gauge steel strips, provides only mechanical protection and cover risk against fire, not recommended for quality work)

-brazed conduits(similar to the former but the ends of the steel tubing are brazed together to make the conduit damp proof. Disadvantages-brazing material is left projecting inside the tube which make drawing of the ire impossible)

Rigid Conduit

-**Heavy Gauge Welded Conduit**(made out of heavy gauge steel and tube edges are electrically welded)

-**Solid Drawn Conduit**(drawn from solid and no joint throughout its section, heaviest and best, costlier)

These are available in 3 m length and are threaded at two ends to provide coupling.

Flexible Conduit

-made from galvanized steel, specially wound upon each other

-**Concaved double strip**(concave-shape steel strips spirally wound one upon the other, gasket is provided to make moisture proof)

-**Flat double strip**(similar to the former except that the strips are flat)

-**Single strip**(Single galvanized steel strip, strips have interlock, gasketed)

Double strips are preferred to single strip since-

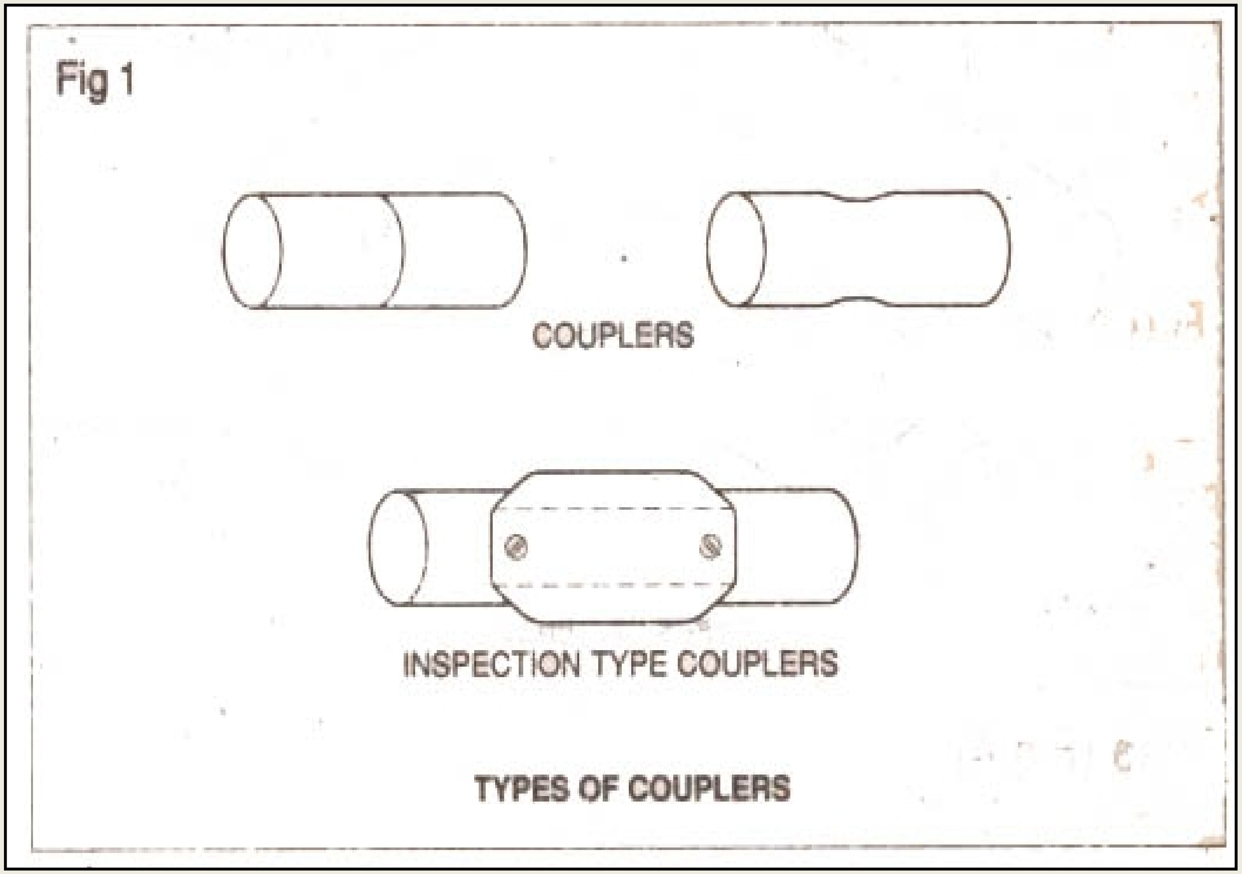
- -they are more flexible
- -smother from inside

