PENYELIAAN PEMASANGAN ELEKTRIK

Kursus Kemahiran Penyeliaan Tapak Bina Elektrik

Oleh: Ir. MOHD SABRI BIN MAT DERIS

Kandungan

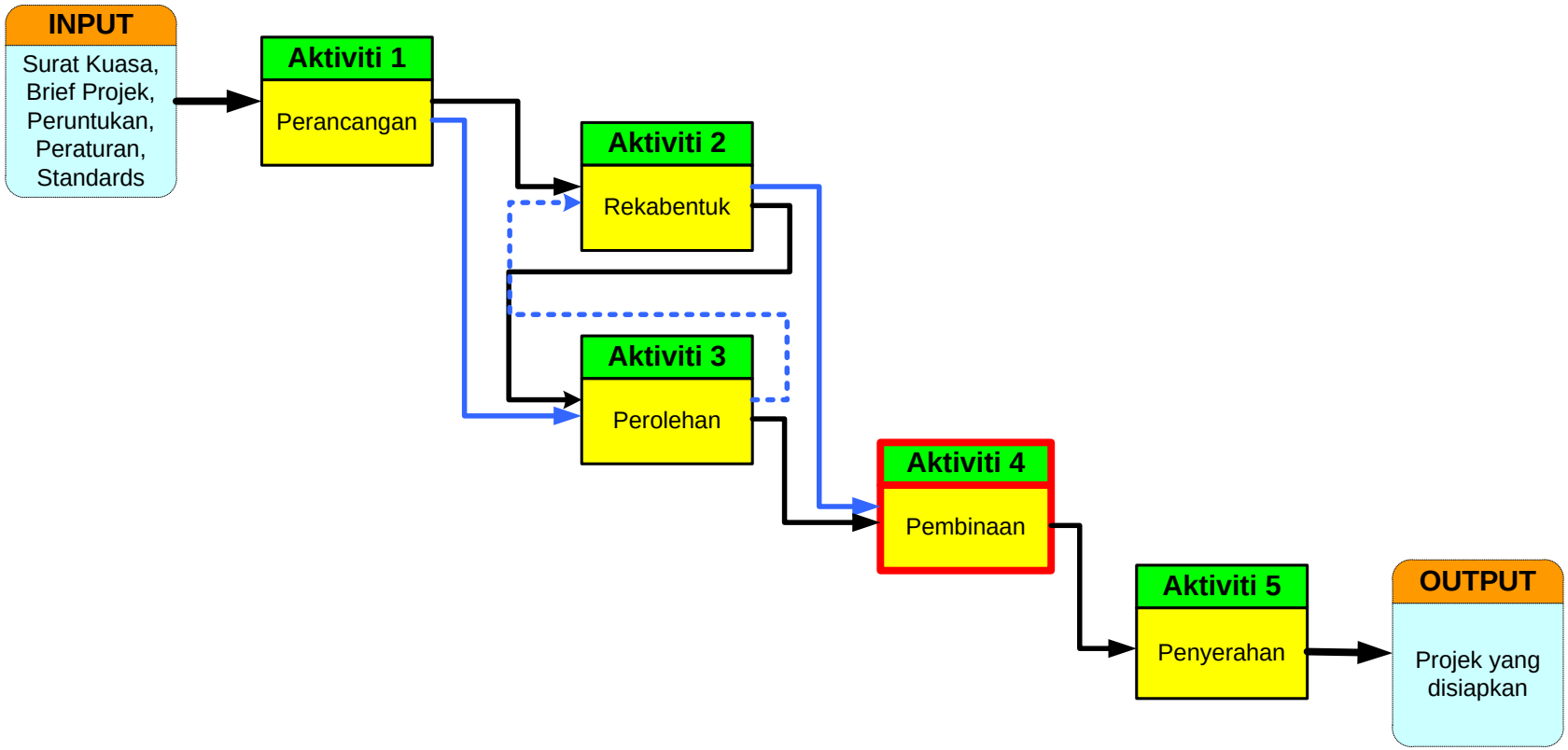
- Pengenalan
- Skop Penyeliaan
- Rujukan Piawaian
- Aktiviti Penyeliaan
- Asas Teknikal Pemasangan Elektrik
- Kaedah Pemasangan Elektrik
- Pengukuran & Pengujian
- Prosedur Penyeliaan Pemasangan
- Rekod-Rekod Penyeliaan

Pengenalan- Proses kerja projek

PROSES KERJA JKR - LEVEL 1

PEMETAAN PROSES KERJA PERKHIDMATAN PERUNDINGAN TEKNIKAL & PENGURUSAN PROJEK

LAMPIRAN C



Pengenalan- Definisi

Penyeliaan Pemasangan:

- Kerja-kerja pemantauan, pengawasan, pemerhatian, pemeriksaan, dan pengawalan sesuatu aktiviti pelaksanaan projek pembinaan/ pemasangan.

Urusan Penyeliaan Projek Elektrik:

- Penyeliaan kerja di tapak bina
- Pentadbiran kontrak.

Pengenalan- Tujuan

Memastikan pemasangan elektrik:

- Berfungsi (*Functional*)
- Selamat (*Safety*)
- Tahan (*Reliable*)
- Boleh-senggara (*Maintainability*)
- Ekonomik (*Economic*)
- Estetik (*Aesthetic*)

Skop Penyeliaan

- Kawalan Mutu Bahan/ Peralatan Kerja

  - Syarat Kontrak: 203A Klausa 9.

- Kawalan Mutu Kerja/ Method Pemasangan

  - Syarat Kontrak: 203A Klausa 9.

- Kawalan Kompetensi / Kemahiran Pekerja

  - Syarat Kontrak: 203A Klausa 19.

- Kawalan Mutu Produk Akhir

  - Syarat Kontrak: 203A Klausa 9.

Rujukan Piawaian

- Akta Bekalan Elektrik (Akta 447)
- Peraturan-Peraturan Elektrik 1994
- IEE Regulation, edisi ke-16.
- Arahan Teknik JKR
- Spesifikasi JKR
- Garis panduan Teknikal JKR
- Arahan jabatan
- Peraturan pihak berkuasa berkaitan.

Aktiviti Penyeliaan

- Perancangan & kerja awalan.
- Pemahaman skop, lukisan, spesifikasi.
- Verifikasi bahan/ peralatan/ method/ kompetensi.
- Pemeriksaan visual.
- Pengukuran & pengujian.
- Senarai semakan & rekod.
- Tindakan pembetulan & penambahbaikan.

Asas Teknikal Pemasangan

Setiap staf yang terlibat perlu memahami:

- rekabentuk & fungsi pepasangan
- kaedah pemasangan & bahan
- keperluan operasi & senggara
- kaedah pengukuran & pengujian
- Keperluan kompetensi / kemahiran pekerja
- Keperluan penyimpanan rekod dan data
- Kawalan mutu produk.

Rekabentuk & Fungsi

- Gambarajah litar.
- Jenis litar: Kategori 1/ Kategori 2 / Kategori 3.
- Saiz pengalir / busbar/ peralatan.
- Kaedah sambungan.
- Sistem perlindungan.
- Sistem pembumian & ikat-bumi.

Kaedah Pemasangan & Bahan

Kaedah pemasangan:

- Pendawaian permukaan
- Pendawaian terbenam
- Pendawaian konduit permukaan
- Pendawaian konduit terbenam
- Pendawaian kabel kupram tebatan mineral (micc)
- Busbar Ducting / Rising Main
- Talian Atas
- Kabel bawah tanah
- Contoh pemasangan

Keperluan Operasi & Senggara

- Sistem suisgear dan retikulasi kabel agihan.
- Sistem papan suis agihan.
- Klasifikasi & kadaran peralatan.
- Sistem perlindungan.
- Bekalan kecemasan/ janakuasa.
- Keperluan ruang & struktur sokongan.
- Integrasi binaan & kepenggunaan.

Pengukuran & Pengujian

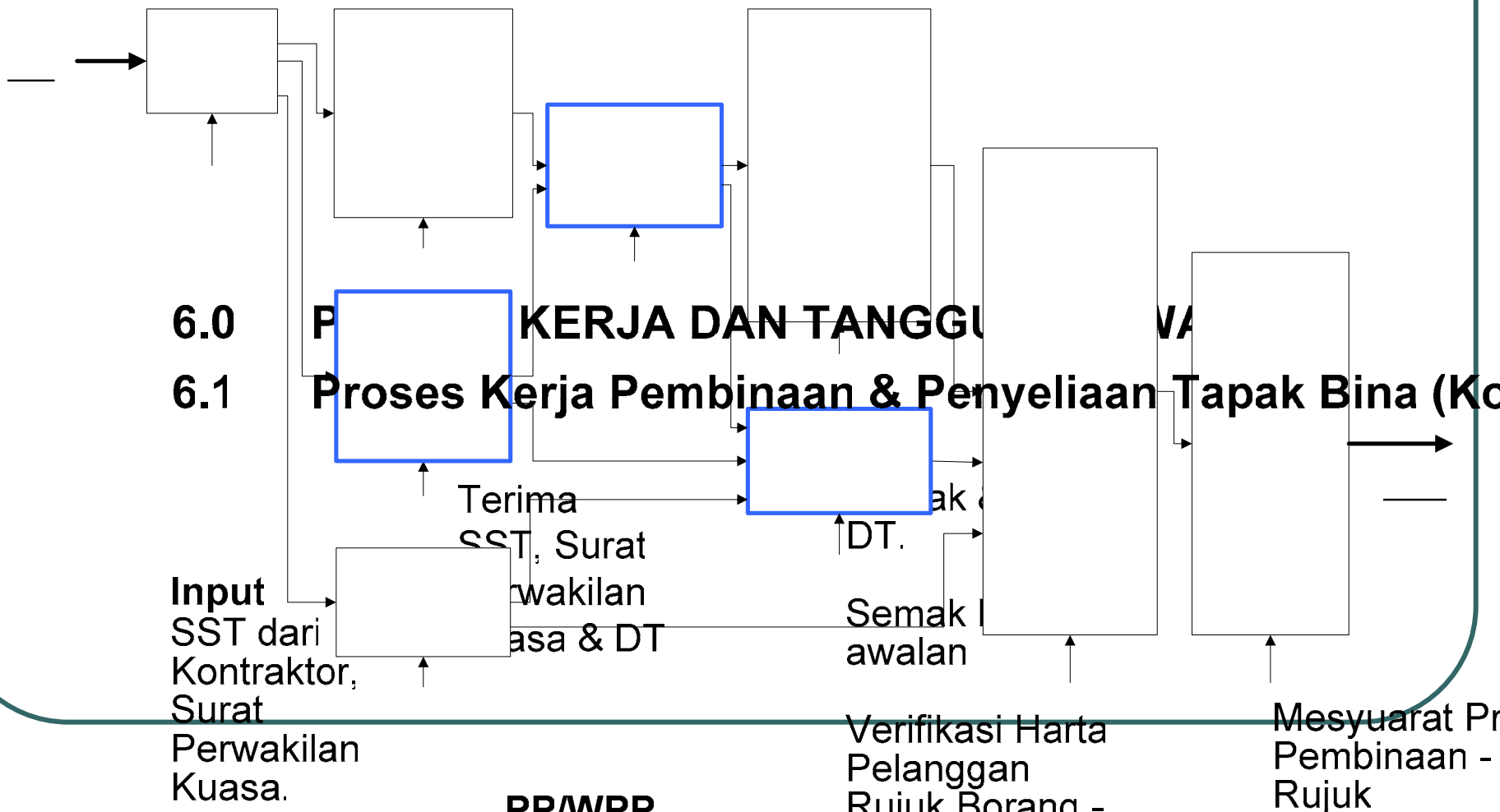
Ukur:

- Ketepatan - voltan nominal, kadaran arus, frekuansi, faktor kuasa.

