Telecom Australia

CABLES AND CONDUITS

ISSUE 4, 1980

Issued To [redacted]

Issued By : GENERAL MANAGER
ENGINEERING DEPARTMENT

TO ALL EXTERNAL PLANT STAFF

This Instruction Handbook has been prepared for use by staff engaged on the installation and maintenance of telecommunication cables and conduits.

The handbook contains essential information on all aspects of underground construction, including conduit laying, manhole building, installation of large size cables, subscribers distribution cables, pillar terminals and cross-connecting cabinets. More detailed information is available from Engineering Instructions listed throughout the handbook.

We have a vast investment in human skills in the external plant area. Industrial accidents take a heavy toll of our skills, cause suffering and inconvenience, and reflect upon our operating efficiency. We all have a responsibility to make ourselves aware of hazards and to prevent accidents by following the working precautions associated with construction and maintenance activities. Your attention is drawn particularly to Section R - Safety Precautions.

WE MUST REGARD ALL INDUSTRIAL ACCIDENTS AS PREVENTABLE AND DO OUR BEST TO REDUCE THE ACCIDENT RATE.

Do not regard your handbook as an ornament for display in a bookcase. It is a TOOL, and you should use it as such. Take it with you on the job and refer to it whenever you are in doubt. Use it to improve your knowledge of your work. If your handbook needs replacing, your Senior Lines Officer will arrange for you to be issued with a new book.

R.G. MARTIN
GENERAL MANAGER - ENGINEERING
AUSTRALIAN TELECOMMUNICATIONS COMMISSION

CASH AWARDS

ARE PAID FOR GOOD IDEAS WHICH SAVE TIME, MONEY OR MATERIALS
SEND YOURS NOW TO:

FREEPOST 13,
EXECUTIVE OFFICER,
STAFF SUGGESTIONS BOARD,
TELECOM AUSTRALIA.
COMMUNICATIONS HOUSE
199 WILLIAM STREET,
MELBOURNE. VIC. 3000

ENQUIRIES TELEPHONE : 03 630 7254

Write a brief description of your idea, include sketches where possible and post direct to the above address.

To avoid disappointment and wasting Telecom's time in investigating your suggestion make sure that your ideas are practical. Discuss them with your supervisor and if possible try them out first.

ON THE LINE

On the Line

Send your contribution to:
Editor
ON THE LINE
Lines Construction Branch
Telecom Australia
29th Floor
570 Bourke Street
Melbourne Victoria 3000

Phone (03) 630 7696

ON THE LINE is your newspaper. It contains interesting facts, achievements, pictures, suggestions, problems, items of interest etc. It depends on contributions from External Plant Staff.

ON THE LINE is over 20 years old and your efforts have kept it afloat. Don't hesitate to contribute a story or your experiences, whether personal, technical, on or off the job. Assistance is available to help you prepare an article.

- Photographs can be arranged by your supervisor or District Telecom Office.
- Drawings, sketches or cartoons can be organised by your District Telecom Office.
- If you supply the facts by phone or mail, ON THE LINE can organise a story.
- Names do not need to be published but would be appreciated.
- Nothing submitted, nothing published. Remember its your newspaper.

Issue 4, 1980

CONTENTS

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

SECTION A

DESIGN CONDUIT ROUTES

- SURVEY OF ROUTE
- ENDS AND CURVES
- MANHOLE SPACING
- INSTALLATION DEPTH
- CALCULATING VOLUME OF TRENCH EXCAVATION
- DESIGNING CONDUIT DRAINAGE
- CONDUIT PLANS
- PLAN SYMBOLS - CONDUITS

DESIGNING CONDUIT ROUTES

NUMBER OF DUCTS REQUIRED

Conduits are normally laid to cater for the number of cables to be installed along a route for at least 20 years and in some cases for much longer periods eg, exchange entrances, main road crossings etc. The number required is determined by the Planning Branch (or local Engineer in the case of minor routes) having regard to the anticipated telephone development for the area obtained from subscribers surveys and junction and trunk traffic studies.

SELECTION OF ROUTE

This entails careful inspection of the area to be served or points to be linked, to select a route which will permit economical laying of conduits and provide ready access for installation and maintenance of cables. The route should normally be as short as possible, but should avoid the following locations wherever practicable :

- Streets where future alterations in alignments or levels may later mean shifting or altering the conduit line.
- Streets with expensive paving where the cost of reinstatement would be high.
- Wet, unstable or made up ground where it may be necessary to take special action to support the conduits or to stabilise the ground.
- Low lying or swampy areas where conduits cannot be drained.

LOCATION OF CONDUITS WITHIN FOOTPATH ALLOCATION

The allocation of footpath space for installation of water, gas and sewerage, mains, and for electric power and telephone cables, is usually the subject of local agreement between the authorities responsible for these services. The section of footpath allocated to Telecom may vary from district to district.

Telecom's section of the footway is normally adequate for conduit installation, but is seldom wide enough for the construction of manholes. Encroachment on other authorities' footpath allocations for manhole construction should be restricted to a minimum.

SURVEY OF ROUTE FOR CONDUITS

A detailed survey of the proposed route is necessary to decide on factors such as the most suitable depth and location for the conduits in footways, the positions of road crossings, the locations of manholes, and the method of drainage. From this survey, working drawings are prepared and an estimate is made of the cost of installing the conduits.

Consult the authorities concerned to obtain details of the location and depth of other underground services which may be encountered along the route. Determine from the Road Authority (Local Council or Main or Country Roads Board) whether any alterations are likely to be made to the existing levels or alignments of streets or footpaths involved.

Measure the route accurately and fix the positions of the manholes. (See page A-4).

Keep the conduit run as straight as possible to reduce the strain on the cable during hauling. Provide bends for changes of direction and to avoid obstructions. (See page B-7).

Take levels where necessary to determine the best method of drainage (See page A-9).

Record the following information :

- Centre to centre measurement between manholes and pits.
- Distance from ducts to building alignment.
- Class of soil to be excavated ie, sand, clay, rock, etc.
- Quantity and class of footpath and road reinstatement necessary.
- Location and size of manholes required and method of drainage.

For multi-duct routes determine the most suitable arrangement of conduits for the particular location. Consider the number of conduits required (immediately and in the future), soil conditions, drainage, location and depth of existing Telecom and other authorities underground plant, mechanical aids to be used etc.

On new routes, it is normally desirable to arrange the configuration of conduits so that not more than one half of the Telecom's footpath allocation is occupied. The other half of the allocation is thus preserved for future conduit installations.

Locate minor conduits where they will not interfere with future major conduit installations.

BENDS AND CURVES IN CONDUIT ROUTES

Conduits should be laid in a straight line between adjacent manholes wherever practicable, but horizontal or vertical bends are permitted for changes in direction to avoid obstructions provided that the following conditions are observed :

- The curve should be as gradual as possible. Abrupt changes in direction must be avoided. (For recommended method of installation see pages E12-15 for PVC and E-18 for AC conduits.)
- The bends should be, where possible, close to a manhole but not closer than 1 metre. Cables being installed should enter the duct at this manhole.
- The flexibility of PVC conduits enables gradual changes in direction to be made without the use of preformed bends. The radius of the curve should not be less than 10 metres.
- Severe changes in direction may be made by means of PVC preformed bends (See page E-2). In all cases it is necessary to set the bends in concrete to ensure that no movement of the pipes can occur while cables are being hauled.
- Curves in AC conduit runs should be provided by means of preformed PVC bends, Type 100/6. Offsetting AC pipes to change direction produces a lip at the joint which can interfere with cable hauling and offsetting must therefore not exceed 1° (ie, 60 mm per conduit length).
- Bends greatly influence the length of cable that can be hauled and the length of the conduit section between manholes must be reduced where there is more than one major bend in the section.

SET UP BARRICADES AROUND ALL HAZARDS, AND AT NIGHT ATTACH WARNING LAMPS.

MANHOLE SPACING IN CONDUIT ROUTES

Manholes should be spaced as widely as possible to reduce conduit construction costs, simplify cable installation and minimise encroachment on the footpath allocation of other authorities. The maximum length of a section will be influenced by local conditions and the equipment available for rodding ducts and hauling long lengths of large diameter cable.

Manholes should normally be spaced about 230 metres apart, but this may be influenced by other factors such as :

- Obstructions in the line of the conduits which cannot be avoided by the use of conduit bends (See page A-3).
- Major changes in direction of the conduit route where conduit bends are unsuitable (See page A-3).
- Junctions in conduit routes.
- Jointing requirements to suit local customer's needs.
- Loading and repeater requirements.

In major conduit routes manholes should not be provided for the sole purpose of housing joints in local subscribers cable eg, at Pillar and Cabinet locations. These may be provided for by laying an extra 100 mm conduit in the trench above the main conduit run and feeding this conduit into small auxiliary manholes or jointing pits where cable joints are necessary or where cabinet or pillar cable tails are to be connected. (See page A-5).

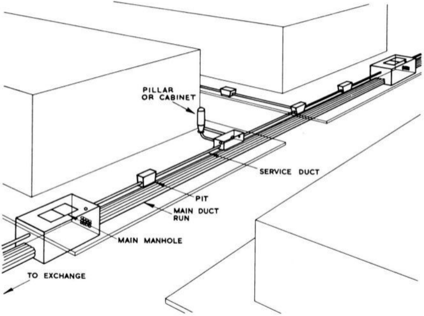
Avoid jointing subscribers distribution cables in main manholes if possible.

Locate manholes away from the junction of property lines at street corners to avoid relocation if the corners are truncated at a later date. (Minimum distance from corners is 3 metres).

Avoid locations where obstructions such as bus shelters and trees etc, may interfere with cable hauling operations.

USE ONLY LOCKING TYPE MANHOLE KEYS TO LIFT MANHOLE COVERS, GET HELP TO LIFT HEAVY COVERS.

MANHOLE SPACING IN CONDUIT ROUTES



SERVING LOCAL SUBSCRIBERS ON MAJOR DUCT RUNS

INSTALLATION DEPTH OF CONDUITS

AMOUNT OF COVER OVER CONDUITS

The depth at which conduits are installed must be sufficient to ensure that they cannot be broken, displaced or deformed by any traffic loading which may be imposed upon them. Adequate protection can normally be provided with the following depth of cover over the uppermost conduits :

Conduits laid in footways - 450 millimetres
Conduits laid in roadways - 450 millimetres beneath the drain invert.

These depths are for normal construction and may be varied to clear obstacles, provide drainage, conform with existing construction or to provide for future development.
Nests of conduits under roadways will normally be laid with at least 600 mm cover.
When installing conduits in unmade footpaths and roads obtain details of any proposed alterations to levels and alignments and make due allowance when determining depth of conduits to ensure that adequate cover will be maintained.

DEPTH OF TRENCH

To obtain the minimum depth of trench to be excavated multiply the outside diameter of the pipes by the number of pipes high and add the minimum depth of cover shown above. Then add a further 50 millimetres to enable a bedding of sand to be provided or the conduits encased in concrete.
Provide a fall in the conduit run so that water will drain to the manholes (See page A-8).
In unstable ground or where there is a risk of ground subsidence, provide a firm base for the conduits with a 75 mm layer of concrete (reinforced if necessary) projecting 50 mm on either side of the conduits. Cover the concrete with a 50 mm layer of sand or fine soil for the bedding of the conduits.

CALCULATING VOLUME OF TRENCH EXCAVATION

Depth of Trench (mm)	Width of Trench (mm)									
	200	300	350	400	450	480	500	520	550	600
50	0.01	0.015	0.0175	0.02	0.0225	0.024	0.025	0.026	0.0275	0.03
100	0.02	0.03	0.035	0.04	0.045	0.048	0.050	0.502	0.055	0.06
200	0.04	0.06	0.07	0.08	0.09	0.096	0.10	0.104	0.11	0.12
300	0.06	0.09	0.105	0.12	0.135	0.144	0.15	0.156	0.165	0.18
400	0.08	0.12	0.14	0.16	0.18	0.192	0.20	0.208	0.22	0.24
500	0.10	0.15	0.175	0.20	0.225	0.24	0.25	0.26	0.275	0.30
600	0.12	0.18	0.21	0.24	0.27	0.288	0.30	0.312	0.33	0.36
800	0.16	0.24	0.28	0.32	0.36	0.384	0.40	0.416	0.44	0.48
1000	0.20	0.30	0.35	0.40	0.45	0.48	0.50	0.52	0.55	0.60
2000	0.40	0.60	0.70	0.80	0.90	0.96	1.00	1.04	1.10	1.20

VOLUME OF EXCAVATION (cubic metres, m^3) FOR ONE LINEAL METRE OF TRENCH

To obtain the cubic metres (m^3) of excavation necessary, multiply the length of trench in metres by the factor for the depth and width in the table above. Where the depth of the trench is not listed in the table, factors can be added to give the appropriate depth.

Example : Trench 200 metres long, 850 mm deep, 450 mm wide.

Factor = 0.36 (for 800 mm) + 0.0225 (for 50 mm)

= 0.3825

Volume of Excavation = 200 X 0.3825 = 76.5 cubic metres.

DESIGNING CONDUIT DRAINAGE

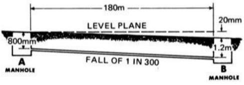
Conduit routes normally follow the general ground contour but wherever practicable they should be designed so that the pipes are self drainage.

Typical methods of providing a fall for drainage of conduits are shown on page A-9 For long sections in level ground it may be desirable to provide a fall in both directions from the centre point. Otherwise, minimum cover is provided at the manhole at the higher end and a fall of not less than 1 in 300 is made to the manhole at the lower end.

Where self drainage cannot be achieved eg, where conduits dip beneath an obstruction, the section of conduit containing water should be of rigid PVC. Cables installed in such conduits must be moisture barrier sheathed or polythylene jacketed lead sheathed.

<u>EXAMPLE - FINDING FALL FOR CONDUITS</u>

Distance Manhole A to Manhole B = 180 metres
Natural fall in ground = 200 mm
Required fall 1 in 300.



<u>Formula</u> :

Amount of fall required :

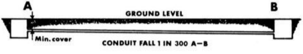
$$= \frac{\text{Distance between Manholes in Metres}}{300}$$

$$\text{Fall required for 180 metres} = \frac{180}{300} = 0.6 \text{ metre} = 600 \text{ millimetres.}$$

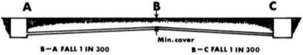
Subtract the amount of natural fall (200 mm) from the required fall (600 mm). The difference (400 mm) is the amount to be added to the excavation depth at Manhole B. Therefore if the depth of the trench at Manhole A is 800 mm the depth of trench at Manhole B should be 1.2 metres.

DESIGNING CONDUIT DRAINAGE

LEVEL GROUND
MANHOLE TO MANHOLE GRADE
Grade conduits for 1 in 300 fall from manhole A to manhole B



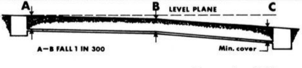
LEVEL GROUND
CENTRE TO MANHOLE GRADE
Alternative method. Grade conduits from centre of section towards each manhole.



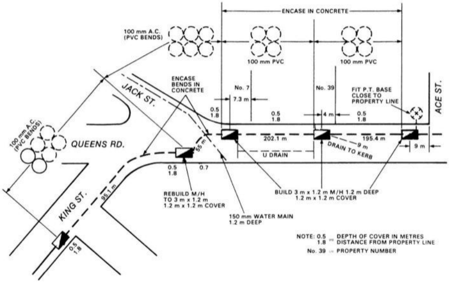
SLOPING GROUND
LESS THAN 1 IN 300 FALL
At manhole B measure depth required to provide 1 in 300 fall from the level plan A-B.

SLOPING GROUND
MORE THAN 1 IN 300 FALL
Provide standard minimum cover at each manhole.