Flexible conduits are available in length up to 250 m. Costlier than rigid conduits.

- **PVC Fittings and accessories couplers**

1. Couplers
2. Elbow
3. Bends
4. Tee
5. Circular boxes
6. Rectangular boxes.

- Couplers

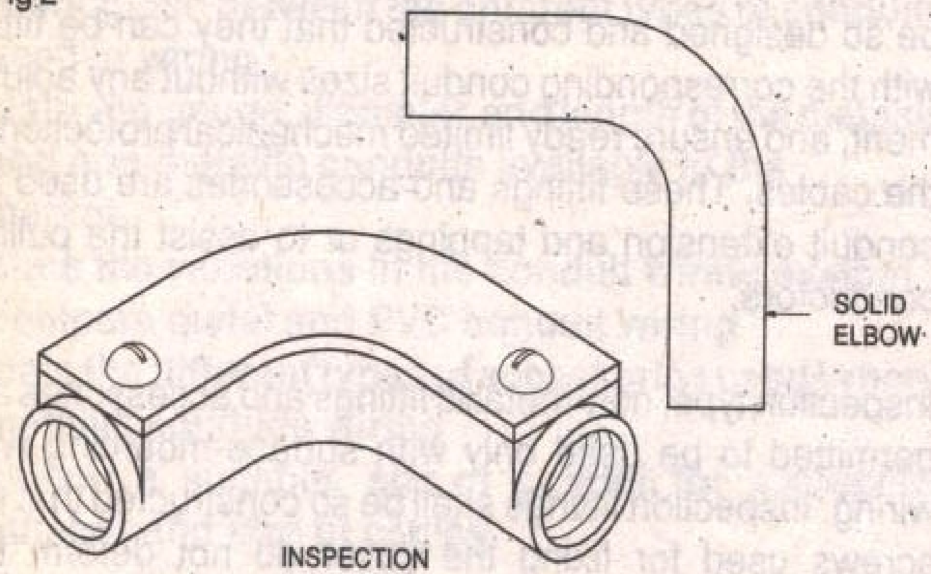


Elbow

- Radius of the bend must be greater than 6 times the internal diameter of the conduit