Ujian:

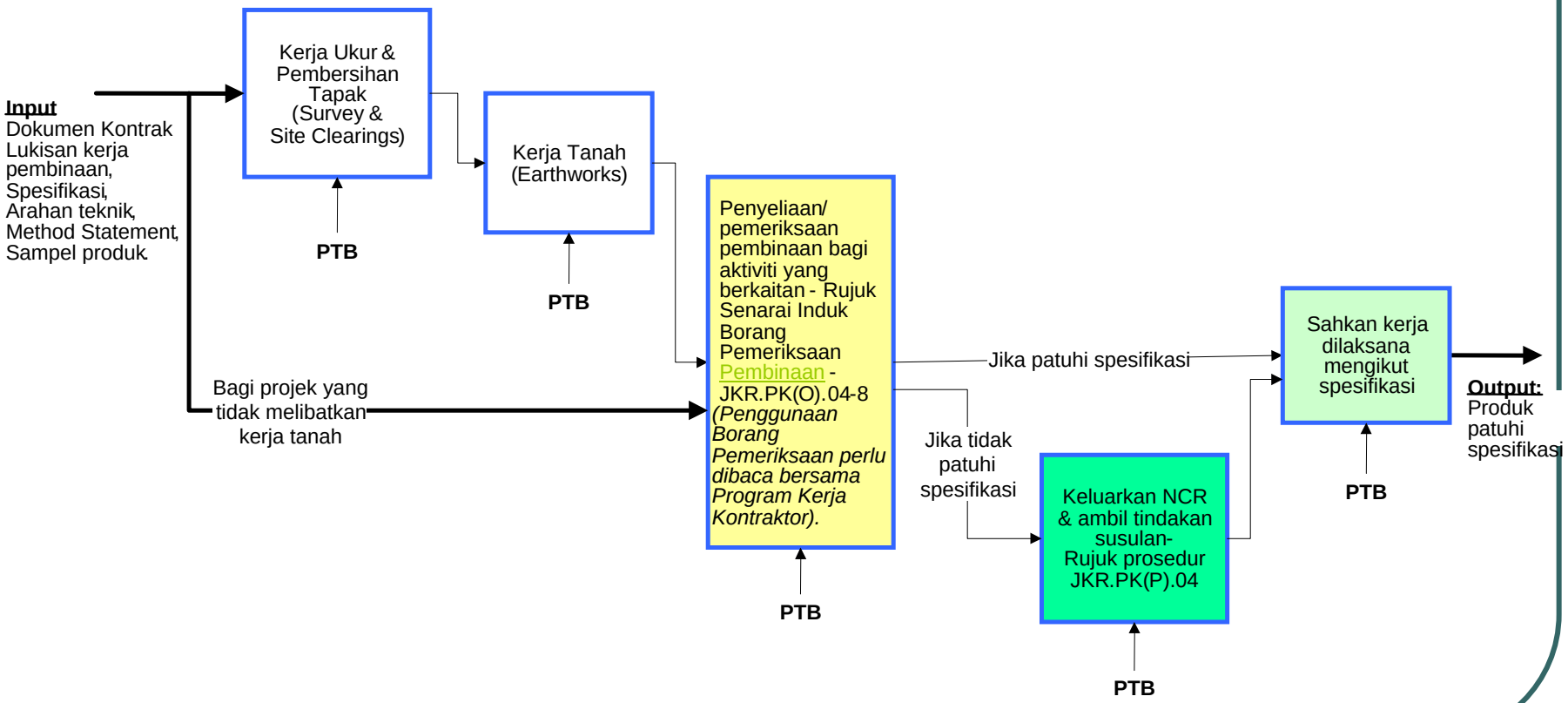
- Penebatan.
- Kekutupan.
- Keterusan.
- Keterusan litar cecincin
- Galangan gelong bumi.
- Rintangan bumi.
- Kepekaan perlindungan.
- Contoh pengujian

Prosedur Penyeliaan

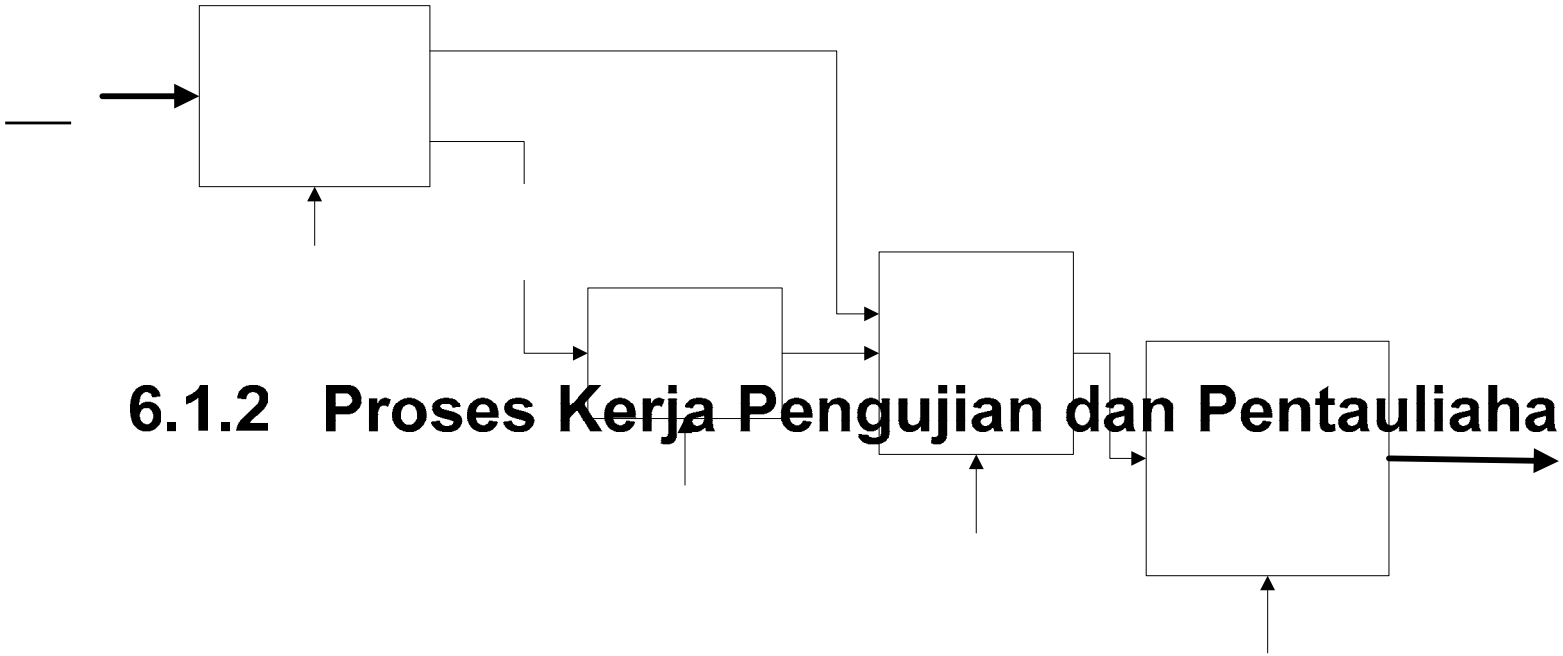


Prosedur Penyeliaan

6.1.1 Proses Kerja Pemeriksaan Pembinaan



Prosedur Penyeliaan



6.1.2 Proses Kerja Pengujian dan Pentauliahan

Tentukan produk untuk pengujian &

Input

Rekod-rekod Penyeliaan

- Senarai semakan/ Borang pemeriksaan.
- Sijil Kalibrasi/ Akredasi.
- Keputusan pengukuran & pengujian.
- Lukisan kerja/ pembinaan.
- Lukisan siap bina.
- Manual operasi & senggara.
- Manual data teknikal.
- Inventori pepasangan.
- Dokumen kontrak/ sijil-sijil insuran.
- Rekod-rekod urusan kontrak & kewangan.

SEKIAN

Terima Kasih

Lampiran

- Kaedah Pemasangan
- Pemerisaan Pemasangan
- Pengukuran & Pengujian

Kaedah Pemasangan

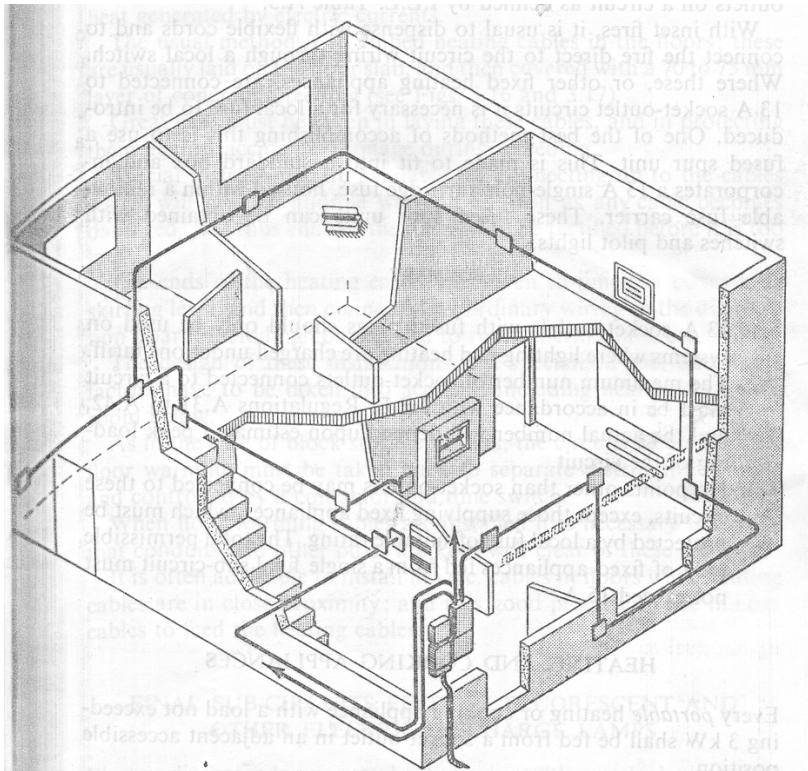


Fig. 3.15. A typical schematic layout of a 13 A socket-outlet ring circuit for a small house with a floor area of under 100 m².