VARYING SLOPE
A-B LESS THAN 1 IN 300
B-C MORE THAN 1 IN 300
Grade for 1 in 300 fall A-B measuring from level plan then grade to minimum cover at Manhole C.

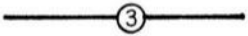
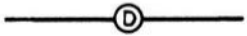
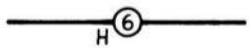


CONDUIT PLANS



Issue 4, 1982 Typical Works Plan For Installation of Conduits

PLAN SYMBOLS

Symbol	Description
Conduits	
	Route of conduit
	Roadway manhole
	Footway manhole
	Roadway manhole with footway entrance.
Pits	
 3	eg No 3 pit
 D	eg Type 'D' pit
 J 2	Injection Moulded Pit eg J2 pit.
 H 6	Hand Moulded Pit eg H6 pit.
	'O' or 'A' pit when used on private property.

PLAN SYMBOLS

Symbol	Description
Pits (Cont'd)	
	Buried pit, identified eg Buried No.6 pit.
	Buried pit, unidentified.
	Buried loop (for subsequent installation of pit or cable terminal box)
Repair Point (point where conduit has been repaired)	
	General symbol
	NOTES : . Locate by measurements from adjoining manholes or pits. . On multiway conduit runs indicate ways concerned.

PLAN SYMBOLS

Conduit Type

Symbol	Description
	Tunnel
OO C100	Pipe eg Two Ø 100 mm concrete pipes
P	Plastic (PVC or polyethylene)
E	Earthenware
C	Concrete
A	Asbestos Cement
G	Galvanised Iron
CI	Cast Iron
B	Black Iron

PLAN SYMBOLS

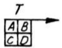
Multiway Conduit

Symbol	Description
 E85	Earthenware - butt jointed eg 4 way, 85 mm x 85 mm each
 E100	Self aligning eg 4 way, Ø 100 mm each
	Rocla eg 4 way (concrete)
 C90	Other than Rocla (concrete) eg 4 way, Ø 90 mm each
 P100CE	Concrete encased eg 4 polyethlyene pipes Ø 100 mm each, concrete encased.

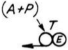
PLAN SYMBOLS

Symbol | Description

Conduit Occupancy

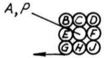


Occupancy as viewed in direction of arrow (parallel to the conduit route with 'T' denoting top of 4 way conduit. The codes shown in the ways will identify cables detailed in a schedule shown on the conduit plan.



Two cables

Two cables in one pipe.



Example of multiple conduit.

PLAN SYMBOLS

Cover over Plant and Property Line Distance

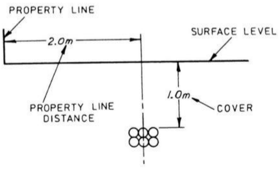
NOTES :

- Cover over plant is the distance from surface level to top of plant at appropriate end of manhole.

- Property line distance is distance from property line to centre line of plant.

e.g. The notation for a single group of conduits as shown below would be $\frac{1.0}{2.0}$

ie the $\frac{\text{cover}}{\text{property line distance}}$



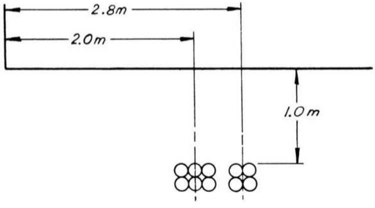
Single Group of Ducts

PLAN SYMBOLS

Where cover only is available. $\frac{1.0}{-}$

Where property line distance only is available. $\frac{-}{2.0}$

e.g. The notation for two groups of conduits separated by more than 0.2 m as shown below would be $\frac{1.0}{2.0 \quad 2.8}$



Two Groups of Ducts

PLAN SYMBOLS

References : EI Drafting Symbols C0100
TPH Lines General L6211 Issue 3, 1982

OFFICERS PLANNING AND APPROVING WORK ARE RESPONSIBLE FOR ENSURING THAT A THOROUGH INVESTIGATION OF SAFETY AND OCCUPATIONAL HEALTH HAZARDS HAS BEEN MADE AND APPROPRIATE NOTES INCLUDED ON DRAWINGS, SKETCHES, OR PLANS OF THE PROPOSED WORK. (Reference:

EI LINES General L6215 "WORKS AUTHORITY DRAWINGS AND SKETCHES - SAFETY NOTES").

SECTION B

EXCAVATING TRENCHES FOR CONDUITS

- OPENING TRENCHES IN ADVANCE
- LOCATING OTHER AUTHORITIES SERVICES
- MEASURING FALL IN GROUND WITH DUMPY LEVEL
- MEASURING FALL IN GROUND WITH BONING RODS
- LEVELLING AND GRADING BOTTOM OF TRENCH
- SUPPORTING TRENCHES
- SUPPORTING TRENCHES WIBH TIMBER - STABLE GROUND
- SUPPORTING TRENCHES WITH TIMBER - UNSTABLE GROUND
- SUPPORTING TRENCHES WITH STEEL TRENCH GUARDS
- INSTALLING STEEL TRENCH SHEETING
- SUPPORTING TRENCHES CLOSE TO EXISTING STRUCTURES
- BACKFILLING AND REINSTATING TRENCHES
- PROTECTING TRENCHES AGAINST EROSION
- SAFETY PRECAUTIONS - TRENCH EXCAVATION

NOTE : INSTRUCTIONS DEALING WITH SHORING PRACTICES WILL BE REVISED WITHIN 12 MONTHS

EXCAVATING TRENCHES FOR CONDUITS

ADVICE TO LOCAL AND OTHER AUTHORITIES OF PROPOSED TELECOM WORKS

Form E.717 giving details of the proposed Telecom construction must be forwarded to the authority responsible for the particular roadway eg. Town or Shire Council, Main or Country Roads Board, at least fourteen days before commencement of the work. The method of preparing Form E.717 is given in the Linemen's Handbook, Works and Admin. Procedures. In some cases the form is prepared in the District/Section Office.

PRELIMINARY INSPECTION BY SUPERVISORY OFFICER

Before commencing any conduit installation work the Lines or Senior Lines Officer, Works, should inspect the job site to determine the method and sequence of operations, staff and mechanical aids required and the precautions necessary to ensure the safety of workmen and the general public while work is in progress.

Plan the work so as to cause the minimum inconvenience to other authorities and the general public.

If necessary, arrange for traffic control when trenching across busy roads.

LOCATION OF MATERIAL STACKS AND MECHANICAL AIDS

Select safe positions for material such as conduits to be laid out along the route where it will not obstruct or endanger vehicular or pedestrian traffic.

Be particularly careful in the placement of stationary mechanical aids such as compressors and concrete mixers.

LOCATION OF EXCAVATED MATERIAL

Keep spoil clear of gutters, road drains, water courses etc, and ensure that it does not impede traffic flow or prevent access to fire hydrants or other services.

Arrange for disposal of excess spoil. Use Form E.657 (2/80) when disposing of surplus spoil on private property.

Where it will be necessary to stack soil against fences or buildings, obtain permission from the owner of the premises or some responsible person.

PREVENT ACCIDENTS BY PLACING BARRICADES AROUND OPEN TRENCHES AND SPOIL HEAPS.

EXCAVATING TRENCHES FOR CONDUITS

MARKING OUT

Conduits should preferably be laid on one side of the Telecom footpath allocation so that further conduits can be installed beside them if required.

Mark out both sides of the trench, measuring from the property line as follows:

- . On smooth level surface, eg. concrete, use a chalked string stretched tightly and spring it to make a chalk mark on the surface.
- . On a rough surface, use string line between pegs as a guide and mark the surface using a sharp pick.

Where ditching machines are used, set up a guide line to suit the particular type of machine. Marking of the footpath is normally not required.

CUTTING PAVEMENT SURFACES

Asphalt. Use a compressor operated paving breaker (or spader) and associated asphalt cutter if available, otherwise a hand asphalt cutter or mattock may be used.

Poured Concrete. Provision of straight edges when concrete is cut is essential as satisfactory reinstatement cannot be made where an irregular shaped opening has been made. A power operated concrete saw is the most effective means of cutting concrete, however a compressor operated paving breaker may be used. Trim edges square with a large cold chisel and hammer.

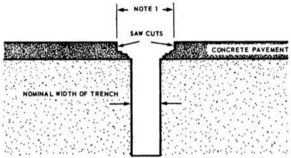
Bore or push pipe under short sections of concrete, eg. vehicular driveways wherever possible.

Precast Concrete Slabs. Lift slabs along the line of the trench wherever practicable. Avoid damaging the slabs during removal, and carefully reset them in position when reinstating the trench.

Concrete Slabs Cast in Situ. Lift slabs if possible. Otherwise treat as poured concrete.

Lawns; Use a spade to cut and lift out the turf in squares. (Water the lawn first in hot, dry weather.) Place turf to one side of the trench, clear of the soil, and carefully replace it on completion of the work.

SAFETY PRECAUTIONS WHEN EXCAVATING TRENCHES - See page B-24.



CUTTING PAVEMENT WITH CONCRETE SAW

NOTE : Width of trench between saw cuts approximately 75mm greater than nominal width of trench.

Depth of saw cut not less than 1/3 thickness of concrete.

Remove concrete between cuts with pavement breaker.

Cut steel reinforcement at centre point of trench and bend back along trench line so that it may be restored to its original position when the concrete pavement is reinstated.

WEAR SAFETY BOOTS TO PROTECT YOUR FEET FROM INJURY WHEN ENGAGED ON CONDUIT WORK.

OPENING TRENCHES IN ADVANCE

BUILT UP AREAS

Lines Supervisors, unless directed otherwise by Lines Officers should ensure that the trench is opened and prepared sufficiently in advance and that the pipe or cable laying team is not held up because of lack of open trench, this includes breaks in work (tea, lunch and overnight). At any time, the minimum length of trench that should be prepared should not be less than one pipe length plus operating space to several pipe lengths. The length and time the trench needs to be opened could vary from job to job especially where pipes are concrete encased.

In locations such as clearways, main roads or areas where traffic density varies, the breaks in work (tea and lunch) may be staggered to maintain continuity during the hours of accessibility. Roadway excavations should only be left open overnight or at weekends when substantial gains will result.

When opening trenches in advance, consideration should be given to soil conditions, eg. in sand.

. the added cost of supporting the trench will influence the length of opened trench.

. with shallower untimbered trench, work problems, added costs of supporting plant for other services and providing vehicle and pedestrian access have to be taken into account when considering leaving trenches open overnight.

OPENING TRENCHES IN ADVANCE

OPEN COUNTRY

Where trenches are excavated in open country, long lengths of trench can be safely opened without protection. Line Supervisor should ensure that owners of properties involved or adjoining are made fully aware of the operations to avoid injury during isolated movement by owners or their staff, or by cattle or fauna. Warning signs placed at appropriate locations should be used if considered necessary by Lines Officers.

In all cases, the Lines Supervisor should inspect the job just prior to ceasing duty to ensure that all of the precautions as applicable to the situation have been taken. He should check the stability of the barrier posts and rails and the placing of covering mesh or alternative material and assure himself that the warning lights are lit or switched on.

TRENCH EXCAVATION METHODS

The method and the equipment used when excavating will depend upon the soil conditions. The development and use of mechanical aids and associated equipment has increased over recent years. Power driven excavators such as ditchers, back hoes, etc may be used in soil appropriate to their digging capacity, whereas compressor operated pneumatic tools (jack hammers, paving breakers and spaders etc) are required for the more difficult digging conditions. Handwork is now normally confined to more skilled work such as the trimming of trenches, placing of timbering to support trench walls, pot holing etc.

APPROPRIATE ADVANCE WARNING SIGNS MUST BE ERECTED BEFORE ANY WORK IS PERFORMED AT ROAD OPENINGS.

EXCAVATING TRENCHES FOR CONDUITS

SPOIL PLACEMENT

Place the excavated soil not closer than 600mm or 1/3 of the final depth of the trench whichever is the greater from the edge of the trench and at the same time ensuring that it does not cause any unnecessary obstruction to traffic.

Where possible keep the top soil separate from the sub-soil, for example by placing it on the opposite side of the trench.

Place the soil in heaps rather than in a continuous ridge to maintain access for workmen and the public. As soon as possible remove spoil which will not be reused. (See page B-1.)

WATER IN TRENCHES

Water may enter a trench from water-logged soil, springs, heavy rain or damaged water pipes or drains. Water increases the likelihood of trench cave-in and should be removed as quickly as possible. If possible, provide surface drains or pumps to prevent water entering the trench. In saturated soils the trench area may be dewatered by setting spear pumps close to the line of conduits and slightly deeper than the required trench.

Do not allow water to flow unchecked along the trench. Build a temporary dam or dig a sump and bale or pump the water out. Avoid working with water underfoot as it is not possible to consolidate the bottom of the trench properly in these conditions.

BLASTING

Explosives may be used for trench excavation but their use is restricted to Telecom approved Shotfirers. (See Explosives Handbook.)

EXCAVATING TRENCHES FOR CONDUITS

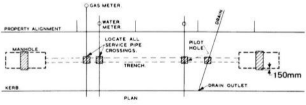
LOCATING OTHER AUTHORITIES SERVICES

Before excavating the trench, pot holing in advance to locate other authorities' services is essential at each manhole location and at points along the route where there is a likelihood of encountering obstructions. (See Section C.) Dig the holes 150mm wider and deeper than the proposed manhole or trench. Obstacles in footways can usually be detected by noting:

. the positions in gutters of the drain outlets from nearby properties;
. the positions of gas and water meters;
. the positions of sewers as indicated by vents;
. the positions of other authorities manholes, pits, stop cocks, drain gratings, etc.
. the absence of overhead power lines, indicating buried power cables.

The use of a pipe locating instrument will assist in locating metallic pipes and cables. A wooden handled crowbar (S116/108) in conjunction with rubber gloves and rubber boots must be used when pot holing for power cables. NEVER WORK ALONE

Unapproved tools and methods such as sharp pointed steel probes with metal handles must not be used to locate other authorities' services.



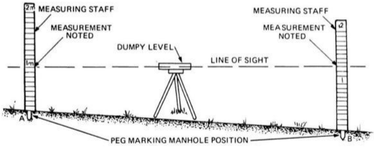
LOCATING OBSTRUCTIONS BY POT HOLING

MEASURING FALL IN GROUND WITH DUMPY LEVEL

Set up dumpy level at any intermediate point between manholes along the line of the trench. Adjust the telescope to the horizontal position by the levelling bubble.

Sight through the dumpy level to a measuring staff held at the manhole positions. The difference between the heights recorded is the fall in ground between the two points.

The method of determining the amount of fall necessary to provide adequate conduit drainage is given on pages A-10 and A-11.



USE OF DUMPY LEVEL TO CHECK GROUND FALL

USE NON FLASHING RED LAMPS (S159/21) TO DEFINE THE LIMITS OF A HAZARD OR AN OBSTRUCTION.

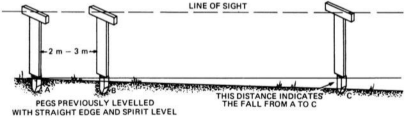
MEASURING FALL IN GROUND WITH BONING RODS

At the higher end of the section drive a peg (A) so that its top is flush with the surface of the ground.

Drive another peg (B) 2 to 3 metres away along the line of the trench and adjust its height to the same level as the first peg by means of a straight edge and spirit level.

Set up boning rods on these pegs and sight to a third boning rod at the far end of the section. Raise or lower peg (C) until the three rods are sighted in line. The height of peg (C) above ground indicates the amount of fall.

See pages A-10 and A-11 for method of determining the amount of fall necessary to provide for drainage of the conduits.