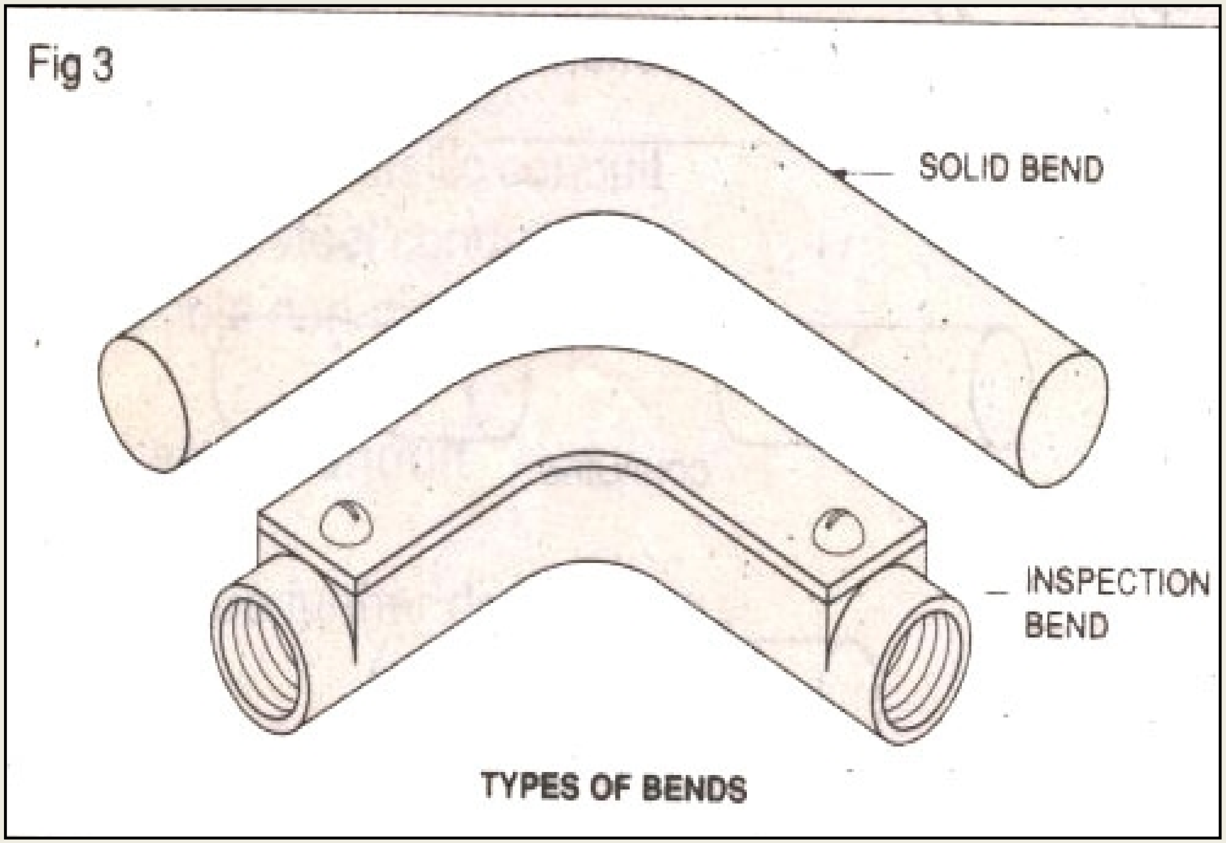
- Standard L's are available in market
- When cutting conduit, care must be taken for offset due to ell.