Laluan pendawaian

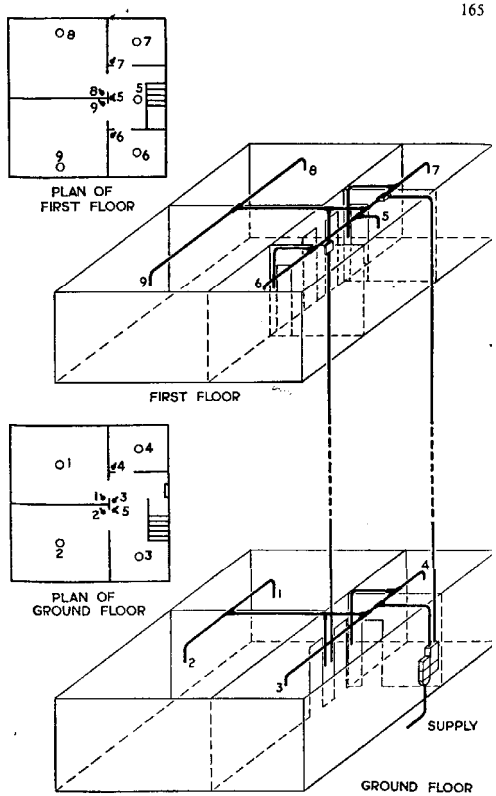


Fig. 5.37. Layout of conduit for electric lighting in typical semi-detached house
The layout of cables is shown in Fig. 5.38.

Laluan pendawaian

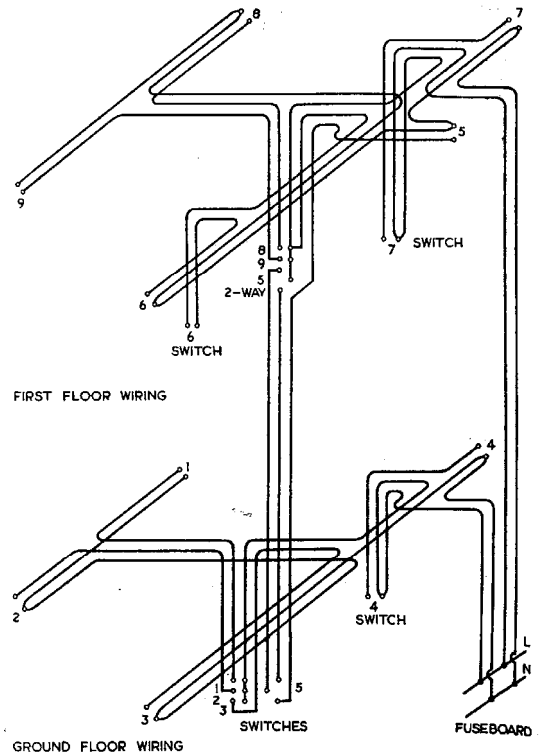


Fig. 5.38. Arrangement of cables in typical conduit lighting installation shown in Fig. 5.37.

Note that where cable is looped into switch or light positions the conduit carries three cables.

Contoh Laluan konduit bagi siling

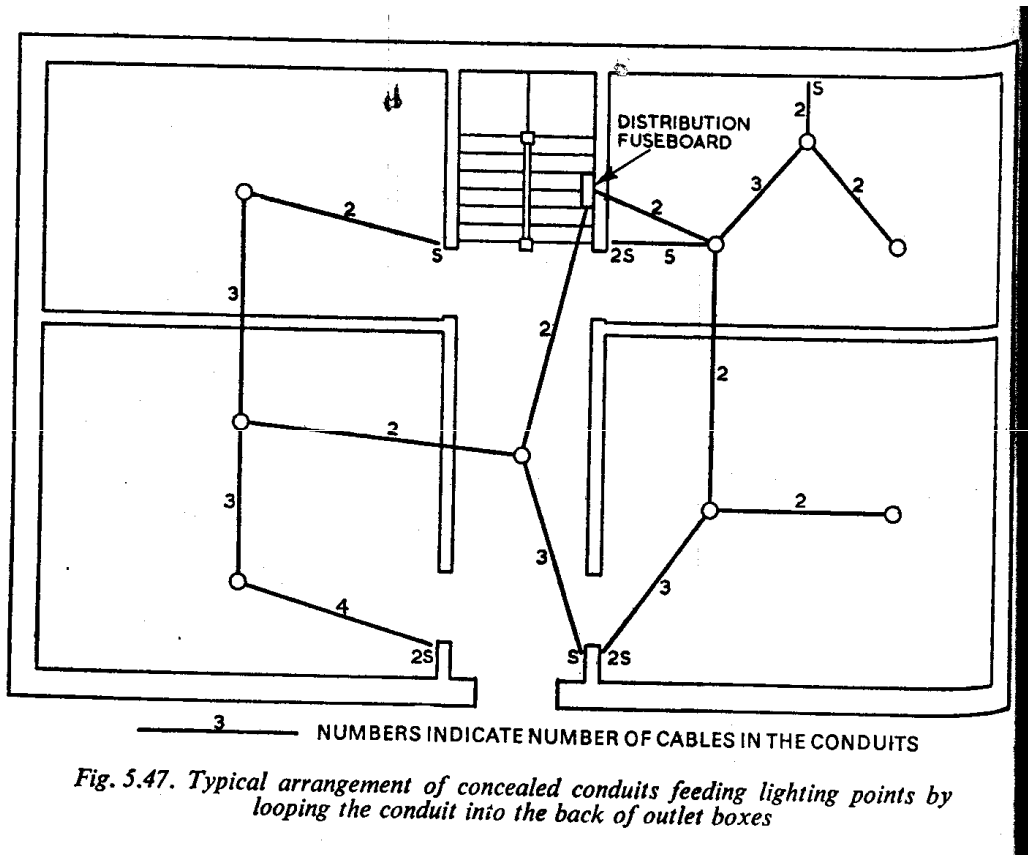
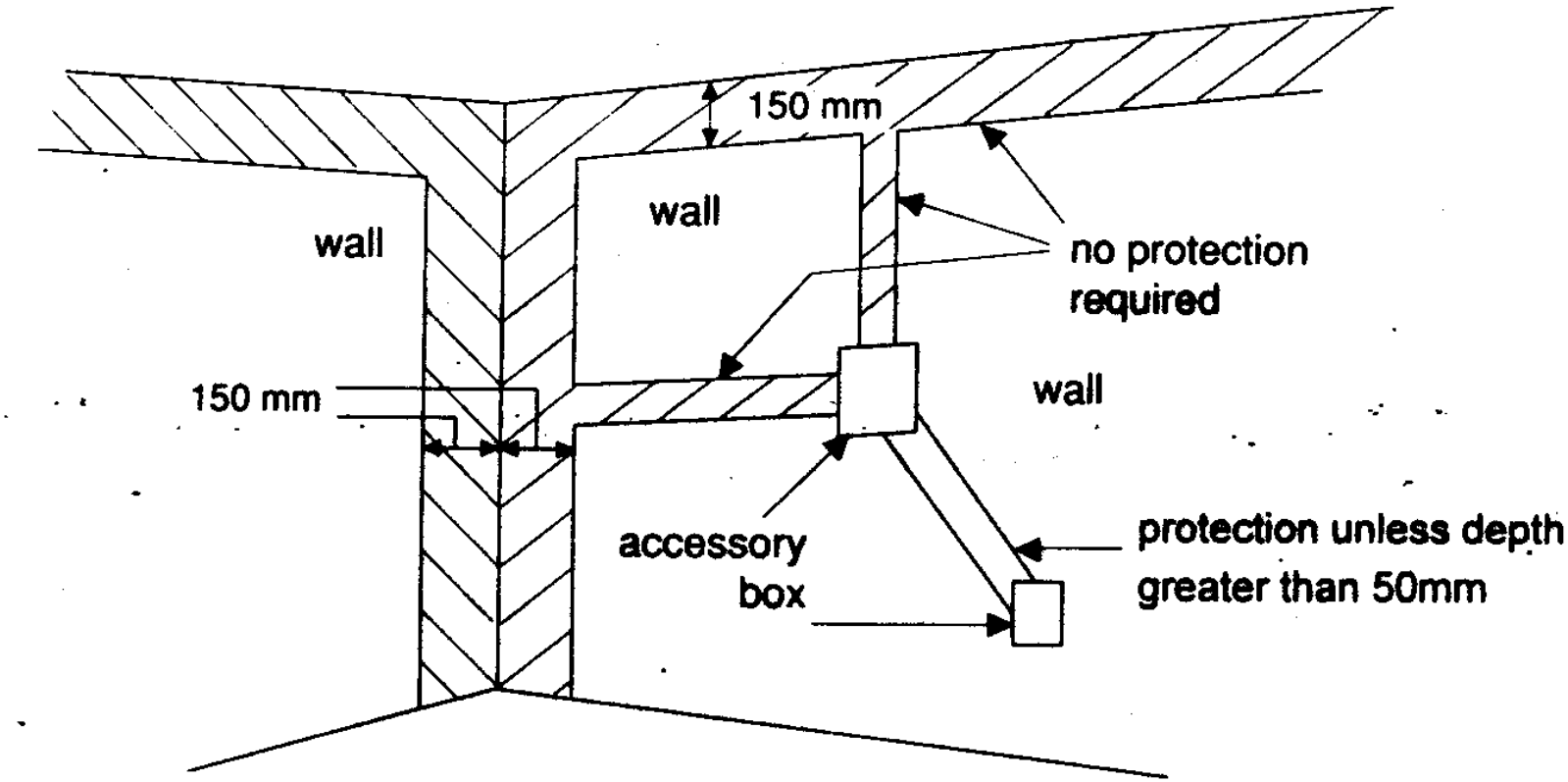


Fig. 5.47. Typical arrangement of concealed conduits feeding lighting points by looping the conduit into the back of outlet boxes

Laluan pendawaian pada dinding

Fig 7.3.2 Permitted cable routes



Aksesori Pendawaian

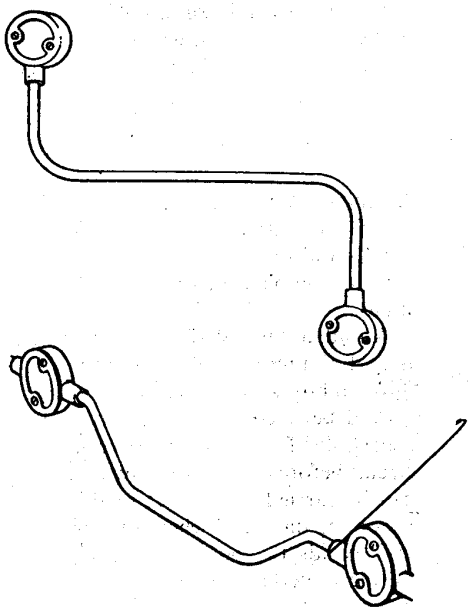


Fig. 5.16. Bending of conduit
Cable must not be drawn round more than two right-angle bends or their equivalent, I.E.E. Regulation B.91. The bends in the lower diagram are each at 45°, making a total of 180° in all.

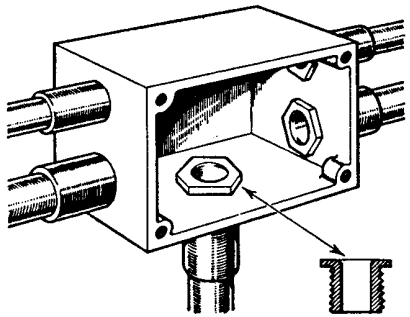


Fig. 5.15. Adaptable box
Where two or more conduits are run in parallel it is good practice to embrace all conduits with an adaptable box.