USE OF BONING RODS TO CHECK GROUND FALL

PARK MOTOR VEHICLES AND MECHANICAL AIDS WHERE THEY DO NOT OBSTRUCT DRIVEWAYS OR ENTRANCES TO PREMISES.

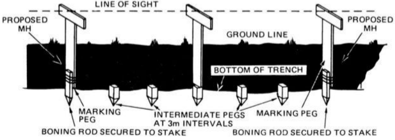
LEVELLING AND GRADING BOTTOM OF TRENCH

USE OF BONING RODS - UNDERGROUND REFERENCE POINTS

Place pegs in ground at manhole positions and set to correct surface level. Check fall in ground between manholes and determine depth of trench and grading required for conduits.

Excavate trench to correct depth at manholes at each end of section (or intermediate point where there is a change of grade) and set up boning rods. Hold a third boning rod at intermediate points (about 3 metres apart) where the level is to be checked. Sight along tops of the rods and adjust the level of the trench at intermediate points until the tops of the rods are in line.

Pegs may be driven into the bottom of the trench to indicate the correct depth and the trench can then be levelled between pegs.



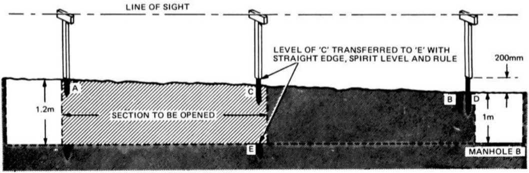
USE OF BONING RODS TO CHECK TRENCH GRADE

LEVELLING AND GRADING BOTTOM OF TRENCH

USE OF BONING RODS - ABOVE GROUND REFERENCE POINTS

Where it is not convenient to set up underground reference points work from above ground pegs as shown below:

Example. Assume the trench should be 1.2 metres deep at Manhole A and 1 metre deep at Manhole B to provide the required grade.
Drive an additional peg (D) at Manhole B so that its top is higher than the ground level of peg (B) by the difference in depth of the two ends of the trench (in this case 200mm).
Drive pegs at intermediate points and adjust their height by sighting with boning rods.
The depth of trench required is the depth at Manhole A (in this case 1.2m) below the top of the intermediate pegs.
All pegs must be slightly offset from the trench line. Levels may be transferred to the bottom of the trench by means of a straight edge and a spirit level.



USE OF BONING RODS WHERE ONLY PART OF TRENCH IS OPENED

SUPPORTING TRENCHES

The most serious danger in excavation work is that the sides of the excavation will collapse and bury an employee. No one can be sure, even men with many years of experience in excavation work, that at some stage of the work, conditions will not arise that will result in a collapse. If shoring is not provided or is not sufficiently strong or has been incorrectly installed, such a collapse can result in a serious injury or death. To reduce the risk to employees engaged in digging the excavation or to any other employee who may have to undertake work in it, all excavations should be properly shored, unless the material is solid rock, free from joints and fissures or the wall of the trench is cut back to a safe angle.

WHEN SUPPORT IS NECESSARY

During excavation of trenches constant care must be taken to guard against any earth collapse or slide which could endanger staff or affect the stability of adjacent buildings, structures or underground services (gas, water, sewerage, electricity, telephones etc).

- Support all excavations over 1.5 metres deep and manhole excavations longer than 2.4 metres by timbering (or equivalent steel supports).
- Trenches over 1.2m deep where seamed rock is encountered.
- In soil where the sides are so unstable that they cave-in or flow immediately upon being excavated and where it is impractical to batten the sides.
- Excavations which are less than 1.5m in depth, which could collapse causing injury to people and endanger adjacent property, buildings and/or services.

REMOVE ANY SHARP OBJECTS SUCH AS GLASS OR WIRE FROM THE WALLS OF THE TRENCH.

DEGREE OF SUPPORT REQUIRED

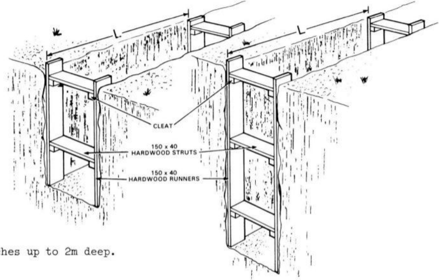
The ability of a trench to be self supporting and the amount of support required where it is not, is governed by the following factors:

- Type of soil, ie sand, loam, clay or rock (in order of stability).
- Moisture content of soil.
- Adverse weather and the possibility of water entering the excavation (usually caused by heavy rain or frost).
- Depth of trench.
- Length of time the trench is to remain open (ground which appears stable when opened up can sometimes dry out, crack and collapse in the space of a working day).
- Vibration of the ground from nearby traffic.
- Earth pressure resulting from loads imposed by nearby buildings or walls.
- Old excavations running parallel to the new trench (eg for Telecom conduits or other service mains).

Where timbering is required, it shall proceed as the work of excavation progresses. Where mechanical aids are being used the length of untimbered trench shall not exceed 3m.

AVOID ACCIDENTS BY TAKING PRECUATIONS TO PREVENT CAVE-IN OF TRENCHES (SEE PAGE B-20)

SUPPORTING TRENCHES WITH TIMBER - STABLE GROUND

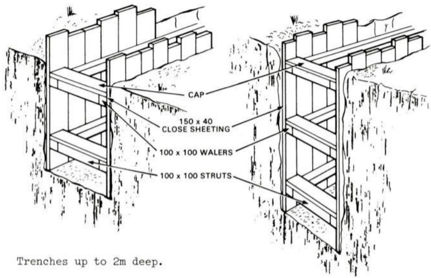


Trenches up to 2m deep.

Trenches up to 3m deep.

<u>OPEN TIMBERING - STABLE GROUND</u>

Hard to solid soils (L = 1.5 metres maximum)
Soils likely to crack or crumble (L = 1 metre maximum)
Issue 4, 1980



Trenches up to 2m deep.

Trenches up to 3m deep.

<u>CLOSE TIMBERING - SAND, LOAM, WET CLAY, LOOSE OR FILLED SOILS</u>

Fit struts (toms) at 2 metre (max) spacing.

GREATER DEPTHS REQUIRE ENGINEERING DESIGN. WHEN IN ANY DOUBT - ASK ADVICE FROM YOUR SUPERVISOR.

SUPPORTING TRENCHES WITH TIMBER - UNSTABLE GROUND

FITTING TIMBERS

Place three runners (side laths) on each side of the trench, one at each end and one in the centre of waler boards (3 to 4 metres long). Secure the walers by driving struts (toms) firmly between them and then fit the intermediate runners in position. Drive the runners down and lower or fit additional walers as the trench is excavated.

Keep runners close together where necessary to prevent loose or wet soil or sand from trickling through. Caulk spaces with paper, rags or hessian if trickling persists.

Steel screw-type jacks may be used instead of wooden struts.

Item	Dimensions	Spacing
Runners (or side laths)	150mm x 38mm *Hardwood	Spacing depends on the type of soil but should not exceed 1.5 metres for open timbering. They should extend to the bottom of the trench if possible.
Walers	100mm x 100mm *Hardwood	Maximum separation 1 metre.
Struts (or toms or spreaders)	100mm x 100mm *Hardwood	Maximum spacing depends on type of soil but should not exceed 2 metres.

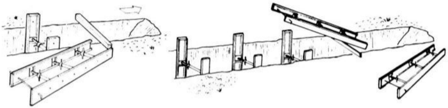
DIMENSIONS AND SPACING OF TIMBERS

Where alternative materials are used they should be at least equivalent in strength to the specified hardwood items.

* Timber grade to be used shall be Stress Grade F11, Hardwood (Refer SAA Timber Engineering Code AS1720).

TRENCH GUARD COMPONENTS

Trench Guard (1.5 or 3 metres), Trench Jack (Plate Head), Trench Jack (Bracket Head), Headstock Bar, Waling Hook, Driving Dolly.



INSTALLING TRENCH GUARDS IN STABLE GROUND

Step 1

Assemble trench guards sets at required intervals (1.5m max. hard to solid soils, lm max. soils likely to crack and crumble).

Slip plate head jacks into the guards. (Jacks locate in the angle cleats and cannot fall out.)

Slide headstock bar through holes provided in the guards.

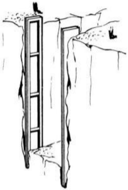
Step 2

Lay a length of timber across the trench just behind position for support.

Lift end of trench guard set on to the timber and with a man each side of the trench holding the headstock bar, slide the set into the trench and stand it up in position.

Tighten the top jack and then the lower jacks progressively.

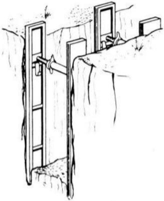
INSTALLING STEEL TRENCH GUARDS IN UNSTABLE GROUND



1

Step 1

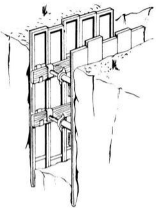
Toe in guards at bottom of trench close to excavator. Drive guards with hand dolly or air powered hammer.



2

Step 2

Toe in opposite pairs and temporarily strut with plate head jacks. Fit waler hooks and top waler (100mm x 100mm Hardwood). Secure with bracket head jacks at 2m (max) spacing.



3

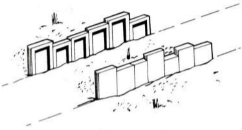
Step 3

Insert additional guards behind waler and toe in as before. Fit lower waling boards.

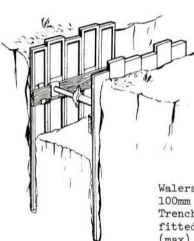
Issue 4, 1980

INSTALLING STEEL TRENCH GUARDS IN VERY UNSTABLE GROUND

When trenching very unstable ground such as wet loam or free running sand, it is sometimes necessary to drive the guards ahead of the excavation.



1



2

Step 1. Set up a guide rig or platform along the line of the proposed trench and drive the guards into position deeper than depth of trench required.

Step 2. Commence excavation and when depth of trench is below the first waler cleat fit waling boards and trench jacks. Proceed with excavation adding walers as the angle cleats are uncovered until the trench is fully excavated.

Walers 100mm x 100mm hardwood. Trench jacks fitted at 2 metre (max) spacing.

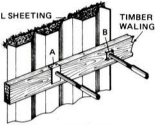
INSTALLING STEEL TRENCH SHEETING

Steel Trench Sheeting may be used to support trenches in unstable ground. It is particularly suitable for very wet soils and free running sand.

Typical steel sheeting is available in lengths of 1.8, 2.4, 3.0, and 3.6 metres and width of 400mm.

Driving caps are available for protecting the heads of the sheets when they are driving into the ground before the trench is excavated.

Horizontal support for the sheeting is provided by timber waling (100mm x 100mm hardwood) and screw jacks. Walers must not be more than 1 metre apart.



A – SCREW JACK WITH ANGLE END PLATE
B – SCREW JACK WITH CLAW END PLATE

Jacks at 2 metre (max) spacing.

SUPPORTING TRENCH WITH STEEL SHEETING

AVOID TRENCH CAVE-INS

Most trench cave-ins are caused by:

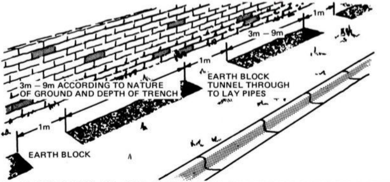
- Taking a chance without shoring or inadequate shoring.
- Inadequate knowledge of shoring necessary or misjudgement of soil stability.
- Failure to maintain shoring after a change in soil stability caused by rain, washouts or damage due to operations.
- Failure to place excavated soil a safe distance from the trench.
- Collapse of trench walls due to loads applied by vehicles or mechanical equipment approaching too close to the edge of the trench.

SUPPORTING TRENCHES CLOSE TO EXISTING STRUCTURES

Where trenches are excavated close to walls, buildings or other structures, particular care is necessary to ensure that there is no resulting movement of the structure. Support trenches by the methods shown on pages B-10 to B-17 but make allowance for the extra pressure on the soil due to the weight of the structure. Other methods which may be used in special circumstances are:

- . Open up the trench in short lengths only or leave earth blocks as shown below.
- . Drive sheet piling close to the structure foundations and adequately brace and shore it before commencing to excavate.
- . Strut and shore the building prior to excavating.
- . Underpin the foundations of the building so that the load is tranferred from the existing foundations to new foundations.

INSPECT THE STRUCTURE PRIOR TO COMMENCEMENT OF THE WORK, TAKE PHOTOGRAPHS AND ADVISE THE OWNER OF ANY EXISTING DAMAGE OR WEAKNESS. REPORT ANY DAMAGE PROMPTLY.



USE OF EARTH BLOCKS IN FIRM GROUND WHEN EXCAVATING CLOSE TO A WALL

BACKFILLING AND REINSTATING TRENCHES

Commence backfilling trenches as soon as possible after the conduits have been laid.

The refilled soil must be well compacted to ensure stability of the conduits and to avoid later subsidence of the soil.

BACKFILLING AROUND CONDUITS

Where conduits are laid without concrete encasement, refill the trench up to 50mm above the conduits with sand or fine granular soil free from stones.

Tamp soil firmly around the conduits with an even pressure on both sides to avoid disturbing the alignment of the conduits. Carefully pack soil between the pipes to prevent a watercourse from forming along the line of conduits with consequent undermining of the refilled soil.

Where there is a danger of sand or soil under the pipes being washed away, mix dry cement with it in the proportion of 1 part cement to 20 parts sand.

For multi-way conduit routes complete the packing of sand around one layer of conduits before installing the next layer.

BACKFILLING ABOVE CONDUITS

Wherever possible the excavated material should be used for backfilling above the conduits unless it is unsuitable (ie wet clay) or immediate consolidation of the trench is necessary (eg road crossings) (See page B-23).

Replace the soil in layers not greater than 150mm for clay soils and 300mm for granular soil ensuring that no stones or hard objects are placed closer than 100mm to the conduits.

Use mechanical rammers throughout, applying light compaction only on the first layer.

Finish the backfill with a slight mound on the top of the trench to ensure that any later subsidence will not leave a depression. The mound must not be high enough to interfere with vehicular or pedestrian traffic.

Satisfactory compaction is achieved by power ramming for 3 minutes or when the wheel of a heavy vehicle passed over the refilled trench does not make a significant permanent depression.

Lawned footways should be well rammed and finished level when the lawn turfs are replaced

BACKFILLING AND REINSTATING TRENCHES

BACKFILLING TRENCHES ACROSS ROADWAYS AND FOOTWAYS SUBJECT TO HEAVY TRAFFIC

Material capable of satisfactory compaction must be used for backfilling from the sand bedding of the conduits or concrete encasement to the bottom of the road pavement.

Where the excavated material is not suitable for backfilling it should be replaced by high strength granular material such as sand, graded crushed rock, decomposed granite or filling material specified by the Road Authority.

Alternatively the trench may be filled with lean mix concrete in the proportions of 1 part cement to 20 parts graded aggregate.

Where requested by the Road Authority replace the road pavement, including any base course, with suitable road material to within 40mm of the paved surface. Provide temporary reinstatement of bituminous pre-mix, cold asphalt or similar material to the level of the existing paved surface.

BACKFILLING FOOTWAYS SUBJECT TO HEAVY TRAFFIC

When backfilling trenches in busy footways such as shopping centres, use a granular material which will provide immediate consolidation of the trench.

Where prompt reinstatement of the pavement cannot be arranged, top the trench with a 25mm layer of bituminous pre-mix or similar material.

BACKFILLING AROUND JOINTING CHAMBERS

Carefully fill the spaces left outside the manhole walls or cable jointing pits with fine soil or sand, and ram.

REINSTATEMENT OF ROAD AND FOOTWAY SURFACES

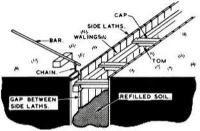
Arrange for reinstatement of paved surfaces by the Road Authority.