Fig 2

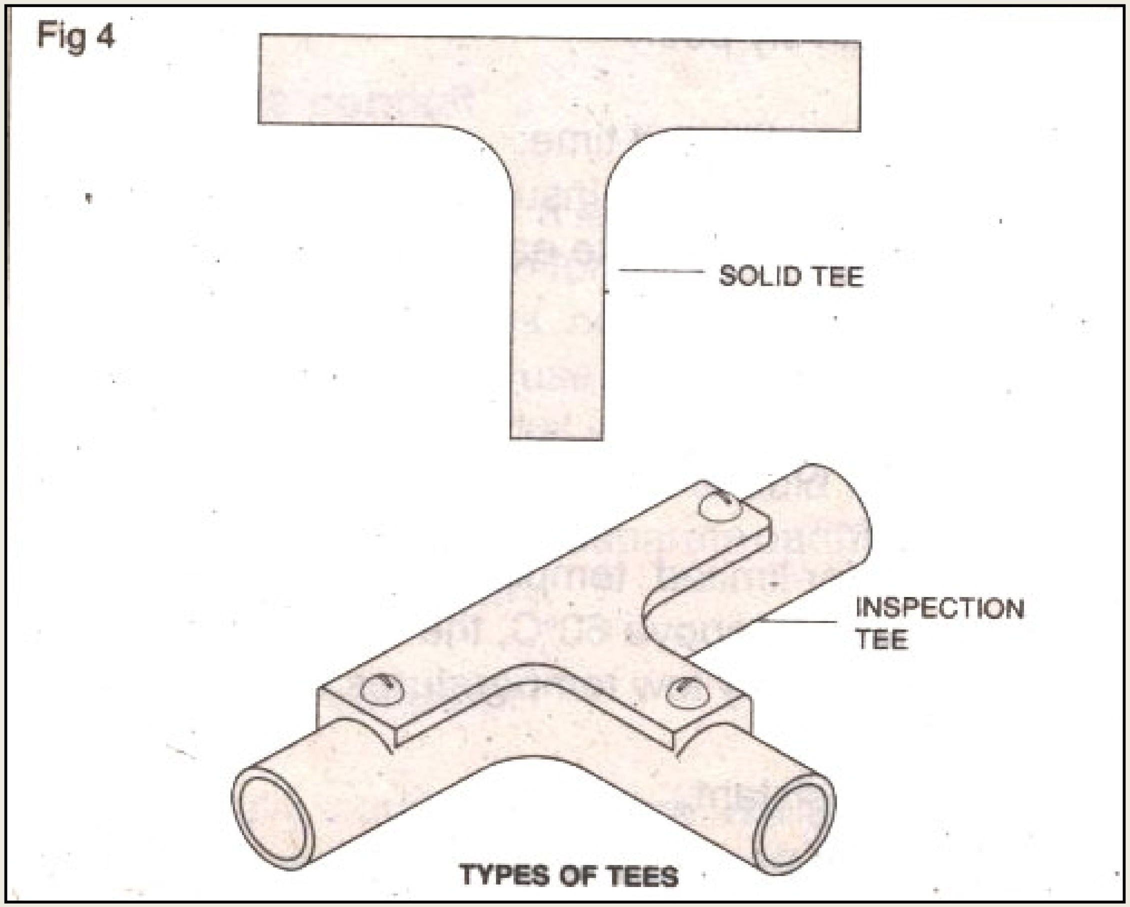


TYPES OF ELBOWS

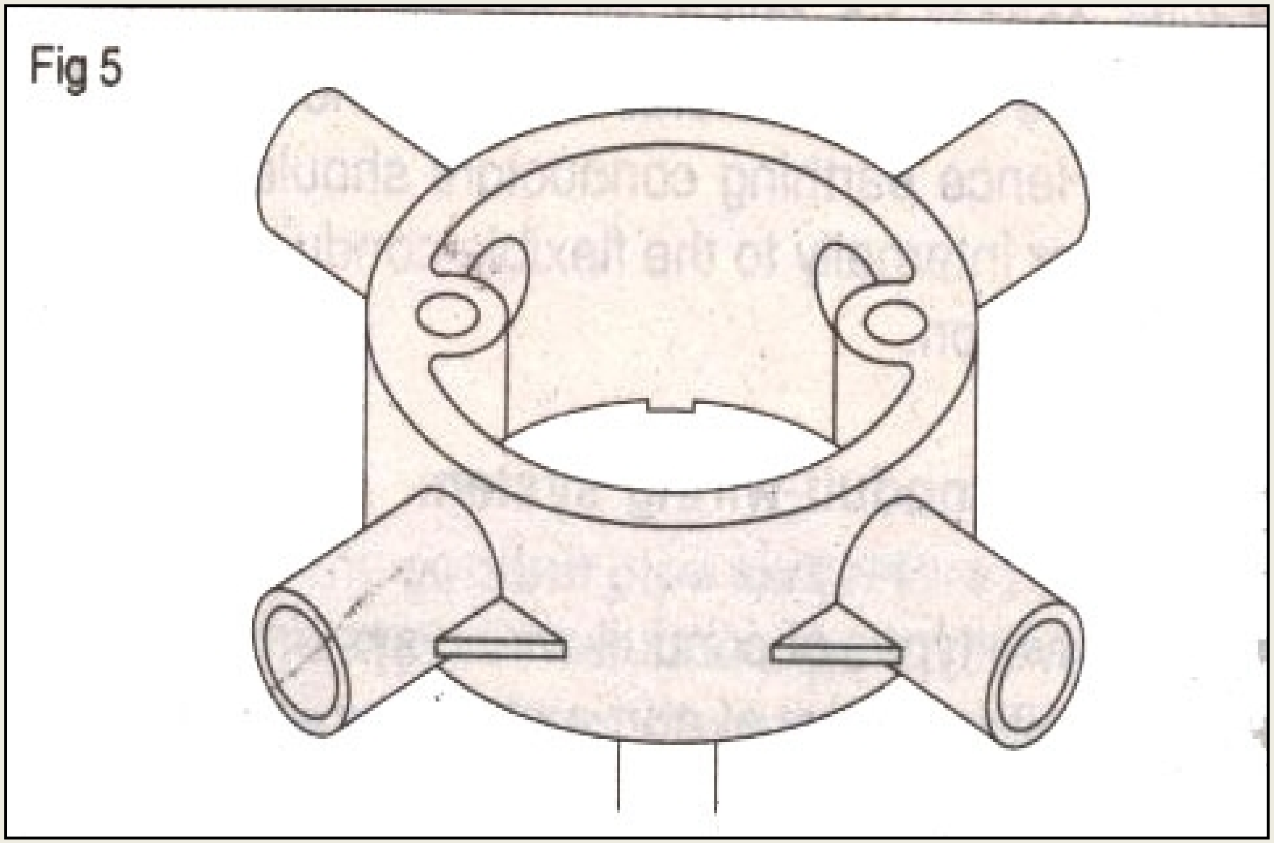
- Bends



* Tees

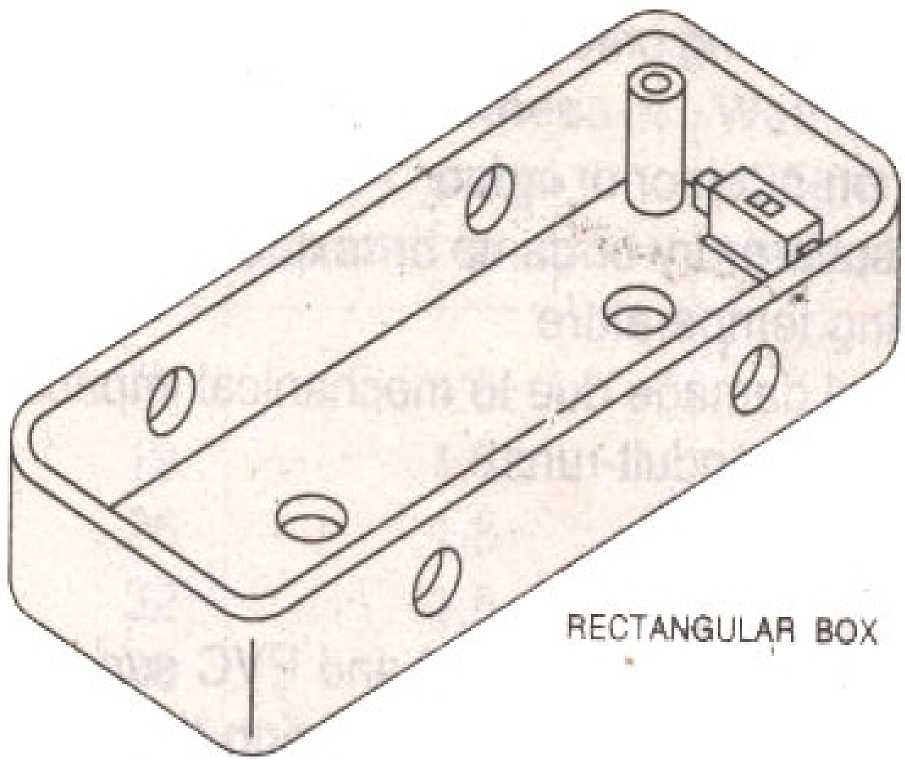


- Circular boxes



- Rectangular boxes

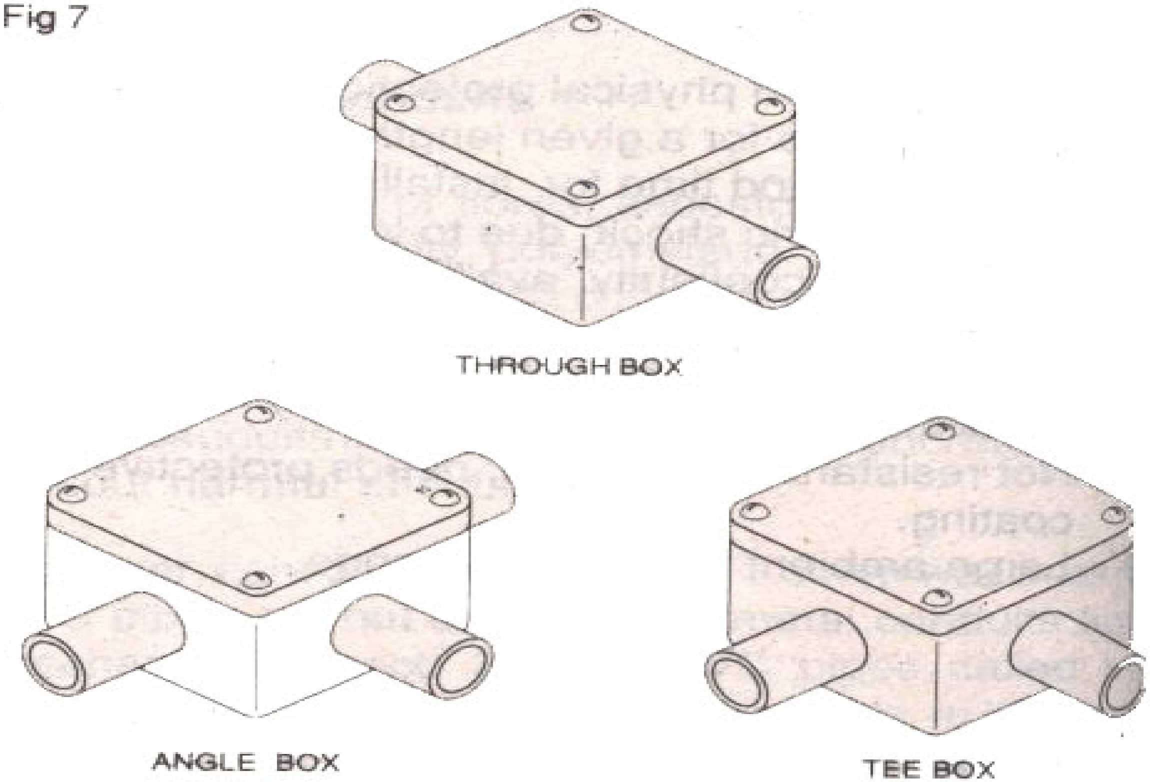
Fig 6



RECTANGULAR BOX

- Junction Boxes

Fig 7



TYPES OF BOXES (JUNCTION BOXES)

The answers of the following questions must be included in report

- *What are the various types of conduit used ?*
- *How is the conduit cut and threaded ?*
- *What is the use of offset and how is it obtained ?*
- *How is the flexible conduit fixed to the conduit box ?*
- *What do you understand by fishing wires through rigid conduit ?*
- *What is the difference between a conduit box and a conduit fitting ?*