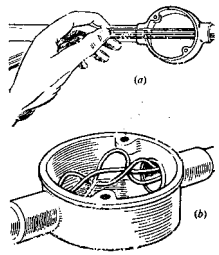


Fig. 5.39. Threading cables
Cables must be fed in carefully to prevent them from crossing or becoming tangled as shown in Fig. 5.39 (*b*). To thread not more than three cables, take them firmly between the fingers and thumb and keep them taut as shown in Fig. 5.39 (*a*).

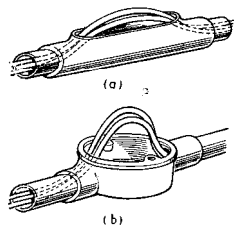


Fig. 5.40. For drawing in large cables an inspection sleeve is often better than a round conduit box as with the latter it is often difficult to stow away the final loop
(*a*) Inspection sleeve.
(*b*) Conduit box.

Fire barrier

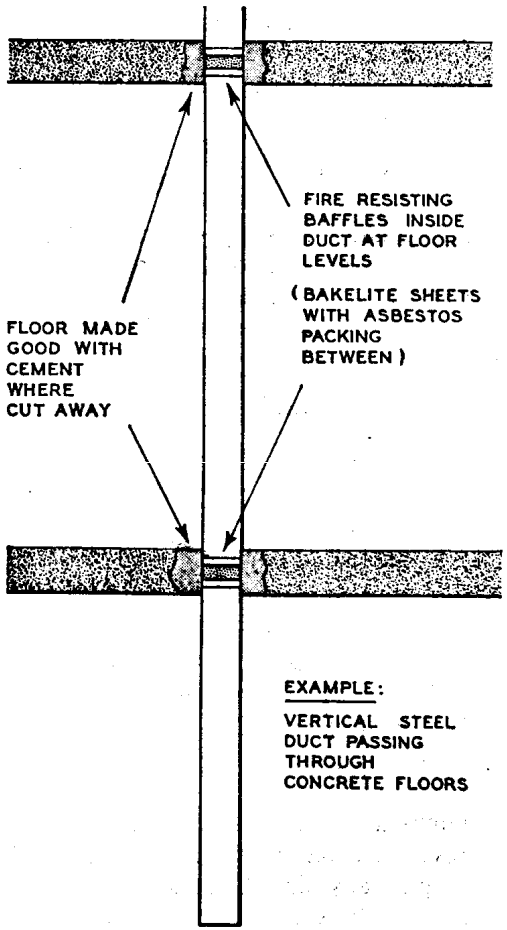


Fig. 4.17. Preventing the spread of fire
In vertical cable ducts fire-resisting baffles are fitted where the trunking passes through floors and the floors are made good with cement where cut away.

Kaedah Pemasangan terbenam

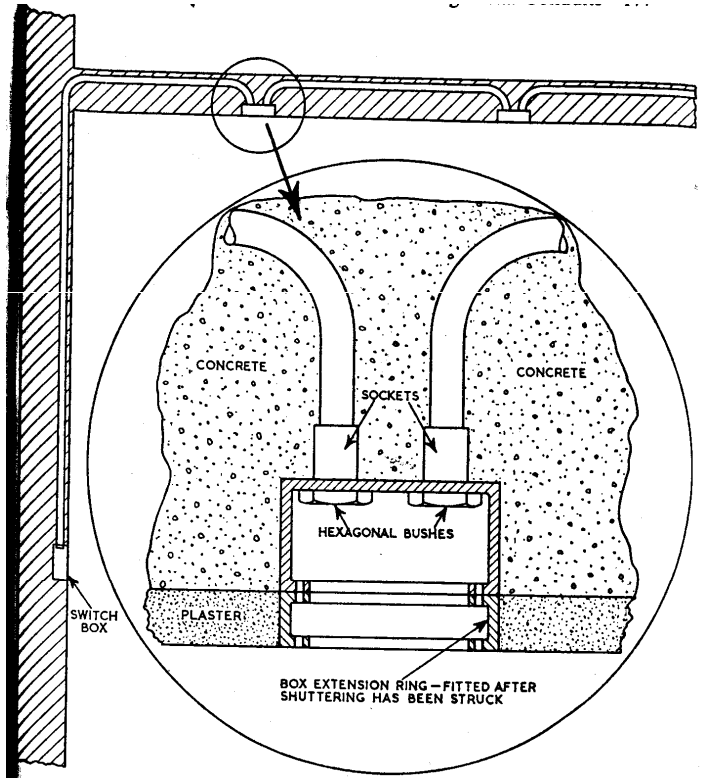


Fig. 5.48. Details of conduit box and method of fastening conduit
A socket is fixed outside the back of the box and a brass hexagonal bush inside. The bush should be firmly tightened, otherwise there will be difficulty in obtaining a satisfactory continuity test on completion.

Flexible conduit

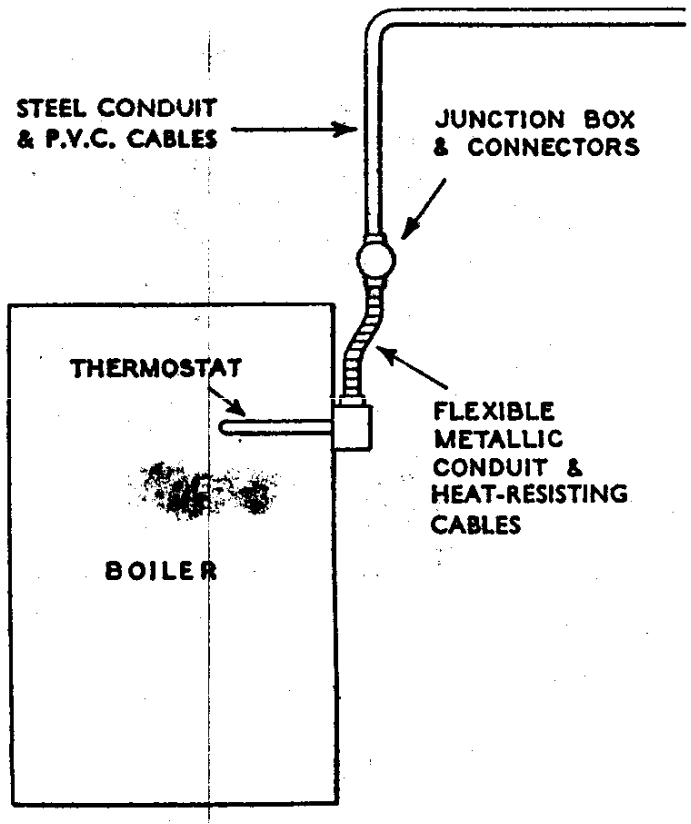


Fig. 4.16. A method of wiring cable-feed to boiler thermostat

A short length of heat-resisting cable is used in the vicinity of the boiler where the temperature is high. This is joined to the main p.v.c. cable by a connector.

Pemasangan konduit pada mesin

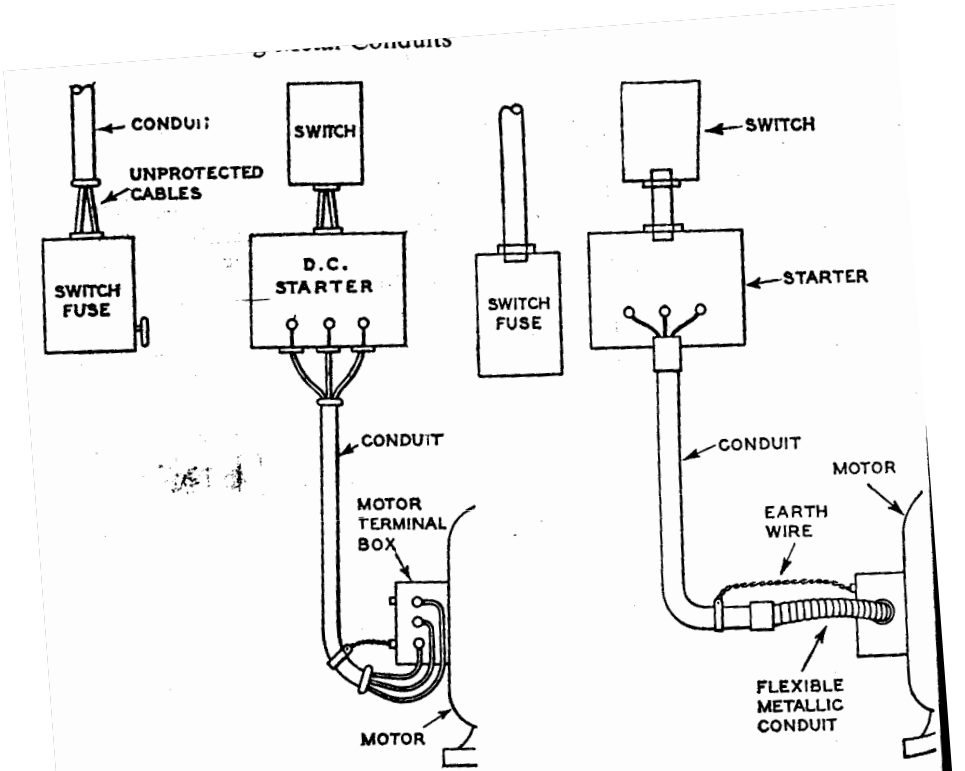


Fig. 5.32. 'Wrong' and 'right' methods of terminating conduit at switch and starter

Fig. 5.32 (*a*) shows the wrong method, which is frequently adopted because proper conduit outlets are not always provided on starters and motors. The lengths of unprotected cable are subject to mechanical damage which may lead to electrical breakdown. Fig. 5.32 (*b*) illustrates the right method. Conduit is either taken direct into the equipment or terminated with flexible metallic conduit.

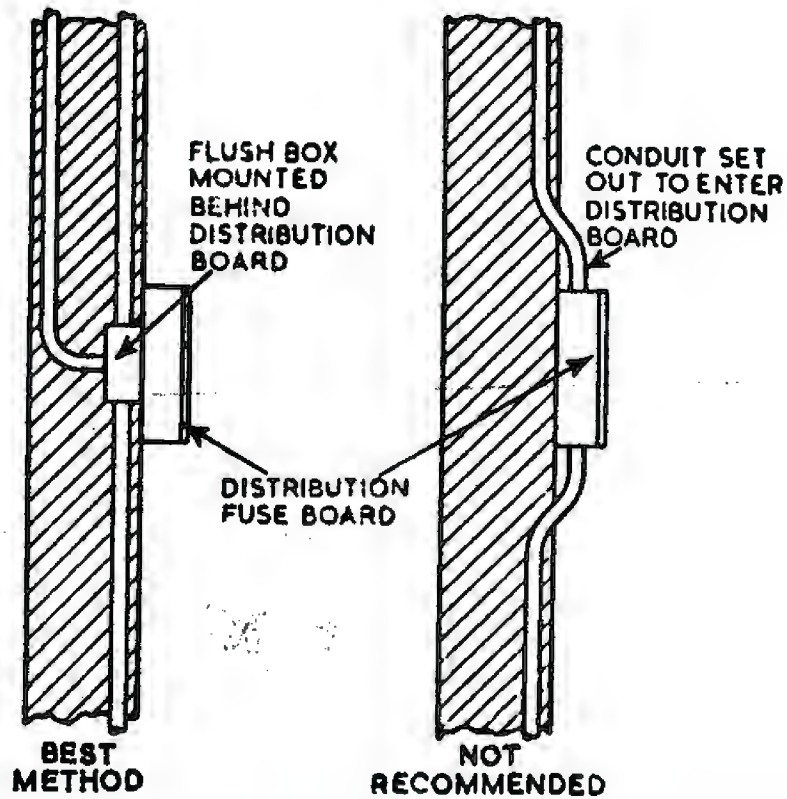


Fig. 5.50. Surface mounted distribution fuse-boards

A good method is to run the conduit into a flush adaptable box in the wall behind the distribution fuseboard. This avoids the unsightly 'setting out' of conduits as shown on the right.