Prepare Form E.718 and forward to the authority on completion of the work, requesting reinstatement to be carried out at Telecom's expense. Where permanent reinstatement cannot be carried out promptly, temporary reinstatement with bituminous pre-mix should be provided as described above.

RECOVERING TIMBER, TRENCH GUARDS AND STEEL SHEETING

In most cases, trench supports may be recovered in conjunction with backfilling of the trench, as follows:

- Fill in and ram the soil to a point just below the bottom waling boards.
- Remove the bottom waling boards and toms.
- Continue backfilling the trench and removing further waling boards until the soil is within 300mm to 400mm of the top waling boards.
- Raise the side laths by means of a lever or lifting jack to within 75mm of the surface of the backfilled soil.
- Complete backfilling and ramming the soil, removing the supports as the trench is filled.



USE OF LEVER TO REMOVE TIMBER FROM TRENCH

A mobile crane or front end loader can be used to advantage for removal of trench supports In deep trenches it may be necessary to leave the timber, or some part of it, in the trenc as to remove it might endanger adjacent buildings, walls etc. When this is done, backfilling must be carried out with special thoroughness.

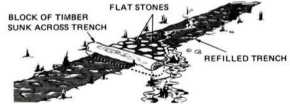
CLEAN UP PROPERLY WHEN THE JOB IS COMPLETED. ENDEAVOUR TO LEAVE THE JOB SITE AT LEAST AS TIDY AS IT WAS BEFORE THE WORK WAS COMMENCED.

PROTECTING TRENCHES AGAINST EROSION

Erosion of refilled trenches can occur in hilly country after heavy rain due to water flowing along the trench line and scouring out the soft refilled soil. The danger is most prevalent in country areas, particularly where road drains divert the flow of water towards the trench.

To prevent erosion, obstructions may be placed across the trench at intervals of 6 metres to 12 metres to divert the flow of water across the trench rather than along it. A block of wood about 300mm longer than the width of trench and 150mm to 250mm thick placed across the trench and sunk partly into the soil is suitable for the purpose. A wall of stones is also effective. Ram the soil well adjacent to the block and set flat stones on the uphill side to assist in preventing water undermining the block. Pack soil behind the block on the downhill side.

Where trench washaways occur in urban areas and blocks cannot be installed, it may be necessary to stabilise the top 150mm of backfilled soil by the addition of cement (1 part cement to 20 parts soil).



DIVERTING WATER FROM TRENCH WITH WOODEN BLOCK

SAFETY PRECAUTIONS - TRENCH EXCAVATION

The main hazards to staff during trench excavation and the precautions necessary to prevent accidents are:

CAVE-IN OR SLIPPING OF SIDE WALLS OF TRENCH

Support deep trenches and trenches in unstable ground as described throughout this handbook. Erect barricedes to prevent persons from falling into the trench at or near the sides of the trench.

Do not take chances with unshored or inadequately shored trenches. (See page B-18.)

MATERIAL FALLING ON WORKMEN IN TRENCH

Stock spoil at a safe distance from the excavation. (See page B-6.)

Chock conduits so that they cannot roll into the trench.

Erect barricades to prevent members of the public or other workmen knocking or kicking material into the trench.

PERSONS FALLING WHEN CLIMBING INTO OR OUT OF TRENCH

Do not jump into the trench, gently lower yourself.

If the trench is more than 1 metre deep, use a ladder.

MEN WORKING TOO CLOSE TOGETHER IN TRENCH

Do not work so close to other men that you may be struck by tools or materials being handled by them.

Remove any sharp objects such as glass and wire from the walls of the trench.

CONTACT WITH MACHINERY

Keep well clear of moving parts of excavating machines and other mechanical aids.

INJURIES FROM DEFECTIVE TOOLS

Cold chisel and gads with mushroomed heads, hammers with loose heads or split handles and other defective tools are potentially dangerous and must not be used.

STAFF REQUIREMENTS

No person shall be allowed to work alone in a trench unless another person is on duty outside the trench to render assistance in the case of an emergency.

SAFETY CLOTHING AND EQUIPMENT

Safety Helmets shall be worn at all times when:

- Associated with conduit and manhole construction, cable hauling, pit and pipe construction, buried cable installation or operation of mechanical aid or working in any other excavation.
- When working below another person and there is a likelihood of persons being injured by objects falling from above and it is impracticable to provide overhead protection.
- Entering or working in cable tunnels.
- When working on explosive work or when in the vicinity of the shot site.
- In any other work situation where in the opinion of the supervisory officer a safety hazard exists and there is a danger from falling objects or staff are likely to injure their heads in performing their duties.
- On building sites declared as 'safety helmet or hard hat areas' under State legislation or where industrial organisations have declared particular sections of their premises safety helmet areas.

Ear Muffs shall be worn when:

- Operating or working in close proximity to breakers, drifters, spaders and other pneumatic tools.
- Operating or working in close proximity to machines which are identified as producing noise levels over 85 dBa.
- Using or working close to explosive powered tools in a confined space.
- In other situations considered necessary by the supervisor in charge of the work.

Gloves shall be worn:

- For protection from sharp materials, handling sheet metal, timber, bricks, cast concrete, armoured cable, wire or steel sections.

Gloves Rubber, 650V shall be worn:

- For protection from electrical hazards. For staff working on wires or equipment or using tools likely to contact power voltages.
- When using electric drills, grinders, saws etc in an earthed situation, not standing on rubber mats, or where there is any possibility of contacting household power or lighting wiring.

Respirators shall be worn:

- In dusty conditions and where dust caused by the use of pneumatic tools or high speed cutting equipment could endanger the health of the operator.

Safety Vests shall be worn:

- When engaged on line work on or close to roadways, railway or tramway lines or in other work situations where in the opinion of a supervisory officer a safety hazard exists. The vests are to ensure that the wearers will be clearly visible for some distance by drivers.

Safety Goggles shall be worn:

- When working on the ground in situations where staff may come in contact with power voltages.

Safety Footwear - Boots/Shoes shall be worn at all times:

- By operator and supervisory staff working in the field as well as depot staff who are required to handle plant, materials, heavy tools or equipment.
- Other staff who in the course of their work are required to spend time on either private premises or in an environment where they are subject to hazards equivalent to those outlined above.

Use of Internal Combustion Engines

The use of internal combustion engines in deep excavations creates severe problems in the safe dispersal of the exhaust gases. In addition, the location of petrol tanks or LPG cylinders in deep excavations would pose a severe hazard, should leaking liquid, vapour or gas be ignited.

For these reasons, internal combustion engines should never be used in deep excavations.

When working in a deep excavation or cable chamber, any internal combustion engine driven equipment which is needed, such as a heater/ventilator/alternator or portable AC generator MUST BE KEPT OUT of the excavation or chamber.

Internal combustion engines must be located above ground level down-wind of the excavation and sufficiently long hoses or cables used to connect the equipment with the work site.

REFER ALSO TO SECTION R, DANGEROUS GASES

Reference : External Plant Construction Safety Note No. 11/82 "Prohibition of Use of Internal Combustion Engines In Deep Excavations"

E.I. LINES Conduits SP9100
E.I. " General SP 4000

SECTION C

EXCAVATION PRECAUTIONS AND PUBLIC RELATIONS

- EXCAVATING ON PRIVATE PROPERTY
- EXCAVATING IN SHOPPING AREAS
- EXCAVATING NEAR OTHER AUTHORITIES PLANT
- SUPPORTING PIPES AND CABLES IN TRENCHES
- TRENCH CROSSINGS
- EXCAVATING NEAR POWER CABLES
- EXCAVATING NEAR GAS PIPELINES
- EXCAVATING NEAR PERMANENT MARKS AND SURVEY PEGS
- PERMANENT MARKS AND SURVEY PEGS
- UNDERGROUND CONSTRUCTION ON RAILWAY PROPERTY

NOTE : TRAINING STAFF IN SAFETY

All staff who are required to excavate near underground power cables, must receive instruction in SAFE WORKING PRACTICES annually. All new staff before being assigned to excavating work parties who are required to excavate near underground power cables, must receive instruction in SAFE WORKING PRACTICES.

The Safety Display Card Series, "Safe Practices for Excavations Near Underground Power Cables" (See EI LINES General Z 9100) is designed to assist Senior Lines Officer, etc, when instructing linemen in SAFE WORKING PRACTICES to be applied, when excavating near underground power cables.

EXCAVATION PRECAUTIONS AND PUBLIC RELATIONS

GUARDING EXCAVATIONS

- Guard all excavations with temporary barricades.
- Place manhole guards or barricades arround open manholes.
- Use lane marker cones ("Witches Hats") to divert traffic around obstructions.
- Where there is any danger to traffic or workmen, erect road warning signs in prominent positions well ahead of oncoming traffic so that they catch the attention of road users and give them sufficient time to take action to avoid danger.
- The types of road warning signs and barricades available are described on page R-2.

GUARDING TRENCHES LEFT UNATTENDED

The following points should be observed when trenches are left unattended for prolonged periods.

- Erect standard guardposts and rails to surround the opening, unless the spoil on one side of the trench is considered by senior supervisors to give adequate protection. Place sandbags or other heavy objects on the base plate of the posts and strut the top of one to provide stability.
- If the trench is required to be timbered for safety purposes, it must not be left unattended until the timbering is complete.
- Where possible, supplement the barrier rails with excavated spoil alongside the trench.
- Where necessary, to prevent children or animals falling into the trench, it should be covered with timber or steel reinforcing mesh suitably supported.

LIGHTING EXCAVATIONS AT NIGHT

- Erect warning lamps, kerosine or flashing type, in accordance with Engineering or local instructions. In the case of roadway excavations, special protective measures should be specified by the EPM or Engineer.

LIGHTING EXCAVATIONS AT NIGHT (Cont.)

- In all cases, the Lines Supervisor should inspect the job just prior to ceasing duty to ensure that all of the precautions as applicable to the situation have been taken. He should check the stability of the barrier posts and rails and the placing of covering mesh or alternative material and assure himself that the warning lights are lit or switched on.
- The warning lamps should be placed on heaps of soil, conduit stacks, mechanical aids and other dangerous items which cannot be removed from the road or footway. (See page R-2 and R-3).

CROSSING ROADS AND DRIVEWAYS

- When trenching across a roadway try to keep half of the road open to traffic.
- Station workmen with STOP/GO banners or red flags or obtain police assistance to direct the traffic where necessary. (See page R-2 and R-3).
- If an excavation across driveways or road openings cannot be filled in at night, trenches should be covered by steel plates or specially designed timber trench bridges (Drawing CL1207) (See page C-7) to allow the passage of vehicles.
  In such cases, barrier posts or rails or other above ground protection may not be required and may be eliminated by discussion with owners, police or local authorities. Before removal of such covers, the special protective measures should be specified by the EPM or Engineer.
- Appropriate advance warning signs must be erected before any work is performed at the locations.

CROSSING RAILWAY OR TRAMWAY LINES

See page C-10.

SHARING TRENCHES WITH POWER AUTHORITY

See page M-11.

EXCAVATING ON PRIVATE PROPERTY

ENTERING PRIVATE PROPERTY

Do not carry out any work on private property without first consulting the owner or occupier of the premises. Explain the details of the work you are going to do as it affects the property and obtain the owner's approval.

If the owner objects and his wishes cannot be readily met, do not proceed with the work but advise your supervisor who will refer the matter to the EPM or Engineer.

Do not enter vacant or temporarily closed premises without permission from the owner (or his agent) or a recognised tenant.

Where unattended premises contain valuable articles it is preferable if the owner's representative can be in attendance, to avoid the possibility of subsequent claims.

AVOIDING DAMAGE OR INTERFERENCE TO PREMISES

Take every care to avoid damage to buildings and other structures. Before commencing work examine the building in the vicinity of the work area and draw the owner's attention to any existing damage. In some cases it may be desirable to have existing defects photographed. If any further damage is caused report it immediately.

Avoid obstructing driveways or paths on private property for long periods. Provide temporary bridges across open trenches to enable pedestrians and vehicles to cross.

STORING EQUIPMENT AND MATERIAL ON PRIVATE PROPERTY

Where it is necessary to leave equipment and material on private property, first obtain permission from the owner or occupier of the premises. Stack items in a position which will cause the least inconvenience to the occupiers of the premises and not be a safety hazard. Make sure pipes and drums are securely chocked to prevent rolling.

CLEANING UP ON COMPLETION OF WORK

Clean up properly and leave the job site in a neat and tidy condition. Pay particular attention to re-instatement of trenches which cross gardens, lawns or driveways etc, to ensure that there will be no cause for complaint by the property owner.

EXCAVATING IN SHOPPING AREAS

GENERAL PRECAUTIONS

Organise jobs in shopping areas so that the work is carried out as quickly as possible and with the minimum of inconvenience to the public.

Leave a passage way for pedestrians to walk in safety. Provide temporary bridges across the trench in appropriate positions for pedestrians and at all vehicular entrances.

Do not allow heaps of spoil or equipment to obstruct shop entrances. Keep spoil from spreading on to areas which have been left free for pedestrians and vehicles. Remove any excess spoil from the job promptly. Place spoil far enough from trench sides so as not to cause walls to collapse.

Place barrier posts and rails around excavations. Do not leave material or tools in a position which could endanger the safety of the public.

Take particular care with backfilling and re-instatement of a trench so as to prevent subsidence. Arrange for paved surfaces to be re-instated as soon as possible.

When excavating close to buildings take precautions to protect foundations (See page B-20).

EXCAVATING IN FRONT OF GLASS OR TILE SHOP FRONTS

Before commencing excavation inspect shop fronts and make a record and take photograph/s of any defects. Draw the shopkeeper's attention to any defects to avoid suspicion of having caused them and to avoid possible claims against Telecom for the cost of repairs.

Erect screens in front of shop windows and glass or tile shop fronts as a protection against flying chips or stones.

When marking out the trench, keep it as far as practicable away from the shop front. The methods of cutting the various types of paved surface and the precautions to be observed are described on page B-2.

Make a further inspection of the shop front on completion of the work. If any damage has been done advise the shopkeeper and inform your supervisor so that repairs can be arranged.

EXERCISE CARE TO AVOID DAMAGE TO PRIVATE PROPERTY, REPORT DAMAGE IMMEDIATELY.

EXCAVATING NEAR OTHER AUTHORITIES PLANT

CHECKING LOCATION OF OTHER AUTHORITIES PLANT

The location of other underground services (gas, water, sewer, electricity etc.) will normally be ascertained from the authorities concerned during the planning stage (See page A-2) and shown on the works plan.

Look for surface indications such as manhole covers, pits, drain outlets, stop cocks etc. to confirm the information shown on the plan. Where necessary check with pipe locators and by digging pot holes (See page B-7) to accurately determine their location. Pot holing in advance to locate other authorities services is essential prior to using mechanical aids. Use only wooden handled tools (eg, Wooden handled crowbar) to locate other services (See page B-7).

Check manholes for warning signs indicating that other authorities pipe or cables are close to the walls.

Where necessary minor alterations may be made to the route, or depth of laying to avoid an obstruction, provided conduits laid on a footway do not extend beyond the Telecom's footpath space allocation. Where a major alteration to the route or depth of laying is involved the EPM or Engineer must be consulted.

In some cases arrangements can be made with the authority concerned for the removal or relocation of minor obstacles.

SUPPORTING OTHER AUTHORITIES PLANT DURING EXCAVATION

Support any pipes or cables exposed during excavation of the trench by means of rope or chains slung from heavy lengths of timber placed across the top of the trench. Alternatively pipes may be supported by brick piers or timber toms placed directly beneath exposed sections.