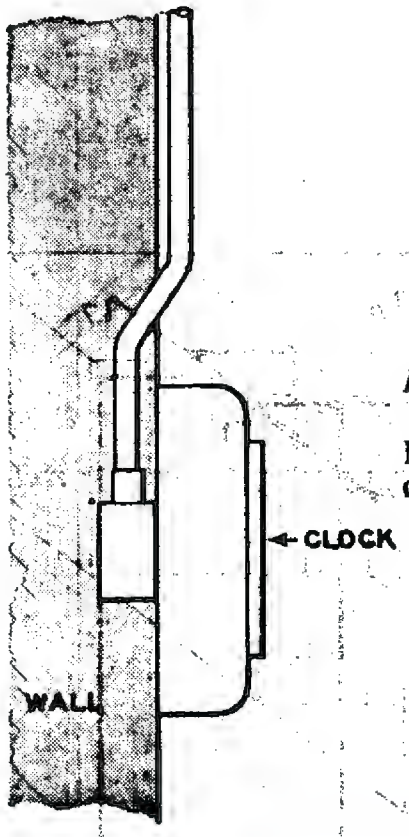


Fig. 5.33. Surface conduit set into wall at clock position

Method adopted for surface system when fitting or accessory must be flush on wall or ceiling.

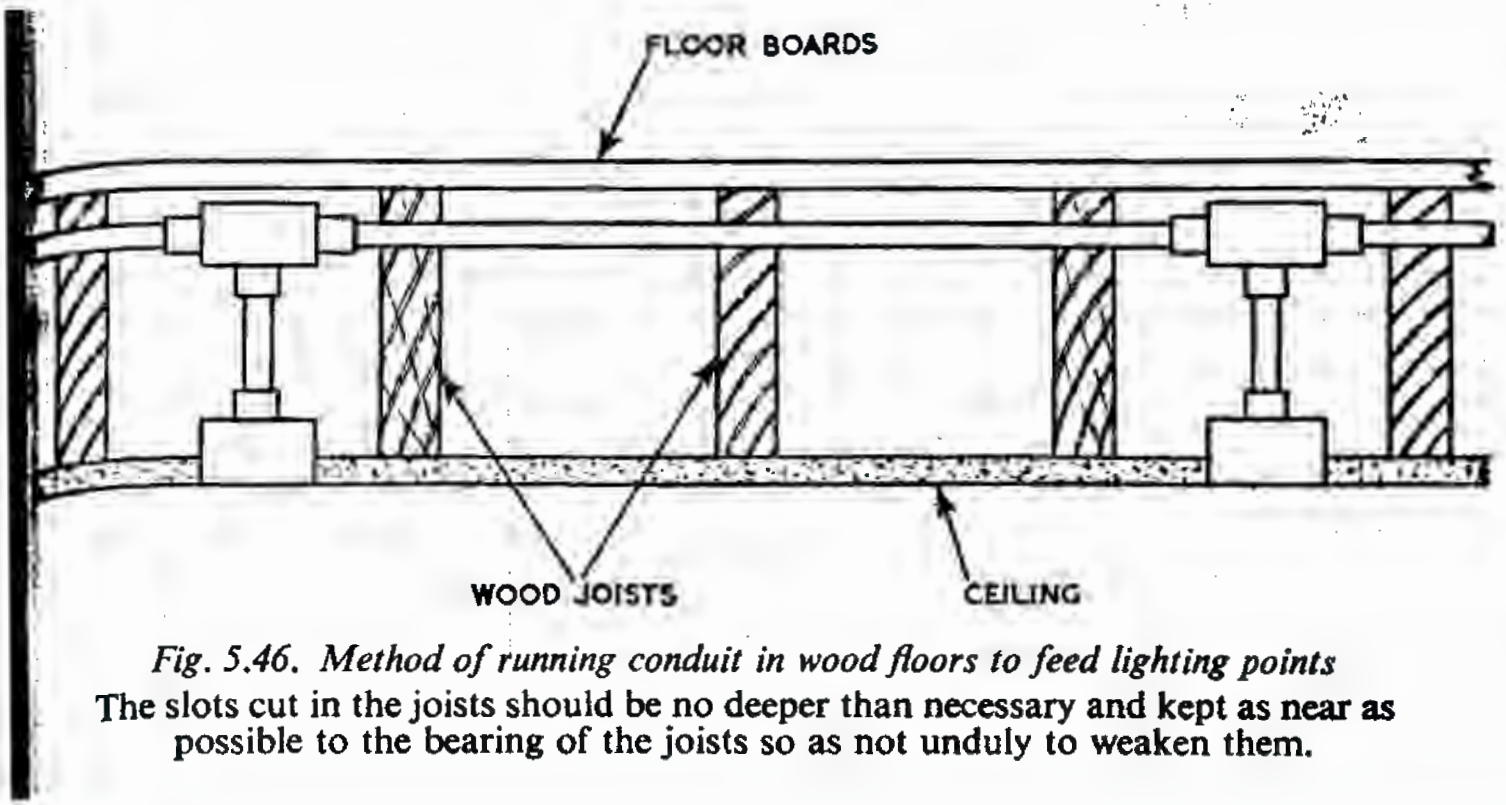


Fig. 5.46. Method of running conduit in wood floors to feed lighting points
The slots cut in the joists should be no deeper than necessary and kept as near as possible to the bearing of the joists so as not unduly to weaken them.

Pemasangan konduit

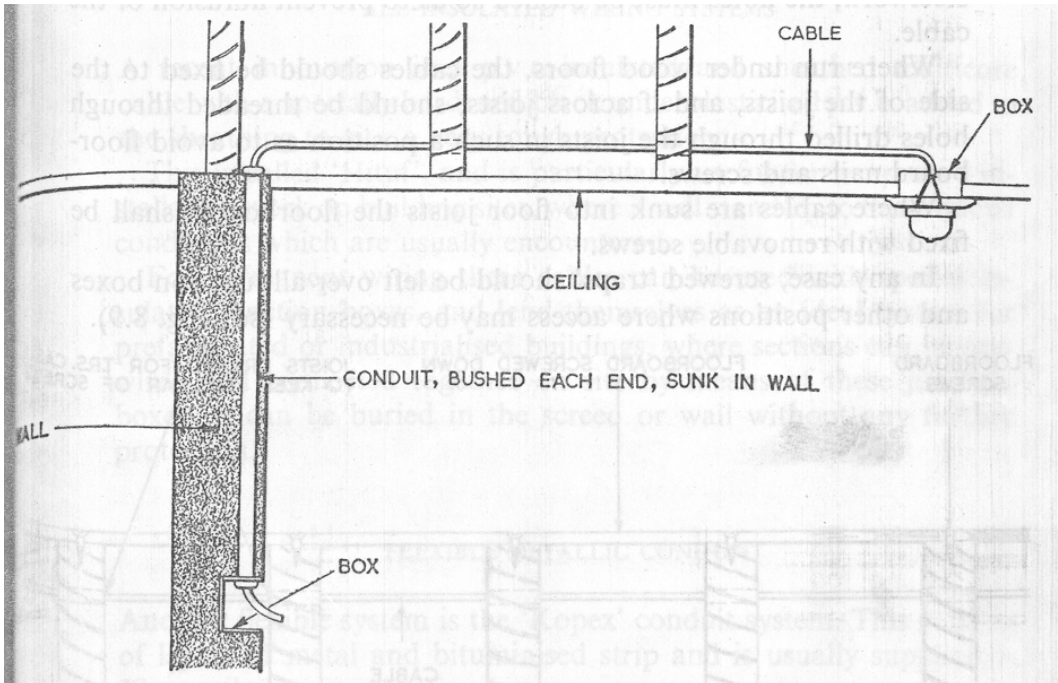


Fig. 8.8. Concealed p.v.c.-sheathed wiring system

When the cable is concealed in a wall a box must be provided at the switch position whether the switch is flush or surface type. Box must also be provided at light positions behind ceiling rose.

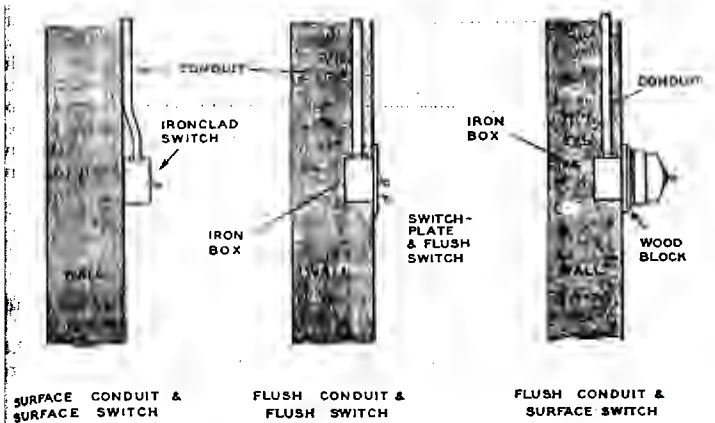


Fig. 5.25. Methods of terminating conduit at switch positions

At switch positions conduit must terminate with a metal box or other suitable enclosure. The illustration shows typical methods of terminating surface and concealed systems.

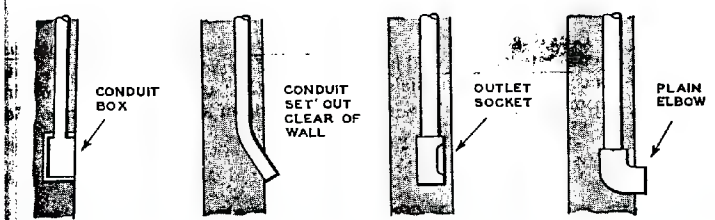


Fig. 5.26. I.E.E. Regulation B.69 insists that a box or other suitable enclosure must be fitted at all outlet positions

Terminations as shown in B, C and D are not permitted.

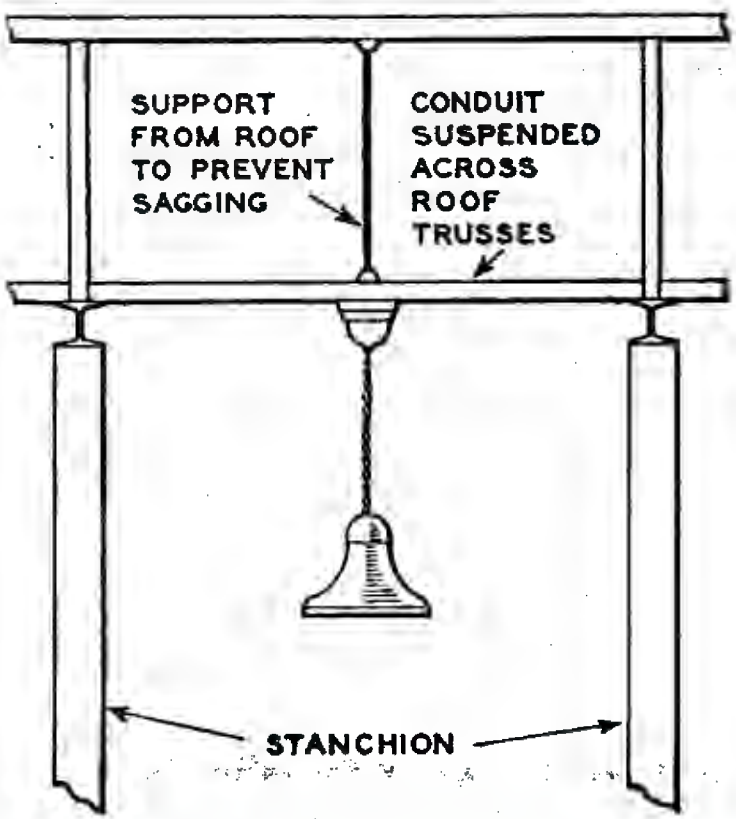


Fig. 5.24. Supporting conduit suspended across roof trusses

When span is considerable, conduit may need support from roof, to prevent sagging. In diagram trusses are shown close together to illustrate method.

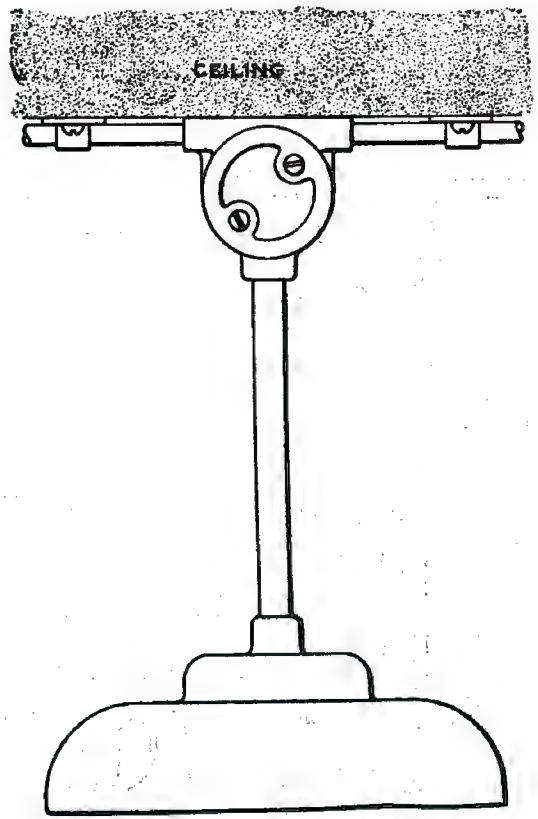


Fig. 5.23. Method of supporting fitting from tangent tee box

The conduit is fixed to the ceiling with spacer bar saddles.

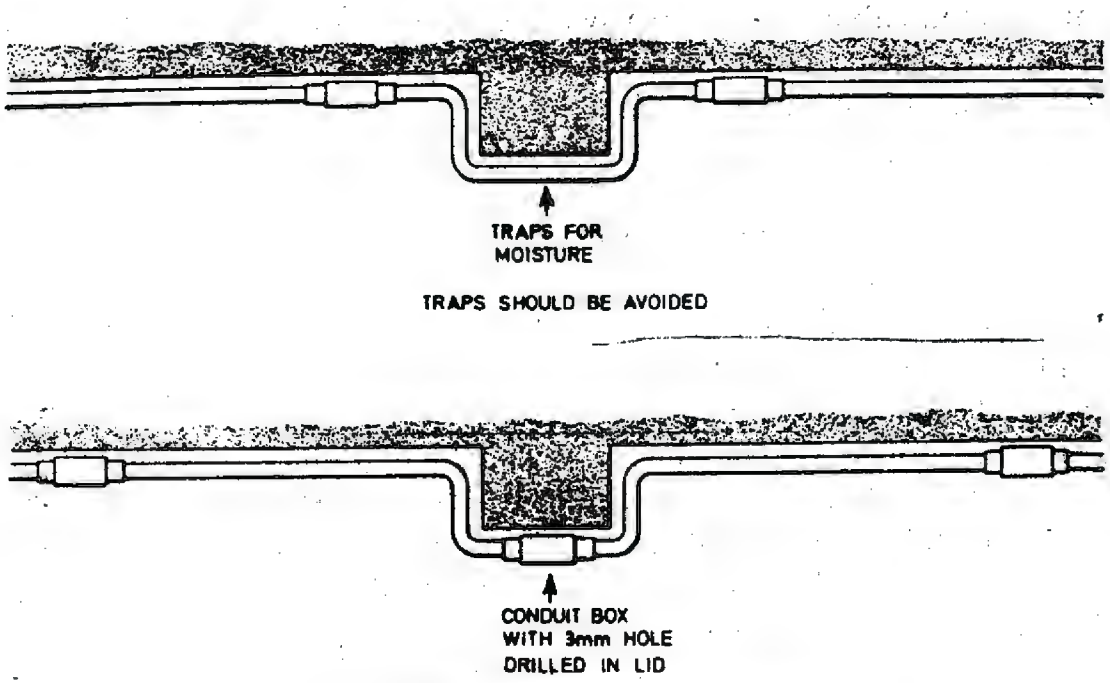


Fig. 5.30. Overcoming condensation

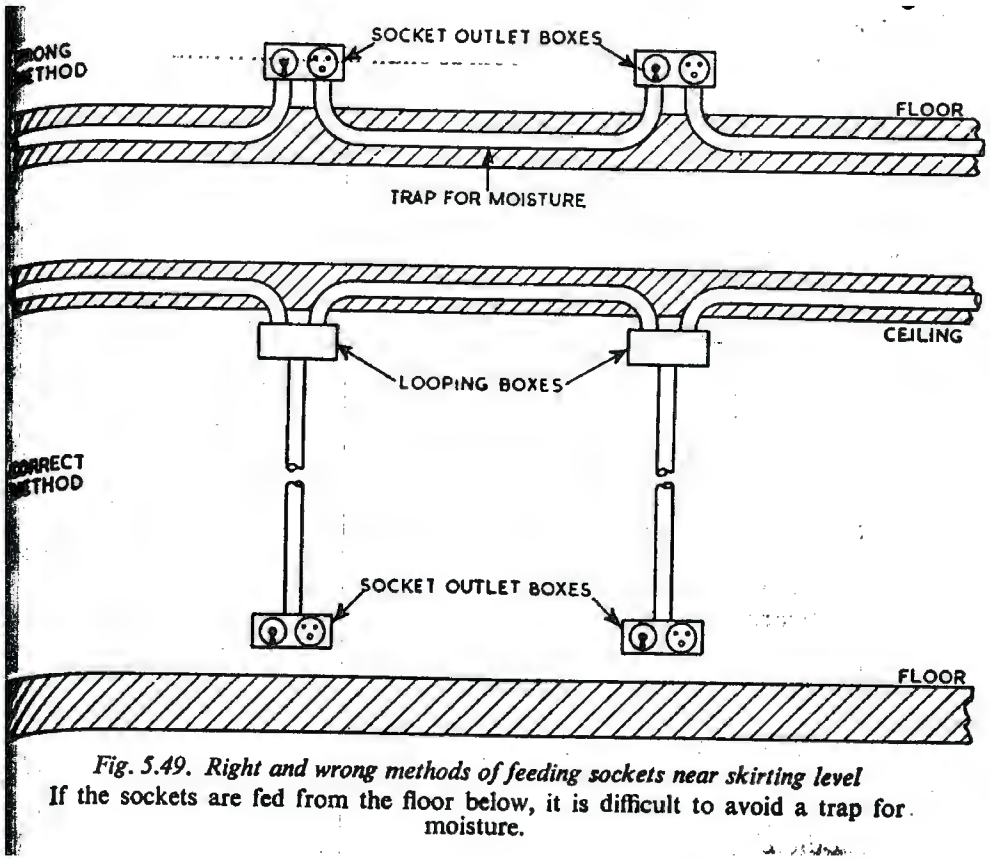


Fig. 5.49. Right and wrong methods of feeding sockets near skirting level
If the sockets are fed from the floor below, it is difficult to avoid a trap for moisture.

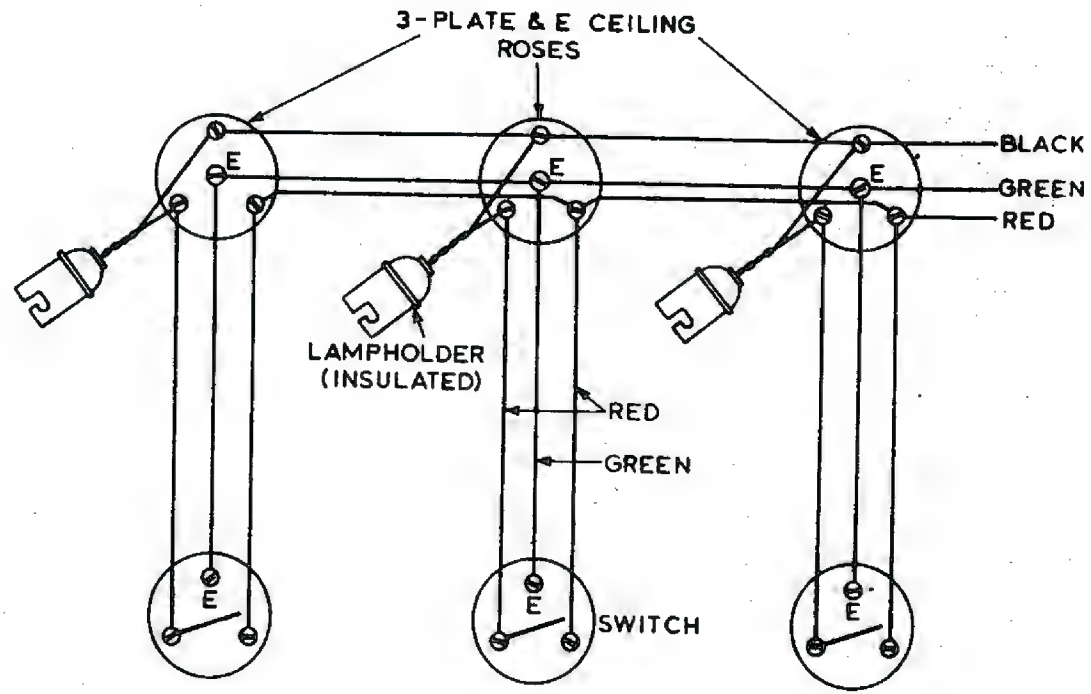


Fig. 8.5. Method of wiring with p.v.c.-sheathed cables using three-plate ceiling roses instead of junction boxes