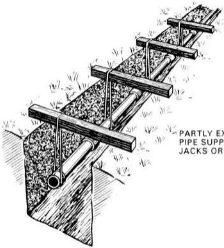
If there is any likelihood of subsidence due to the work being carried out, provide permanent support for the pipes by building brick or concrete piers behind the pipe sockets.

REPORTING DAMAGE OF OTHER AUTHORITIES PLANT

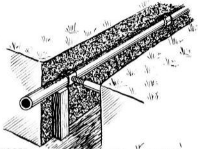
Report any damage of plant immediately to the Supervisor so that arrangements can be made for repairs to be effected.

If plant is found to be damaged or in need of repair, report it to the authority to avoid suspicion that the damage was caused by Telecom's activities.

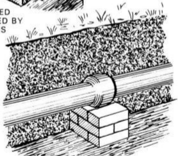
SUPPORTING PIPES AND CABLES IN TRENCHES



FULLY EXPOSED
PIPE SUPPORTED BY
TIMBER AND ROPE SLINGS

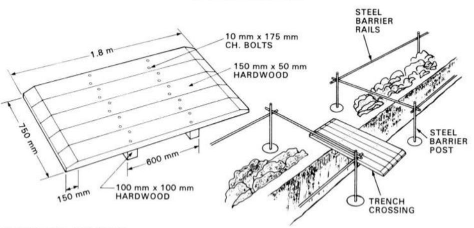


PARTLY EXPOSED
PIPE SUPPORTED BY
JACKS OR TOMS



PIPE SUPPORTED BY PERMANENT BRICK PIERS

TRENCH CROSSING



WOODEN TRENCH CROSSING

NOTES:

. Manufactured to Drawing CL-1207.

. May be used in lieu of steel plates for pedestrian or vehicular crossings.

Install trench crossings for pedestrians or vehicles wherever necessary to provide access to property and at frequent intervals in shopping areas. Erect barrier posts and rails around open trenches and heaps of spoil to warn pedestrians and drivers. Place warning lamps on the barricades at night. (See page R-2).

EXCAVATING NEAR POWER CABLES

LOCATING POWER CABLES

Details of power cables in the vicinity should be shown on conduit works plans. It is the responsibility of Lines Officers to check this information and ensure that the location of all power cables is accurately pin pointed.

It is also their duty to see that safety precautions are taken to protect workmen when working in the vicinity of power cables.

Increasing use is being made of underground cable for power distribution to residences and Supervisors must be alert to detect the presence of these cables which are normally laid shallower and with less protection than high voltage cables. Pot holing in advance to locate electrical cables is essential prior to using mechanical aids. The use of pipe locators together with observation of such items as riser cables on poles, above ground terminals at property lines, manholes, control cabinets, substations, traffic lights or the absence of overhead mains. Watch for electric signs, garden lights, pumps etc.

Power cables, if not in conduit, are normally protected by cover slabs of concrete or brick or by treated timber. Replace any distrubed slabs when refilling the trench.

PRECAUTIONS WHEN WORKING CLOSE TO POWER CABLES - TO AVOID CONTACT WITH

- When excavating close to power cables wear rubber gloves (S34/14-21) and rubber boots (S545/321-329) and use only wooden handled tools eg, Wooden handled Crowbar (S116/108). See page B-7.
- Power cables must always be exposed by hand methods before a ditcher, mole plough, back hoe or any mechanical aid is used in the vicinity.
- Do not work alone when excavating near power cables. Have another man working nearby to give help quickly in the event of an accident.
- Where a power cable is in the way and must be moved, don't try to move it yourself. Refer it to the Engineer or EPM to contact the Power Authority.
- In dangerous locations consult your Supervisor regarding arrangements for temporary disconnection of power by the Power Authority.

BEWARE - CONTACT WITH THE LIVE CONDUCTORS OF A POWER CABLE CAN CAUSE DEATH OR SERIOUS INJURY FROM BURNS AND SHOCK.

SHARED TRENCHES WITH POWER CABLES - See Section M.

EARTH ELECTRODES - SAFETY PRECAUTIONS WHEN INSTALLING

Underground plant, because of the difficulty frequently encountered in determining its exact location, presents a particular problem when earth electrodes need to be installed.

Underground power cables constitute a hazard unless proper safety precautions are observed.

On private property, underground power cables without any protective covering may be encountered. These may have been illegally installed by the householder to provide power to out-buildings, swimming pools etc.

When staff are required to install permanent earth electrodes associated with various items of equipment, or temporary electrodes installed for testing soil resistivity, they should be provided with all available information on the location of underground plant in the vicinity.

The safety precautions and practices detailed in the "Safety Display Card Series - Safe Practices for Excavations Near Underground Power Cables" are also applicable to the installation of earth electrodes, and should be observed.

Available plans of the area showing the locations of underground power cables should be consulted and the positions of the cables should be verified by means of cable locators.

If the presence of underground power cables is verified the cable should be exposed by careful hand excavation before an attempt is made to drive the electrode.

EARTH ELECTRODES - SAFETY PRECAUTIONS WHEN INSTALLING

If the presence of underground power is uncertain, check for visible indications such as :

. absence of overhead power distribution to properties.
. riser cables on power poles.
. jointing boxes or control cabinets on nature strip or private property.
. presence of traffic lights.

On private property check for :

. underground power cable lead-in from street.
. possible leads to out-buildings, swimming pools, garden lights, electric outdoor barbecues, external power points etc.

The wearing of rubber boots (Serial 545/32-329) is recommended at all times when driving earth electrodes. If in doubt about the presence of underground power, it is desirable to also wear rubber gloves (Serial 34/14-21) for additional safety.

When installing earth electrodes, allow at least 1 metre separation if possible from any underground power cable, and 2 metres from any pole. This will allow future replacement of the pole without disturbing the electrode.

Do not kneel on the ground as this action by-passes the protection given by the rubber boots.

While driving the earth electrode, do not touch or lean on any metallic object which may be a good earth, eg, a water pipe.

EARTH ELECTRODES - SAFETY PRECAUTIONS WHEN INSTALLING

References: External Plant Construction Safety Note No. 4/81
"Earth Electrodes - Safety Precautions When Installing"

EI LINES General P3001
EI LINES General Z9000
EI LINES General Z9100
EI LINES Conduits SP9101
EI LINES Conduits SP9102

Safety Display Card Series - Excavations near Underground Power Cables.

EXCAVATING NEAR GAS PIPELINES

DANGER OF GAS FIRES AND EXPLOSIONS

Gas pipelines constitute a serious hazard for staff during excavating or earth boring operations. Staff and operators of mechanical plant must continually exercise care to locate and avoid contact with pipelines and gas service pipes.

Pressures in gas pipes range from 7 kPa to 7000 kPa and damage to a pipe could result in an explosion or fire with possible loss of life, injury or severe property damage.

LOCATING GAS PIPELINES

Plans of medium, high and transmission pressure, gas pipelines are kept at Sectional Offices to enable the location of pipelines to be shown on works plans and sketches for the information of field staff.

Area Supervisors must know the location of the main pipelines in their district, and the type of gas being reticulated.

Field staff should be familiar with local warning signs, markers, valve or pit covers and any other surface features which help to identify the location of pipelines.

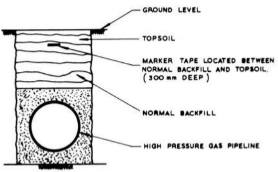
Cable locators may be used for tracing metal gas pipes. Where gas is reticulated in plastic pipes cable locators cannot be used. Where necessary, arrangements should be made for a representative of the Gas Authority to assist in pin pointing the location of the pipe.

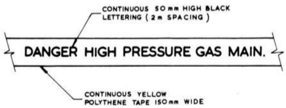
Pot holing by careful hand excavation at successive positions must be carried out to confirm the indicated line and depth of pipes. (Take care - sparks caused by a tool striking a rock or metal pipe may ignite escaping gas).

Gas mains are often distinguished by a yellow colouring or plastic wrapping. In some areas a continuous, yellow plastic marking tape, 150 mm wide, is buried directly above high pressure gas pipelines. (See page C-10).

IF GAS IS DETECTED DURING EXCAVATION WORK TAKE THE EMERGENCY ACTION SHOWN ON PAGE C-10.

EXCAVATING NEAR GAS PIPELINES





LOCATION OF YELLOW MARKER TAPE OVER HIGH PRESSURE GAS MAINS

PROTECTION OF GAS MAINS AGAINST CORROSION

Steel pipelines are usually protected against corrosion with a bituminous coating and a wrapping of asbestos tape or by a wrapping of yellow polyethylene tape.

If this protective coating is damaged during excavation notify the Gas Authority immediately so that repairs can be made.

EMERGENCY ACTION IF A GAS PIPE IS DAMAGED OR A GAS LEAK DETECTED

Take the following action immediately:

. Stop all machines and portable electric tools operating in the vicinity.

. Extinguish all naked flames, cigarettes etc.

. Withdraw all staff to a safe distance and erect gas warning signs (S148/150) stand (S148/65) and barriers to prevent members of the public entering the area. The gas warning signs are to be erected where gas has been detected in any pit, manhole or trench and it is to remain erected until the gas is cleared.

Telephone the Gas Authority to arrange immediate repairs and advise the Supervisor.

DO NOT ATTEMPT TO PLUG A DAMAGED PIPE TO TO STOP A GAS LEAK

EXCAVATING NEAR PERMANENT MARKS AND SURVEY PEGS

Permanent Marks for use as survey control points are normally located in footways or below ground level. The types of marks and their distance from the property line vary from State to State. Line staff must be able to recognise the marks used in their areas. Typical permanent survey marks are shown on page C-12.

Survey pegs and marks are established on property boundaries to define the boundary or indicate an angle in the subdivision line. Iron pins are sometimes placed a short distance away from the pegs to serve as reference points in the event of the pegs being disturbed.

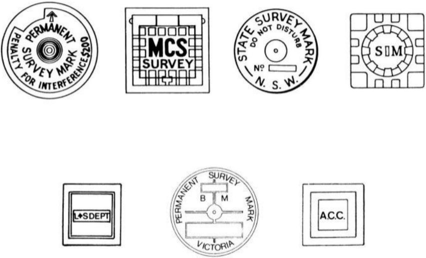
Temporary survey pegs are provided to indicate the alignments of proposed pipe lines, roadway deviations, etc.

PERMANENT MARKS OR SURVEY PEGS MUST NOT BE DISTURBED IN ANY WAY (EXCEPT BY A REGISTERED SURVEYOR). IT IS EXTREMELY DIFFICULT AND EXPENSIVE TO REPLACE THEM IN THEIR ORIGINAL POSITION.

In order to prevent displacement or disturbance of permanent marks or survey pegs every endeavour should be made to locate and identify them before commencing any excavation work. In many cases it is possible to tunnel underneath surface marks without disturbing them.

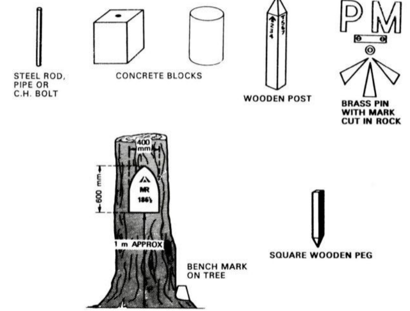
Where it is apparent that Telecom works will interfere with survey marks, the Lines Officer should arrange with the Engineer for modification to the job to avoid disturbing the mark. If this is impracticable, the approval of the Surveyor General must be obtained for the mark to be temporarily removed.

If a survey mark is accidentally disturbed the matter must be reported to the Engineer who will advise the appropriate authority and arrange for the mark to be replaced on completion of Telecom work. The mark may be replaced by an authorised Surveyor only. In no circumstances shall line staff replace the mark.



TYPICAL METAL PLATE PERMANENT SURVEY MARKS

PERMANENT MARKS AND SURVEY PEGS



UNDERGROUND CONSTRUCTION ON RAILWAY PROPERTY

Installation of underground plant on railway property should be in accordance with the "Engineering Code for the Installation, Use and Maintenance of Telecom Underground Installations within Railway Boundaries". Variations from this code must be specifically negotiated with the Railway Authority in each instance. Plans of proposed works must be forwarded to the Railway Authority and no work should commence on railway property until the Railway Authority has advised its requirements.

LOCATION OF CABLE AND CONDUIT ON RAILWAY PROPERTY

- Where underground cable or conduit is laid along railway reserves, locate it as far as practicable from the track or other important structures. Keep as close as possible to the boundary where electric railways exist.
- Keep clear of all railway structures, bridges, cattle grids or stops, drains, signalling equipment, overhead masts, poles, underground cables, buildings, points and crossings etc.
- Locate installations at least 6 metres clear of the toe of banks or the top of cuttings and at least 10 metres from the nearest rail.
- On road-over-rail bridges cable or conduits may be installed in the road or footpath surfacing but conditions for attaching to the bridge structure shall be negotiated with the Railway Authority.

INDICATING LOCATION OF CABLE AND CONDUIT INSTALLATIONS

Provide markers (See Section Q) to indicate location of underground construction:

- At points of entry and exit from railway property.
- At angles and spurs off the route.
- At drains and other points of potential hazard.
- At spacing along the route such that from any marker the markers on either side are readily visible (maximum spacing 400 metres in open country, 200 metres or closer in settled or light timbered areas.)

Marker posts must not be made of flammable material. Wording on the plates should face the railway tracks.

TRENCHING OR TUNNELLING UNDER RAILWAY TRACKS

Crossings of tracks should be approximately at right angles where practicable unless otherwise arranged with the Railway Authority. The excavation must be adequately supported by timbering etc. and where necessary temporary support provided for the tracks.

Small Installations. Where there are not more than 3 conduits up to 100 mm diameter, the conduits may be steel, vitrified clay, concrete, asbestos cement or rigid plastic.

Large Installations. Where the number of conduits exceeds 3 or the diameter exceeds 100 mm the conduits shall:

- be steel or re-inforced concrete pipes with the strength requirements shown on page C-16, or
- be encased in a pipe complying with the strength requirements, or
- be completely surrounded by a concrete encasement. The concrete must fill the interstices between the conduits and be at least 75 mm thick surrounding the conduits on the top, sides and bottom and re-inforced with a surround of re-inforcing fabric No. F92 (601). At least 50 mm cover shall be provided over the re-inforcement.

Backfilling. When backfilling tunnels fill the cavity between the tunnel wall and conduits or encasing pipe with properly compacted fine crushed rock, sand, gravel or other approved material. Backfill trenches under tracks and for 3 metres on either side in a similar manner.

CORING FOR CONDUITS OR ENCASING PIPES UNDER RAILWAY TRACKS

Installations may cross the tracks at any angle. Conduits required are as above. The cable may be drawn into the bore or enclosed in a conduit or encasing pipe. The cavity between the bore and the installed conduits or encasing pipe shall be filled with grout or other material approved by the Railway Authority, unless:

- the bore is 300 mm diameter or less and the cavity between any portion of a conduit and the surface of the bore hole does not exceed 50 mm.
- the material bored through is adequate to prevent settlement of the track.

Uncased Boreholes exceeding 100 mm diameter will not be permitted under tracks unless the installation of conduits or encasing pipe can be completed and any cavity between pipes and boreholes backfilled with grout in time to avoid delay to train services or the material bored through is adequate to prevent settlement of the track.

JACKING PIPES UNDER RAILWAY TRACKS

Jacking of pipes under tracks is permitted at the discretion of the Railway Engineer.

DEPTH OF COVER REQUIRED

Track Crossings - Main lines - not less than 1.2 metres below rail level (i.e. the top surface of the lower rail of the track).

Secondary lines - not less than 1 metre below rail level.

(These depths must be maintained for at least 3 metres beyond the outer rails).

Elsewhere on Railway Property - Not less than 600 mm.

STRENGTH REQUIREMENTS FOR CONDUITS AND ENCASING PIPES INSTALLED UNDER TRACKS

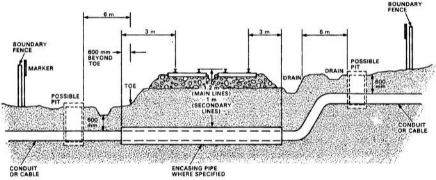
Re-inforced Concrete Pipes shall be Precast Concrete Drainage Pipes (Aust. Standard AS1342 with re-inforced concrete collar joints, spigot and socket joints or rebated joints, Y or Z class pipes as determined by the Engineer.

Steel Pipes fabricated from steel with min. yield stress 250 MPa and wall thickness of:

Internal Diameter	Min. Wall Thickness	Internal Diameter	Min. Wall Thickness
100mm and under	Standard Galv. Iron Water Pipe	Over 450mm to 550mm	10mm
		Over 550mm to 800mm	12mm
Over 100mm to 350mm	6mm	Over 800mm to 1100mm	16mm
Over 350mm to 450mm	8mm		

Corrugated Steel Pipes to Aust. Standard AS2041, Coopers E50 or E70 loading may be used.

Steel pipes must be protected against corrosion by coating or covering the pipes with suitable plastic material, galvanising or other method approved by Railway Authority.



NOTE: DISTANCES SHOWN ABOVE ARE THE MINIMUM PERMITTED IN EACH CASE.

RAILWAY CROSSING SHOWING DEPTHS AND CLEARANCES TO BE OBSERVED

KEEP A SHARP LOOKOUT FOR TRAINS WHEN WORKING ALONG RAILWAY LINES

UNDERGROUND CONSTRUCTION ON RAILWAY PROPERTY

USE OF CONCRETE BOX CULVERTS

Subject to the approval of the Railway Authority re-inforced concrete box culverts may be used as ducts as an alternative to encasing pipes for conduits.

PROTECTION OF TRACK AND BALLAST

Keep excavated material clear of the track ballast to avoid fauling the ballast or blocking the track or drains. Under no circumstances deposit spoil directly on the track ballast. Where it is necessary to place spoil between the rails or upon ballast shoulders use a suitable screen of hessian, timber etc. to protect the ballast.

Ensure that conduit installations will not result in the formation of a waterway beneath the railway tracks.

RAILWAY FENCES

Where it is necessary to breach fences, protect the opening with a temporary closure for the duration of the work and make permanent restoration on completion of the work.

SAFE WORKING OF RAILWAYS

Adequate notice of commencement of the work must be given to the Railway Authority.

Where works affect the safe working of railway operations the timing of the work shall be as directed by the Railway Authority. Otherwise timing shall be mutually agreed.

Any work within 5 metres of the outer rails of any truck or which affects safe working of railway operations shall be carried out in the presence of and under the direction of a staff member of the Railway Authority concerned.

Care must be taken to avoid contact with railway overhead structures, contact wires, cables etc. when operating mechanical excavating or lifting equipment.

Where the staff member of the considers that work being performed could affect the safety of railway operations the work shall be suspended and the matter referred to the EPM or Engineer.

SECTION D

UNDER-ROAD BORING FOR CONDUITS EXCAVATING TUNNELS

- UNDER-ROAD BORING
- EXCAVATING TUNNELS
- SUPPORTING TUNNEL EXCAVATION
- BACKFILLING TUNNELS
- CONDUIT BRIDGES

Issue 4, 1980

UNDER-ROAD BORING FOR CONDUITS

WHERE BORING EQUIPMENT CAN BE USED

To avoid disruption of traffic on busy roads or costly reinstatement of expensively paved surfaces boring equipment may be used to drill a hole under the roadway large enough for the installation of conduits. Bores can also be made under railway lines and embankments, driveways and other obstructions.

Conditions which determine whether boring is practicable are :

- Capacity of the available boring equipment i.e. the diameter and length of bore obtainable. (Number of 100 mm conduits accommodated : 130 mm bore - 1 conduit 280 mm bore - 3 conduits, 400 mm - 7 conduits, 650 mm - 19 conduits).
- Soil conditions. Drilling can be satisfactorily performed in firm soil, clay and light rock but hard rock cannot be penetrated by normal equipment. Specialised machines can be obtained for this purpose in some cases. Light soils, sand and filled or made-up ground are usually unsuitable for boring as the hole cannot be maintained long enough to install the conduits.
- Location of obstructions. Boring is unsuitable where it is necessary to change levels to pass closely beneath or above plant of other Authorities. Large rock "floaters" in the soil will sometimes deflect the drill from line.
- Number of conduits to be installed. An open trench or tunnel may be necessary for major conduit routes where the number of ducts required exceeds the capacity of the bore. Two separate bores are sometimes possible.

BORING EQUIPMENT

Various types of equipment are available, ranging from simple ratchet or hydraulic rams for pushing small size GI pipes through the soil, to large power operated boring machines capable of drilling holes up to 1 metre diameter for the installation of a number of 100 mm conduits. Some types of auger are operated dry and carry the excavated earth backwards from the cutting head by the rotation of the auger. Most of the larger machines have water injection for drill cooling and removal of spoil from the bore. A sludge pump is necessary to remove the water and mud from the trench.

UNDER-ROAD BORING FOR CONDUITS

SETTING UP EQUIPMENT

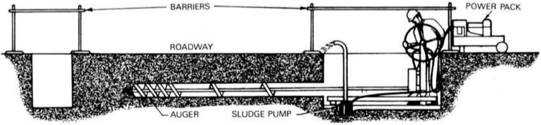
A trench slightly deeper than the hole to be bored and large enough to accommodate the boring machine is usually required at one end of the proposed bore. The machine is secured in the trench (eg. by screw jacks) and lined up in the correct direction by sighting with plumb bobs.

Where water injection is necessary the machine should be set to drill at a slighly upward angle so that the water and mud drains from the bore into a sump dug in the trench from which it is removed by a sludge pump.

For large bores it is necessary to drill a small pilot hole first and enlarge it by means of reamers.

INSTALLING CONDUITS

6mm rigid PVC conduits are used and are jointed progressively and pushed through the hole. To prevent subsidence where a nest of several conduits is laid fill the space around the conduits with concrete grout applied by means of a grouting pump.



TYPICAL BORING MACHINE IN OPERATION

BORING OPERATIONS - SAFETY PRECAUTIONS

All staff must observe ALL safety precautions when working with or near any machine with moving parts.

A machine operator must REMAIN AT the controls of his machine at all times while it is operating.

Staff must KEEP CLEAR of moving parts of operating machines, including driven attachments such as boring rods.

Staff operating mechanical aids are required to hold a Certificate of Competency endorsed for the type of machine concerned.

Staff must NOT guide rotating boring rods with their hands, feet or by the use of crowbars. Boring rod guides are supplied as part of the boring attachment kit. USE THEM. If your kit does not contain the correct guides, have your Senior Lines Officer obtain a set.

One boring rod guide should be placed within 300 mm of the work face and a second guide, as required, placed 3 metres from the first guide.

Party Leaders must supervise boring operations and ensure that members of the public and staff keep clear.

The work area must be guarded by placing orange coloured "witches hats" several metres away from the machine, positioned so as to warn any pedestrians in the vicinity.

BORING OPERATIONS - SAFETY PRECAUTIONS

Extra boring rods must be fitted by first TURNING OFF THE MACHINE and screwing the rods together BY HAND until hand tight. Rods must be tightened further by the use of pipe wrenches (S113/19 or S113/20).

Boring rods which are kinked must NOT be used.

Machines MUST NOT be used if in an unsafe condition.

If any of the controls of a machine become faulty, repairs must be arranged promptly through the Senior Lines Officer.

If difficulty is experienced in operating a machine safely eg, operating controls difficult to use, the operator must advise the Senior Lines Officer promptly.

Staff MUST NOT allow long hair, beards or loose clothing to come near any unprotected moving part of a machine.

References: External Plant Construction Safety Note No. 5/81
"Boring Operations With Trenching Machines".
TPH0042 LC "Safe Use and Operation of Mechanical Aids"
(Lines General SP1100)

REMEMBER MACHINE OPERATORS CANNOT SEE EVERYWHERE AT ONCE AND ALL STAFF MUST OBSERVE SAFETY PRECAUTIONS WHEN WORKING ON OR AROUND OPERATING MACHINES

EXCAVATING TUNNELS FOR CONDUITS

WHERE TUNNELS ARE REQUIRED

Tunnelling is normally resorted to only when trenching for installation of conduits is not practicable due to factors such as :

- heavy traffic road, with perhaps tram lines, to be crossed at greater than normal depth, due to obstructions.
- undercrossing of embanked railway lines or a road.
- in the centre of major cities where large numbers of ducts are required between exchanges or to supplement existing tunnels.
- natural or other surface obstructions eg. ornamental structures or gardens.

In many cases, the use of power boring equipment will eliminate the need for hand tunnelling which is expensive as a minimum head room of 1.2 m is necessary to provide reasonable working space for staff.

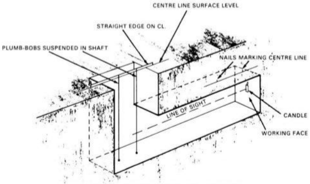
SETTING OUT DIRECTION OF TUNNEL

Mark the centre line of the tunnel on the surface of the ground.

Suspend two plumb-bobs on this line in the shaft keeping them as far apart as possible. (Movement of the plumb-bobs can be reduced by immersing them in a bucket of water or oil).

To obtain line of tunnel, sight to a third plumb-bob suspended from a staple in the tunnel roof or to a candle held on the working face.

Use a theodolite for accurate sighting in long tunnels.



SIGHTING DIRECTION IN TUNNEL

EXCAVATING TUNNELS FOR CONDUITS

ACCESS SHAFTS

As the tunnel level will generally be considerably deeper than the remainder of the conduit line, shafts will be required at each end to give access to the working face.

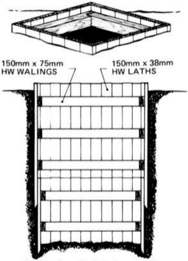
The shafts should be properly supported by timbering or sheet piling and be large enough to accommodate an access ladder and hoisting equipment.

Manholes will usually be constructed at the shaft locations but can sometimes be avoided at one end of short tunnels by using preformed bends in the conduit line.

A method of timbering shafts in loose or wet soil is shown in the drawing opposite.

Alternatively a method using false and bridging sets as described for timbering tunnels (See page D-6) may be used. The sets may be hung from a beam across the top of the shaft by means of hanging bolts.

WEAR SAFETY HELMETS FOR HEAD PROTECTION AND SAFETY BOOTS WHEN EXCAVATING TUNNELS.



Timbering shaft in loose soil.

SUPPORTING TUNNEL DURING EXCAVATION

The extent of timbering necessary depends upon the following conditions:

- the nature of the soil and whether conditions are wet or dry.
- the length and depth of tunnel and the time for which it will be open.
- the proximity of traffic or other vibration sources.
- the extent of earth pressures resulting from nearby buildings, walls, etc.

Tunnels driven through rock are usually self supporting while tunnels in soft ground require continuous support.

Where tunnels are driven through loose ground or where there is minimum cover the surface line must be inspected frequently for signs of subsidence.

TIMBER REQUIRED

Sizes of timber required to support a typical conduit tunnel (eg. 1.8 m high x 1.2 m wide). (See page D-6) are shown in the table below :

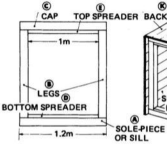
Item*	Drawing Reference*	HW Timber
Legs	B	100 mm x 100 mm
Caps	C	100 mm x 100 mm
Sill	A	100 mm x 100 mm
Laths (Side)	J	150 mm x 38 mm
Laths (Top)	K	150 mm x 38 mm
Laths (Floor)	-	150 mm x 38 mm
Wedges or Chocks	G	-
Spreaders	D & E	100 mm x 38 mm
Bridging (Top)	F	100 mm x 38 mm
Bridging (Legs)	F	100 mm x 38 mm

TIMBER SIZES REQUIRED TO SUPPORT CONDUIT TUNNEL

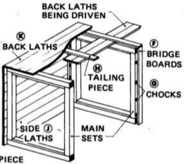
150 mm x 75 mm HW may be used for legs, cap and sill.

*Refer drawings on Page D-6.

SUPPORTING TUNNEL EXCAVATION



MAIN FRAME OR SET



TIMBERS REQUIRED FOR 1200mm SECTION OF TUNNEL

Fit frames at intervals of 1.2 m in soft ground and 1.5 m in solid ground.

SUPPORTING TUNNEL EXCAVATION

In soft ground continuous support is required for the top and sides of the tunnel at all times and this involves driving sharpened laths ahead of the excavation. The timbering required for the worst ground conditions is shown on pages D-6 and D-8. Provide main sets at 1.2 metre intervals throughout the tunnel length. Lace each new set to the preceding one with horizontal bracing.

Assemble sets and drive laths as shown on page D-8. Locate the temporary or false set about midway between the permanent sets to temporarily support the sheeting until the excavation is far enough advanced to insert the permanent set.

The tailing piece (H) prevents the top laths being forced downwards by earth pressure prior to positioning of the false set.

When all side and top sheeting has been fitted wedge it firmly against the main sets by driving timber wedges so that the whole structure is rigid.

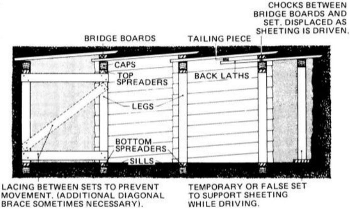
As each successive main set is assembled in position place bridge boards between the set and the top and side laths to form a saddle. Drive chocks (about 12 mm thicker than laths) between the set and bridge boards to provide sufficient space to allow the next set of laths to be driven. The chocks are displaced as laths are driven.

Side and top laths may be close together or separated depending upon soil conditions. Caulk spaces between laths with bags, straw etc. where necessary to prevent soil trickling through. In bad ground tighten up sheeting by wedging and check caulking daily before work ceases.

SHIFTING AND RAISING EXCAVATED SOIL

Depending upon conditions and length of the tunnel it may be desirable to arrange for a rubber tyred or rail type trolley to transport soil from the tunnel face to the shaft. A hoist will normally be required to lift excavated soil to the surface.

SUPPORTING TUNNEL EXCAVATION



<u>Note</u> : All sheeting must be firmly wedged against sets.

BACKFILLING TUNNELS

Proper backfilling of tunnels is most important particularly under roads, railway tracks and close to building foundations. The existence of voids in the backfilled soil, subsidence due to traffic vibration or erosion from water flow can result in soil collapse, sometimes with serious consequences.

Where practicable remove timbers prior to backfilling but do not attempt this if it introduces danger of earth collapse.

Bed the conduit nest in sand and pack the surrounding area with solid material so that later subsidence due to collapse of the tunnel is impossible. The bedding sand may be mixed with cement (proportion 12:1) to assist consolidation.

Where practicable the tunnel should be filled with a weak mix of concrete eg. by means of a pneucrete machine or grout pump. If this equipment is not available pack brickbats or rocks around and above the pipes so that the tunnel is completely filled.

Remove excess spoil from the job site promptly.

Clean up properly on completion of the work and leave the job site tidy.

Arrange for reinstatement of any paved road or footpath surfaces by the Authority concerned.

WARNING!

DANGEROUS GASES CAN ACCUMULATE IN SHAFTS AND TUNNELS. BEFORE ENTERING A SHAFT ALWAYS CHECK FOR THE PRESENCE OF GAS (SEE SECTION R).

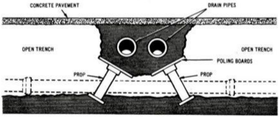
EXCAVATING HEADINGS FOR CONDUITS

Headings are short tunnels a metre or so in length used to pass under obstructions such as gutters, drain pipes, tramway rails and vehicular tracks.