Pembumian- ikat-bumi

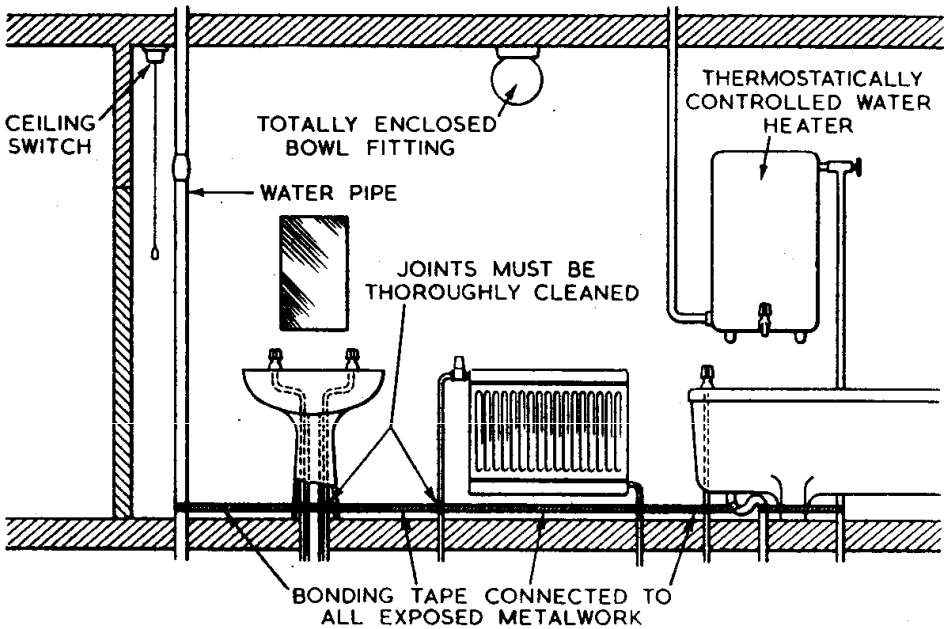
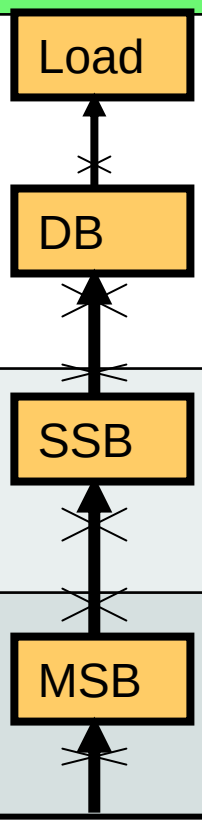


Fig. 14.1. Special earthing precautions in bathrooms

Illustrating bonding of all exposed metalwork (I.E.E. Regulations D.15-18). The bonding strip must be connected to earth. All conduits and other metal parts of the electrical installation should be completely concealed in walls and floors, or otherwise screened so that they cannot be touched. Where this is not possible these should also be bonded to water pipes and other metal parts in the bathroom.

Pemeriksaan Pepasangan

Litar Agihan	Vdrop/ MD	Busbar F/L	Mccb rating.	O/C protect.	S/C discrim. time
	0.5% / 0.6 TCL	6kA 10kA		Mcb/ fuse	Instantaneous 0.02 sec
	1.0 % / 0.3 TCL	30kA	Ics=50% Icu Ics=100% Icu	Mccb/ fuse	1.20 sec
	2.5%/ 0.3 TCL	30kA 50kA	Ics=50% Icu Ics=100% Icu	Mccb/ fuse/ ACB	2.25 sec

Papan Suis- cubicle type

Perkara	**Standard**
Frameworks	≥ 2.5 mm
Panel	≥ 2.0 mm
Type	Form 2b
Indicator instrument	≤ 2m
External cable terminal	≥ 200 mm above base

RCCB

Perkara	**Standard**
Breaking capacity	≥ 6 kA
Tempat hiburan & ruangan basah	10 mA
Hand-held equipment use/sso	30 mA
Litar akhir biasa/lampu/kipas	100 mA
Litar 3 fasa	300 mA

Contoh Borang Pemeriksaan

Tajuk:……., No: JKR.PK(O).04.8-

Projek:…… Blok/Lokasi ……., Tarikh Pemeriksaan:……..

Bil	Butiran Pemeriksaan	Standard/ Keperluan Teknikal	Pengukuran/ Penilaian Tapak	Perakuan penyelia
1.	Thickness of Rubber Mat for LV MSB	≥ 6 mm	8 mm	OK
2.	Corridor Area's illumination level	≥ 200 lux	150 lux	NCR no. 3
3.	Noise level at 1m outside of Generator Room/ Building	≤ 60 dB	75 dB	OK

…… ……

Wakil JKR yang diberi kuasa Wakil Kontraktor yang diberi kuasa

Ujian Keterusan

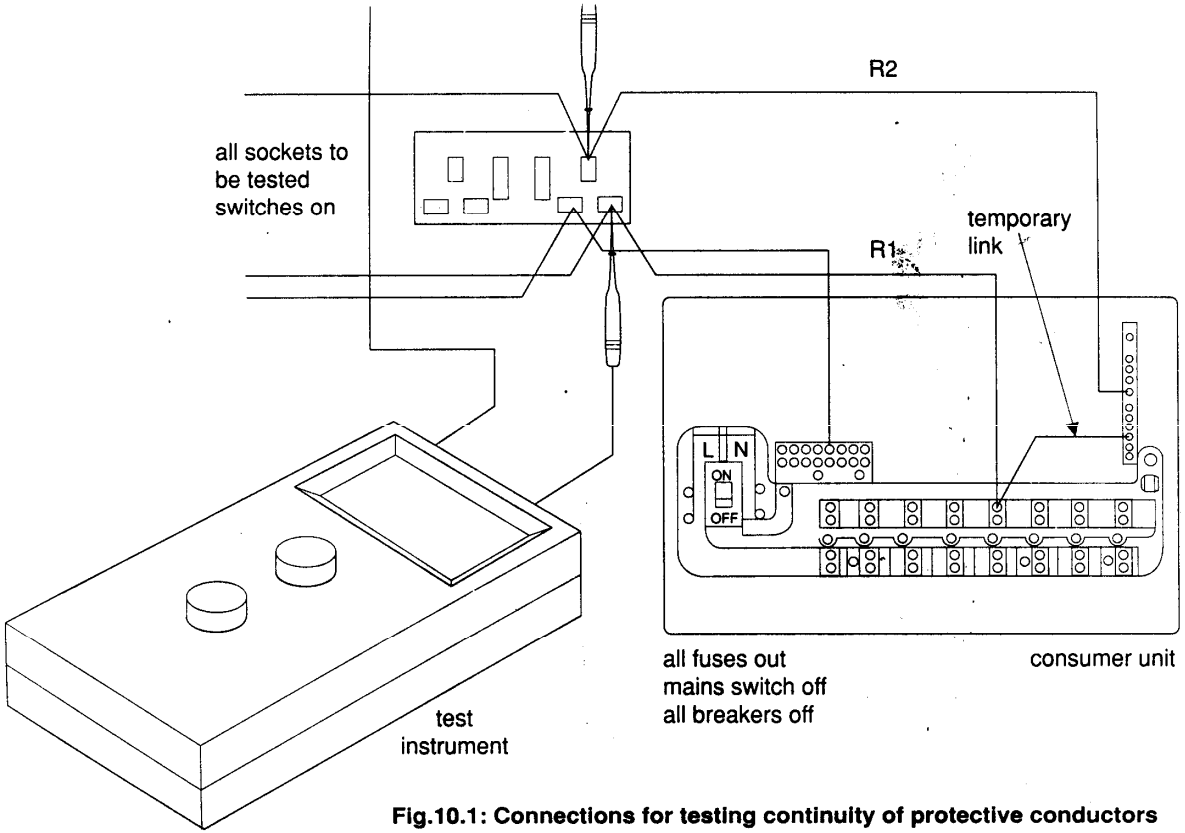


Fig.10.1: Connections for testing continuity of protective conductors

Ujian Keterusan

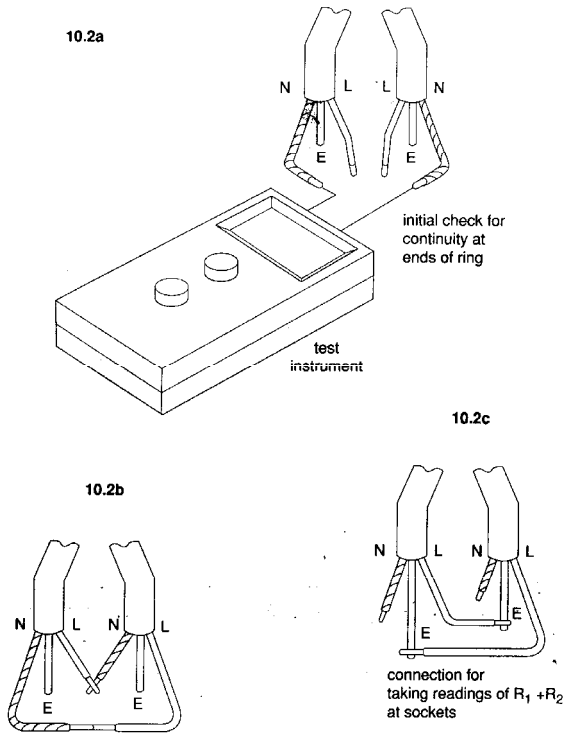


Fig.10.2: Connections for testing continuity of ring final circuit conductors

Ujian Penebatan - pengalir

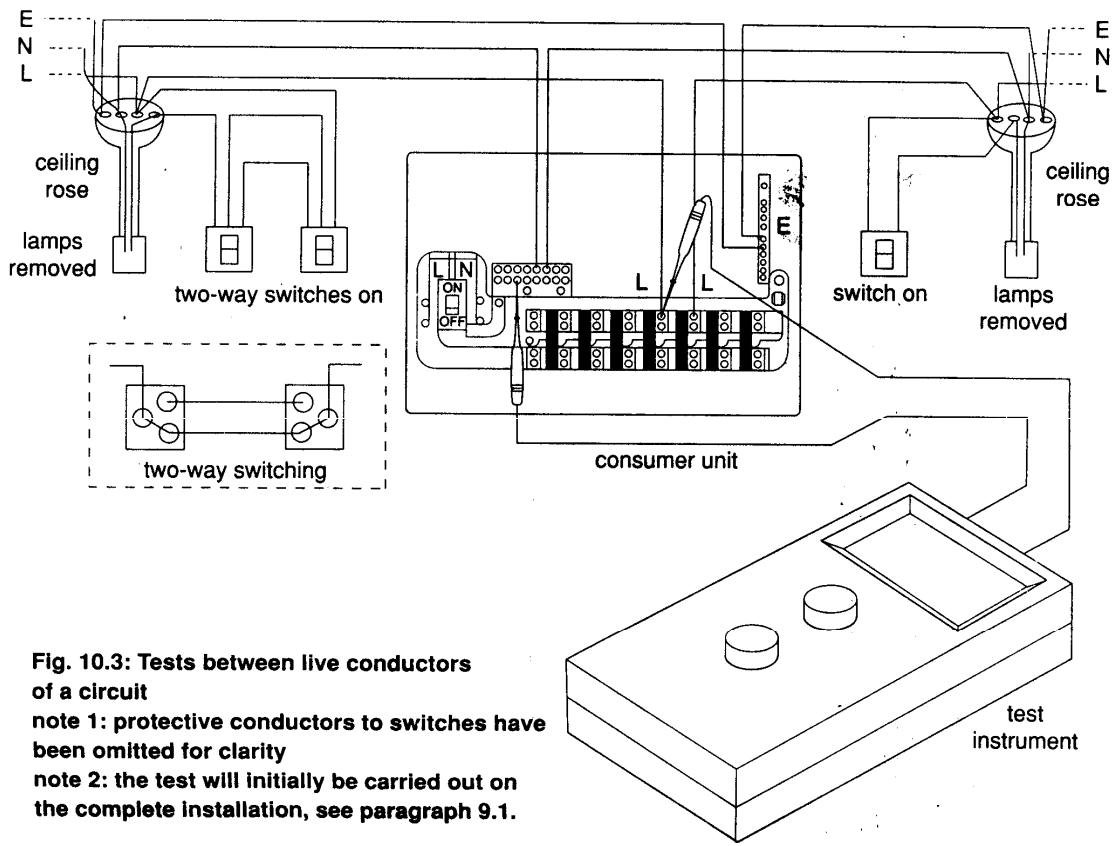


Fig. 10.3: Tests between live conductors of a circuit
note 1: protective conductors to switches have been omitted for clarity
note 2: the test will initially be carried out on the complete installation, see paragraph 9.1.

Ujian Penebatan -bumi

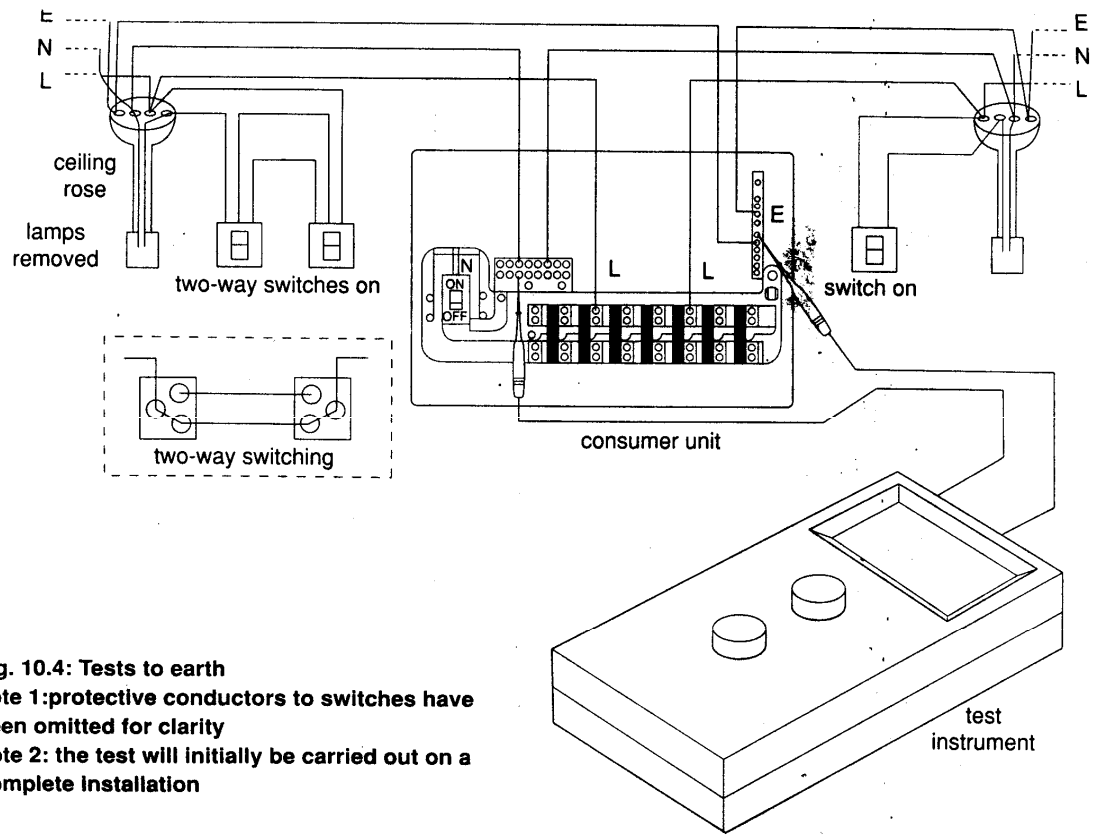


Fig. 10.4: Tests to earth
note 1:protective conductors to switches have been omitted for clarity
note 2: the test will initially be carried out on a complete installation

Ujian Kekutupan

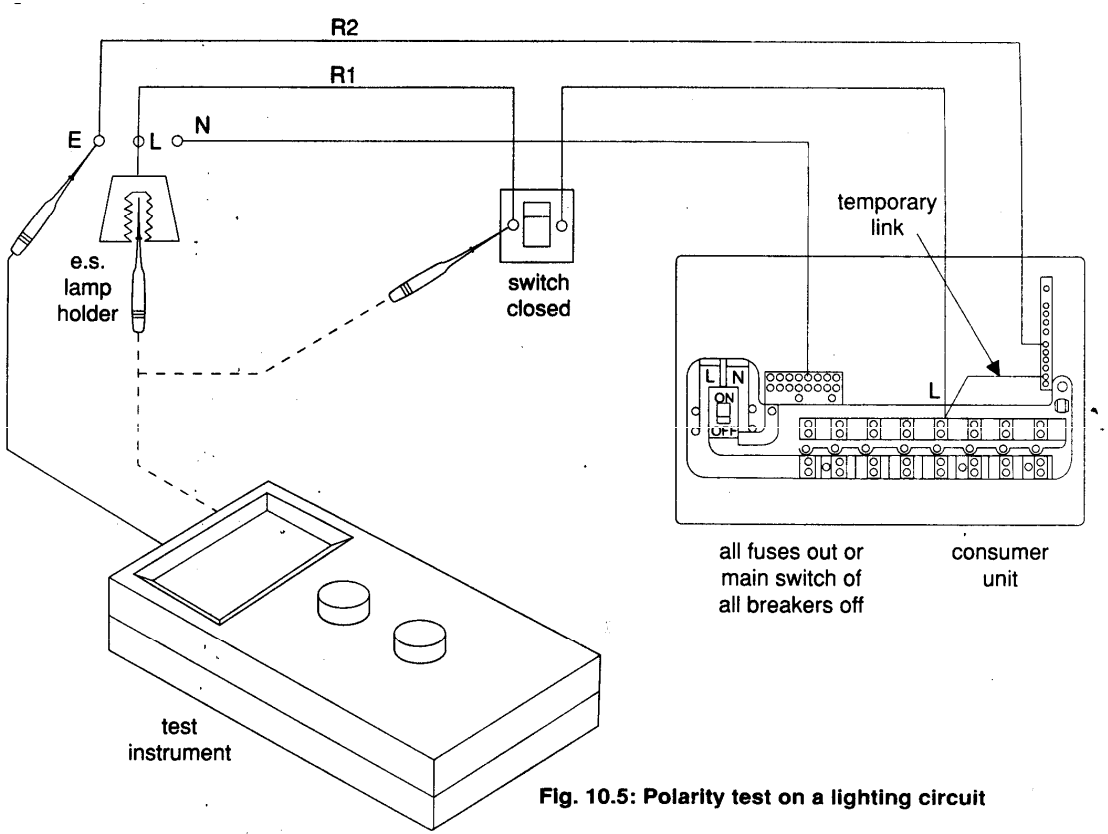


Fig. 10.5: Polarity test on a lighting circuit

Ujian Galangan Gelong Bumi

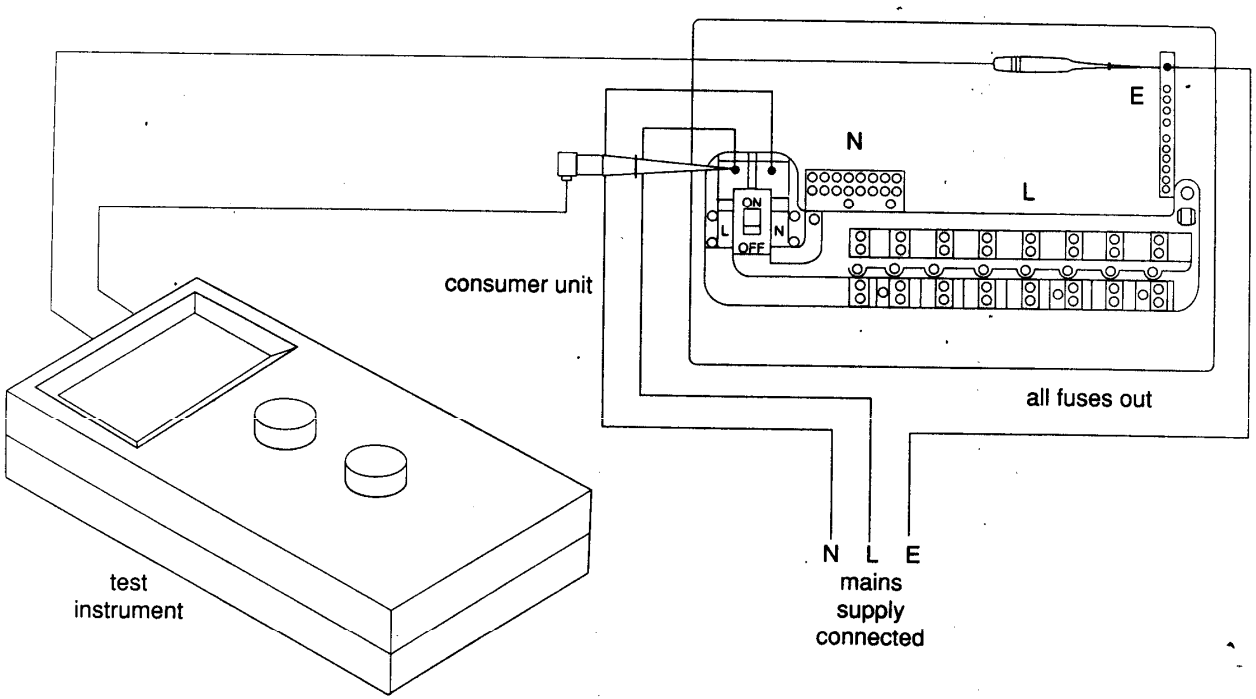


Fig.10.6: Test of Z_e at the source of supply