The heading should be only of sufficient size to provide working room and permit the conduits to be laid.

In good firm soils timbering may not be necessary provided the top of the heading is arched. Otherwise a simple support such as shown below may be used.

Carefully ram backfilling material to ensure that it will adequately support the weight of the heading and prevent subsequent subsidence.



SUPPORT FOR HEADING IN FIRM EARTH

CONDUIT BRIDGES

APPLICATION

Conduit bridges may be provided to cross creeks, gullies, railway cuttings etc. where it is not practicable to install the conduits underground or to attach them to an existing bridge. Typical situations are :

- creeks flowing strongly over the whole year.
- creeks with steep high banks.
- permanently flowing streams with rock bottoms.
- deep concrete lined channels eg. irrigation channels.
- where an existing bridge is subject to severe vibrations.
- deep railway or road cuttings where no traffic bridge exists.

The type of bridge required will depend upon the number of conduits to be installed and the length of span. Separate engineering design will be necessary in each instance.

Bridges will normally be constructed from steel tubing or concrete. An example is described below.

PRESTRESSED CONCRETE DUCT-CARRYING BEAM

Concrete beams may be designed and constructed by a concrete manufacturer for special applications. (See page D-12).

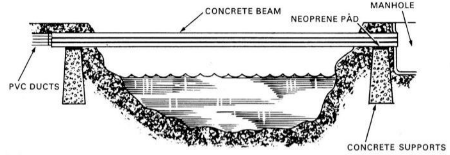
The beams commonly contain six 100/4 ducts and are manufactured in lengths up to about 25 metres. Ducts are rigid PVC cast into the concrete beam with sockets protruding at each end.

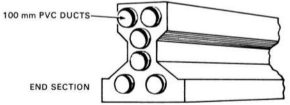
Concrete supports would be required at each end of the beam, the size and depth depending upon the weight of the beam and the nature of the soil. A neoprene pad placed between the beam and concrete support permits expansion of the beam.

The beam may terminate in a manhole wall or be connected direct to PVC conduits at either end. Provision should be made in the conduits at one end for expansion of the beam.

CONDUITS ON OTHER AUTHORITIES BRIDGES See page J-8.

CONDUIT BRIDGES





PRESTRESSED CONCRETE DUCT-CARRYING BEAM

SECTION E

INSTALLING CONDUITS

- CONDUIT TYPES
- APPLICATION
- RIGID PVC CONDUIT - JOINTING
- CONCRETE ENCASED CONDUIT CONSTRUCTION
- LAYING SELF SUPPORTING PVC CONDUITS
- ASBESTOS CEMENT CONDUITS, APPLICATION, LAYING, RUBBER RING JOINT
- JOINTING AC CONDUITS TO PVC CONDUITS
- REPLACING DAMAGED AC CONDUIT WITH PVC CONDUIT
- DUCT SEALING PLUGS

CONDUIT TYPES

RIGID PVC CONDUITS

Internal diameter 100 millimetres (nominal), standard length 4.5 metres, adhesive joint, white colour.

Supplied in three types :

. Type 100/2 : General purpose light weight conduit requiring concrete encasement. Nominal wall thickness 2 millimetres.

. Type 100/4 : Self supporting conduit requiring high strength granular backfill. Nominal wall thickness 4 millimetres.

. Type 100/6 : Heavy duty, self supporting conduit. Nominal wall thickness 6 millimetres.

Conduit and preformed bend sizes available are listed on Page E-2.

ASBESTOS CEMENT (AC) CONDUITS

Internal diameter 100 millimetres (nominal). Length 4 metres. (See list page E-16).

Supplied in two types :

. Rubber ring joint ("Supertite") : Rubber ring joint provides a relatively watertight seal.

POLYETHYLENE CONDUITS

Black, high density polyethylene. Internal diameter 100 millimetres. Supplied in coils. Generally superseded by rigid PVC and only used for special applications such as river crossings.

CONCRETE CONDUITS

Reinforced concrete conduits (S.73/41). NFP. Internal diameter 100 mm. Length 1.8 metres self aligning rubber ring joint. Superseded by rigid PVC and AC conduits.

PLACE CONDUITS IN A SECURE POSITION ALONGSIDE THE TRENCH WHERE THEY CANNOT FALL OR BE KNOCKED INTO THE TRENCH AND INJURE WORKMEN.

RIGID PVC CONDUITS

Serial/ Item No.	Type	Length (Metres)	Wall Thickness	Description and Use
CONDUITS				
73/202	100/6	4.5 m	6 mm	Self-supporting, heavy duty conduit.
73/207	100/4	4.5 m	4 mm	Self-supporting, medium duty conduit.
73/210	100/2	4.5 m	2 mm	Light-weight conduit requiring concrete encasement.
73/215	80/4	4.5 m	4 mm	Self-supporting, medium duty conduit.
BENDS				
73/221	100/6	2 m	6 mm	5 metre radius x $22\frac{1}{2}^{o}$ bend. Socket at one end. For use with Type 100/4 and 100/6 PVC conduits and AC conduits.
73/222	100/6	2 m	6 mm	As for Item 221, for use with PVC or AC on UNDERGROUND INSTALLATIONS ONLY.
73/231	100/2	2 m	2 mm	5 metre radius x $22\frac{1}{2}^{o}$ bend. Socket at one end. For use with Type 100/2 PVC conduits.
COUPLINGS				
73/241	1	-	-	For jointing Type 100/4 and 100/6 PVC conduits.
73/242	2	-	-	For jointing Type 100/2 PVC conduits.
73/243	3	-	-	For jointing Type 100/2 PVC conduits to Type 100/4 and 100/6 PVC conduits.

RIGID PVC CONDUITS - TYPES AND SIZES

NOTE : The Type Number of rigid PVC conduits indicates the internal diameter and wall thickness.

RIGID PVC CONDUITS - TYPE 100/2, CONCRETE ENCASED

Type 100/2 Rigid PVC are general purpose conduits for multiway duct routes. These thin walled conduits must always be encased in concrete to avoid flattening under load.

Advantages over other types of conduit are :

. The smooth bore permits greater cable lengths to be hauled.
. Concrete encasement provides a high degree of protection against mechanical damage.
. The flexibility of the conduits simplifies avoidance of obstructions in trenches and permits contour laying resulting in less excavation.
. Water or gas cannot pass through the walls of the pipe or joints into the conduit system. Silt or tree roots cannot enter through walls or joints.
. Rigid PVC is chemically inert and termite proof. Its insulating properties assist in protecting lead cables from damaging electrolytic corrosion.
. The conduits are light and easy to handle, transport and store.

RIGID PVC CONDUITS TYPE 100/4 AND TYPE 100/6, SELF SUPPORTING

These conduits are self supporting and have most of the advantages listed above but are considerably more costly than Type 100/2 and AC conduits. Concrete encasement is not necessary but high strength granular backfill or soil stabilisation is required where Type 100/4 conduits are laid.

Special conditions which may justify the use of these conduits are :

. Under-road bores or tunnels.
. Attachment to bridges or viaducts.
. In areas of unstable ground eg. swamps, filled sites or loose sand.
. Under-water conduit routes across rivers and bays.
. Adjacent to electricity substations or traction systems if concrete encasement of thin wall PVC conduits is impracticable.

Type 100/6 conduits are used only where the strength of Type 100/4 conduits is inadequate eg. suspension from bridges.

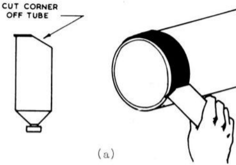
RIGID PVC CONDUITS - JOINTING

Rigid PVC conduits and bends are manufactured with a tapered socket 100 mm long formed at one end. Double ended couplings are also available for jointing plain ends of conduit. Jointing is achieved by pushing the spigot end of one length of conduit into the socket of the adjacent conduit after applying a solvent welding material, Jointing Adhesive, PVC Pipe (S.73/279). PVC conduits may be jointed progressively in the trench or several sections jointed on the surface and then lowered into the trench.

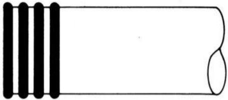
JOINT PROCEDURE

- Ensure before commencing there is a sufficient supply of the correct materials and tools on hand to complete the installation
- Remove any temporary duct plugs from the ends of previously laid conduits or bends
- Ensure that the bore is dry and free from foreign materials
- Clean the inside of the socket and the outside of the spigot end with a rag saturated with methylated spirits. Allow to dry before applying adhesive
- Apply adhesive to the spigot as shown on page E-5. Spread it with the spatula supplied to form a band 70 mm wide. The complete circumference up to the edge of the spigot must be well covered with adhesive. (Note : Where liquid adhesive is used apply it with a brush to both spigot and socket)
- Immediately after applying adhesive push the spigot firmly into the socket and then gently tap the conduit home using a hammer and wooden block, until no further movement occurs. Wipe off any excess adhesive forced out of the joint
- The jointed conduit may be handled for the first few minutes after making the joint which should be ample time to place the conduit into its final position. Further movement MUST be avoided for the next two hours while the weld cures
- Where conduits are formed into bends stake the desired bend, joint conduits on the straight and allow joints to cure for at least two hours before bending conduits around the stakes and securing in position
- Wipe off any adhesive which has been spilt on the skin or clothing. The remaining film of adhesive can be easily peeled off when dry

JOINTING RIGID PVC CONDUITS TO ASBESTOS CEMENT CONDUITS - See pages E-20 and E-21.

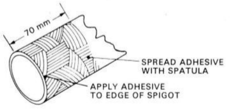


(a)



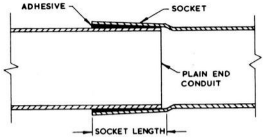
(b)

METHODS OF APPLYING ADHESIVE

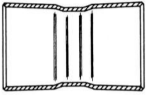


SPREADING ADHESIVE

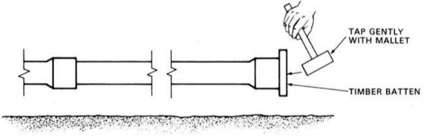
RIGID PVC CONDUITS - JOINTING



SOLVENT WELD JOINT



DOUBLE ENDED CONDUIT COUPLING



TAPPING HOME CONDUIT

CONCRETE ENCASED CONDUIT CONSTRUCTION

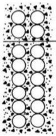
Type 100/2 thin walled rigid PVC conduits must always be encased in concrete. The conduits are arranged in groups (modules) and then encased in poured concrete (normally ready-mixed).

ARRANGEMENT OF MODULES

Conduits are arranged in modules one conduit wide with a maximum of six high. Conduit nests are made up from modules spaced 25 mm apart by means of spacing stakes and completely surrounded by concrete ie. 40 mm beneath the conduits and 50 mm at the sides and above the conduit nest.

Where conduits more than six high are required a second tier is constructed above the first after the initial set of the first concrete pour has occurred.

To prevent the lightweight PVC conduits floating out of the wet concrete they are secured in position by clamping to spacing stakes.



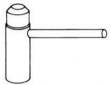
MATERIAL

Spacers (S.73/261). Used above and below the conduits to hold spacing stakes in the correct position. They are designed to support conduits two wide but may be combined for wider nests.

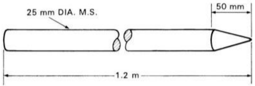
Concrete. Ready-mixed concrete to Telecom Specification No. 1064.

Reinforcing 200 mm x 200 mm welded mesh 7 mm rod (No. F72). Required only in unstable ground. Placed down both sides of the conduit nest.

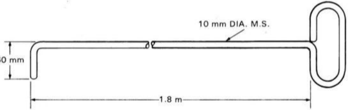
SEPARATION OF MODULES



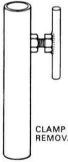
STAKE DRIVING CAP



STAKE



CONCRETE PLACEMENT ROD



CLAMP WITH STAKE REMOVAL BAR

<u>SPECIAL EQUIPMENT REQUIRED FOR CONCRETE ENCASEMENT OF PVC CONDUITS</u>

(Refer Drawing CL 1112 for manufacturing details)

CONCRETE ENCASED CONDUIT CONSTRUCTION

TRENCH PREPARATION

The width of trench depends upon the number of conduit modules as shown in the table :

Conduits Wide	Trench Width
2	350 mm
3	500 mm
4	600 mm
5	750 mm
6	900 mm
8	1200 mm

NOTE :

- Where reinforcement is required increase the width of the trench by 50 millimetres.
- To avoid excessive use of concrete do not exceed these widths.
- In unstable ground timbering (or steel sheeting) may be necessary to support the trench and to act as a former for the concrete.

WIDTH OF TRENCH REQUIRED

The depth of the trench is governed by the number of conduits high, obstructions to be cleared and the depth of cover required. On footways provide a minimum cover of 400 mm over the top of the concrete i.e. 450 mm above the conduits. The bottom of the trench should normally follow the contour of the ground except where it is necessary to avoid obstructions.

INSTALLING CONDUITS

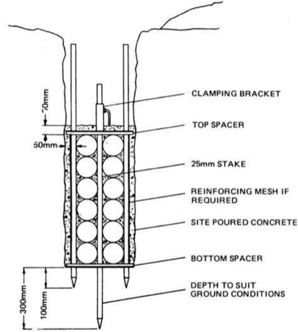
Check conduits for manufacturing defects or damage in transit before installing.

Place two spacers back to back across the bottom of the trench at 1.5 metre intervals with the large bearing surface facing upwards. Place the first spacer 750 millimetres from the beginning of the conduits so that joints will not be made at spacers.

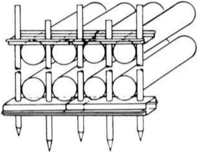
Drive stakes through the centre holes of the spacer about 300 mm deep and through the other holes to about 100 mm so that they stand upright. Use one deep driven stake for every 2 conduits wide in the nest. Timber spacers or stakes should not be used. They swell with moisture from the concrete and cause crushing of the conduit.

Lay conduits in position on the bottom spacer progressively jointing them as described on page E-4. Place successive layers of conduits immediately upon the lower layers to build up the conduit nest. Fit top spacers broad face downwards on stakes and secure in position with clamping brackets on the deep driven stakes so that the conduits cannot float when the concrete is poured.

CONCRETE ENCASED CONDUIT CONSTRUCTION



TYPICAL ARRANGEMENT OF CONDUITS



COMBINING SPACERS FOR WIDE NESTS

NOTES:

- . Fit spacers with larger bearing area towards the conduits.
- . Place two spacers back to back under the bottom conduits.
- . When fitting clamping brackets do not apply pressure to the conduits.

MANHOLE ENTRY

At manholes the conduits must be separated to allow them to be completely surrounded by concrete.

Use two spacers back to back to provide a separation of 40 millimetres between each layer of conduits. Locate the spacers about 150 millimetres from the end of the conduits.

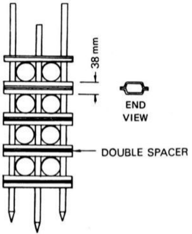
Raising the upper levels of the duct formation at entry to manhole in order to obtain vertical separation between layers should be avoided as it acts as a trap for silt, or lime deposits where faulty joints exist.

The top level of ducts must maintain a drainage grade, and lower levels dropped to obtain the desired separation. It is necessary in some cases to deepen the trench to maintain the required depth of cover.

Where necessary the conduits may be splayed over 3 metres adjacent to the manhole to provide entries close to the side walls of the manhole (See Section F).

The end wall of the manhole may be poured in conjunction with conduit encasement.

Where a manhole is to be built after conduit laying, leave about 1 metre of conduit to be encased during construction of the manhole.



SEPARATING CONDUITS AT MANHOLE

Timbering will be necessary to provide a temporary block across the trench 1 metre from the proposed manhole while the concrete is poured.

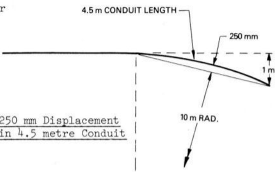
CONCRETE ENCASED CONDUIT CONSTRUCTION

TESTING CONDUITS

On completion of backfilling test conduits for dents or blockage with a 98 mm diameter mandrel 150 mm long. (See Section H).

BENDS AND CURVES IN CONDUIT ROUTE

To avoid obstacles or to negotiate corners, rigid PVC conduits may be cold bent around stakes to a minimum radius of 10 metres (ie. 250 mm displacement in 4.5 metre conduit). Provide additional stakes for bends at intervals of 1/20th of the bend radius to avoid kinking the conduits. Drive stakes well into the ground to withstand the bending force. Tom stakes to the trench wall where necessary.



250 mm Displacement in 4.5 metre Conduit

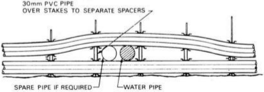
For sharper curves use preformed, 5 metre radius, $22\frac{1}{2}^{\circ}$ Bends 100/2 (S.73/231). Cut bends and fit double ended couplings or add lengths of straight pipe between bends to obtain the required curve. Set out the curve on the ground before cutting conduits.

Vertical deviations to avoid water mains, drains etc. require the use of additional stakes and spacers at intervals of about 600 mm to support the conduits as shown on Page E-13.

As concrete encasement prevents easy removal of other authorities pipes, split pipes or other packing must be placed over their pipe (or a spare pipe installed for later use).

VERTICAL BENDS

IN CONDUIT ROUTE



CONCRETE ENCASED CONDUIT CONSTRUCTION

POURING CONCRETE

Normally ready-mixed concrete (Telecom Spec No. 1064) will be obtained and applied from a chute directly into the trench moving the vehicle along the route as required. Do not dump concrete in a heap on top of the conduits as this may crush the conduits. Allow concrete to flow evenly and smoothly around the conduits, distributing it across the whole width of the trench.

Immediately behind the pouring, use placement rods (page E-8) to work the concrete into all voids and to free any blockage between the conduits.

The maximum height for any pour is six conduits. Where the number of conduits exceeds six high a second pour must be arranged.

Level off the surface of the concrete to provide a minimum of 50 mm cover over the top conduit, except where an additional tier of conduits is to be laid, when the concrete should be smoothed off level with the top spacers.

The quantity of concrete required may be obtained from the chart on page E-14. This chart is for trenches to the widths shown on page E-9. Calculate additional concrete for overbreak by the formula:

Extra width (m) x concrete depth (m) x trench length (m) = m^3 concrete.

WITHDRAWAL OF STAKES

Remove stakes after the initial set of the concrete has taken place and before it sets hard. The correct method of loosening is to rotate stakes before withdrawing. Wash stakes and clamps immediately to remove traces of concrete.

ADDING SECOND MODULE

When removing stakes after concrete encasement of the first module withdraw them until approximately 300 mm still remains in the concrete. Regard top of concrete as bottom of trench and fit another bottom spacer over the stakes.

Install conduits and pour concrete as for the first module.

BACKFILLING Do not backfill the trench until the initial set of the concrete has taken place. The backfilling should be placed in a controlled manner and not dumped in large quantities on one point in the trench.

Compaction should not be attempted until four hours after placing of the concrete, as ramming can damage the conduits.

QUANTITY OF CONCRETE REQUIRED

Read volume of concrete per meter of trench using the V and H scales. Multiply this figure by the length of the trench in metres.

Example

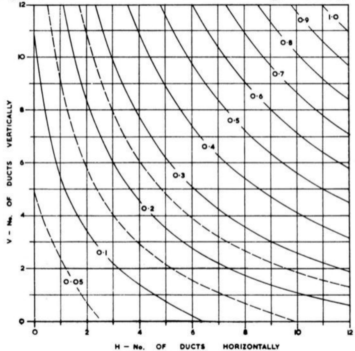
Conduits 4 vertically, 6 horizontally, Trench 50 metres

From chart:

4V - 6H = 0.25

Volume = 0.25 x 50
= 12.5 M^3 conc.

The chart is for trench widths shown on page E-9. For wider trenches (e.g. due to overbreak) calculate amount of additional concrete by formula given on page E-13.



VOLUME OF CONCRETE REQUIRED FOR ENCASEMENT
(Cubic Metres per Metre of Trench)

LAYING SELF SUPPORTING PVC CONDUITS

INSPECTING CONDUITS

Before installation, inspect conduits to ensure that they are free from manufacturing defects or damage and that the interior is clear of soil or other foreign matter.

BEDDING CONDUITS

Provide a 50 millimetre layer of fine soil or sand on the bottom of the trench for bedding the conduits.

PROVIDING CONCRETE BASE

Where the ground is unstable or where there is a risk of subsidence due to other works a 75 millimetre layer of concrete should be laid to provide a firm base for the conduits. The concrete should project 50 millimetres on each side of the conduits and be reinforced where necessary.

LAYING CONDUITS

Install conduits on multi-way routes layer by layer providing a minimum spacing of 25 millimetres between barrels and between the outer conduits and the trench walls. Carefully pack sand around and over the conduits with an even pressure to avoid damaging the conduits or disturbing their alignment.

Cover the top layer with sand to at least 50 millimetres above the conduits.

Where Type 100/4 PVC conduits are laid the back fill material must be a high strength granular material such as sand, metal dust, decomposed granite etc. which is readily compacted.

In unstable soil conditions or locations where heavy loading will be experienced the backfill material may be stabilised by dry mixing with cement (1 part cement to 12-20 parts backfill).

Use 5 metre radius $22\frac{1}{2}^{o}$ bends 100/6 (Ser. 73/221) for curves of less than 10 metre radius. Short lengths of conduit may be joined by Couplings (Ser. 73/241).

The method of jointing conduits is described on pages E-4 to E-6.

ASBESTOS CEMENT CONDUITS

AC CONDUITS, RUBBER RING JOINT

Supplied with a socket attached to one end and a spigot machined on the other. A groove for the rubber ring is machined in the socket.

Lubricant is supplied with the pipes to facilitate jointing.

Oversize couplings are available for jointing short ends or broken conduits.

SERIAL/ITEM	TITLE	DESCRIPTION
73/30	Conduit 100 mm AC Rubber Ring Joint	4 metres long. Supplied complete with rubber ring.
73/31	Coupling AC Rubber Ring Joint	Coupling for jointing short lengths Item 30 with unmachined ends. Supplied with two rubber rings.
73/32	Rubber Sealing Ring (Conduit)	For use when rubber rings supplied with Item 30 are lost or damaged.
73/33	Rubber Sealing Ring (Coupling)	For use with coupling, Item 31.

ASBESTOS CEMENT CONDUITS - TYPES AND FITTINGS

WHEN CUTTING OR DRILLING ASBESTOS CEMENT CONDUITS AVOID INHALING THE DUST. SEE SECTION R - SAFETY PRECAUTIONS.

APPLICATION OF AC CONDUITS

AC Conduits are provided as an alternate to 100/4 PVC Conduit but they suffer from certain disadvantages compared to PVC :
. Lack of impact resistance
. Higher co-efficient of friction
. Cannot be contour laid
. More difficult to install

Conduits With Rubber Ring Joints
This is a general purpose conduit for single or multiduct installations. The rubber ring joint provides a fairly reliable watertight conduit.

BEDDING CONDUITS
Provide a 50 mm layer of fine soil or sand in the bottom of the trench for bedding the conduits. In unstable ground a concrete base may be necessary (See page E-15). Scoop the soil away under the socket so that the barrel of the conduit bears on the bedding material.

FIT DUCT PLUGS TO PREVENT ENTRY OF DIRT WHENEVER CONDUIT LAYING IS TEMPORARILY DISCONTINUED.

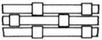
ASBESTOS CEMENT CONDUITS

LAYING CONDUITS

Lay conduits with a minimum spacing of 25 mm (horizontally and vertically) between the barrels to permit placement and compaction of the backfill material. Spacing may be provided by laying the conduits with collars adjacent.

Provide a space of at least 25 mm between the outer conduits and the trench wall.

Backfill to 50 mm above conduits with fine soil or sand, carefully compacting it with a hand rammer around and between the conduits. Take particular care not to disturb the alignment of the conduits.



STAGGERED JOINTS IN MULTIWAY DUCTS

Where necessary, the width of the trench required may be reduced by staggering the joint positions. Start one line of conduits with a full length and the adjacent line with a half length. When conduits are laid in two or more layers, stagger the collars in each layer with respect to the collars in the layer below.

BENDS AND CURVES

The rubber ring joint allows AC pipes to be slightly offset to avoid obstructions but offsetting should not exceed 1° (ie. 60 mm per pipe) as a lip is formed inside the conduit which can interfere with cable hauling and damage the cable.

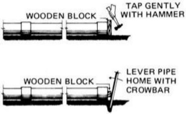
Use rigid PVC conduits, Type 100/4 or Type 100/6 for curves over 10 metre radius.

For all other bends and curves under 10 m radius use preformed PVC bends Type 100/6 (S.73/221). Set the bends in concrete to ensure that no movement can occur when cables are being hauled.

JOINTING CONDUITS - RUBBER RING JOINT

- Examine conduits for defects, remove duct plugs and any soil, stones etc.
- Set rubber ring in the socket with its thickest section towards the inside of the socket.
- Firmly bed the first conduit in the trench with the spigot end towards the manhole. Scoop away soil beneath the socket.
- Using a brush, apply lubricant liberally to the spigot end of the next conduit.
- Push the spigot firmly into the socket of the first conduit and tap home with a hammer or lever with a crow bar as shown in drawing.
- Align conduits with the centre line of the route and fix in position with a little soil tamped on each side of the conduits.

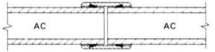
RUBBER RING JOINT



METHODS OF JOINTING AC PIPES

JOINTING SHORT ENDS

Use oversize couplings (S.73/71) for jointing short ends or broken conduits.
Cut the ends square before fitting.
The coupling may be fitted over the spigot or the unmachined outside of the conduit.
Encase spigot to unmachined barrel joints in concrete.



OVERSIZE COUPLING

JOINTING AC CONDUITS TO PVC CONDUITS

JOINTING SHORT ENDS - ADHESIVE JOINT

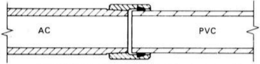
Use oversize couplings (S.73/28) for jointing short ends of conduits. Cut ends square and joint conduits as described above.

AC SOCKET TO TYPE 100/4 OR 100/6 PVC SPIGOT

As the outside diameter of thick walled (4 mm and 6 mm) PVC conduits and bends approximately matches the spigot diameter of AC conduits the standard AC socket may be used for these joints.

Apply lubricant to the spigot end of the PVC conduit and push it firmly into the AC conduit socket (See page E-19).

This is the preferred method of jointing these conduits.

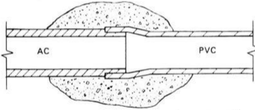


AC SOCKET TO TYPE 100/4 OR 100/6 PVC SPIGOT

AC SPIGOT TO TYPE 100/4 OR 100/6 PVC SOCKET

An AC spigot can be mated to a PVC socket by cutting 40 millimetres off the end of the PVC socket and jointing with gap filling adhesive. (PVC pipe adhesive S.73/279).

Encase the whole joint in concrete.



AC SPIGOT TO TYPE 100/4 OR 100/6 PVC SOCKET

DON'T JUMP INTO A TRENCH - GENTLY LOWER YOURSELF. USE A LADDER IF THE TRENCH IS MORE THAN A METRE DEEP.

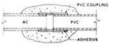
DO NOT PERMIT VEHICLES TO APPROACH CLOSE TO THE TRENCH, THEIR WEIGHT MAY CAUSE THE WALLS TO COLLAPSE.

AC SPIGOT TO TYPE 100/4 OR 100/6 PVC SPIGOT

An AC spigot may be jointed to a PVC spigot by means of a PVC Coupling (S.73/241).

Cut 40 millimetres off the coupling on the AC side of the joint and joint coupling to both conduits with gap filling adhesive.

Encase the whole joint in concrete.



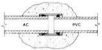
AC SPIGOT TO TYPE 100/4 OR 100/6 PVC SPIGOT

AC BARREL TO TYPE 100/4 OR 100/6 PVC SPIGOT

To joint a PVC spigot to the barrel of a cut or broken AC conduit use an AC Coupling S.73/31. (The coupling may also be used for mating a machined AC spigot to a PVC spigot).

Push conduits firmly together until the ends butt.

Encase the whole joint in concrete.



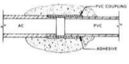
AC BARREL TO TYPE 100/4 OR 100/6 PVC SPIGOT

AC SPIGOT TO TYPE 100/2 PVC SPIGOT

Use a PVC Coupling (S.73/243) for jointing the spigot of a thin wall (2 mm) PVC conduit.

Cut 40 millimetres off the end of the coupling on the AC conduit side and joint the coupling to both conduits with a gap filling adhesive.

Encase the whole joint in concrete.

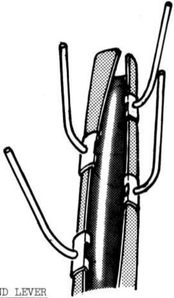


AC SPIGOT TO TYPE 100/2 PVC SPIGOT

CHECK THE LOCATION OF ELECTRICAL POWER CABLES AND GAS AND WATER MAINS BEFORE COMMENCING TO EXCAVATE.

IF AN OBSTRUCTION IS ENCOUNTERED WHEN EXCAVATING UNCOVER IT CAREFULLY - IT MAY BE A DANGEROUS POWER CABLE OR A GAS OR WATER MAIN.

REPLACING DAMAGED AC CONDUIT WITH PVC CONDUIT



HAND LEVER

Where a small section or a length of AC conduit has been damaged with cable in situ, repairs can be carried out as follows :

. Make a longitudinal cut in the 100/4 PVC conduit and coupling with a hand or power saw.

. Remove the damaged AC conduit from the cable.

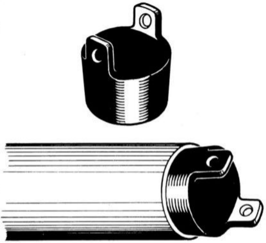
. Place the split PVC conduit under the cable.

. Use the hand levers (Drawing CL 1385) to open the split PVC conduit sufficiently to place the cable inside the conduit. Work progressively along the split until the cable is in the conduit.

. Clean the split with a rag saturated in methylated spirits. Place the PVC strip/s of moulding along the conduit slit. (The 6 mm moulding strip is commercially available and is used in the building industry for jointing asbestos sheeting).

. Raise the tabs of the moulding strip and apply adhesive glue between them and the conduit. To joint the split PVC conduit to existing AC conduit ensure that a socket end or a split PVC coupling is used at each end of the joint. The joints must be concrete encased (See page E-20 and 21).

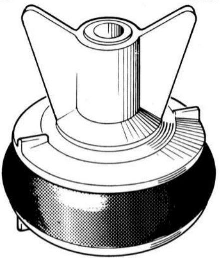
DUCT SEALING PLUGS



TAPERED POLYETHYLENE PLUG

For sealing Rigid PVC, Asbestos Cement and other 100 mm diameter conduits against the entry of soil or other foreign matter where laying of conduits has been temporarily discontinued.

May also be used to permanently seal ends of ducts in jointing chambers until cables are installed.



DUCT PLUG (PRESSURE TYPE)

This plug is particularly effective for temporary sealing of ducts to prevent discharge of water into a manhole during emergency cable repairs etc. and for permanent sealing of unoccupied ducts at exchange to prevent the ingress of gas or water.

Issue 4, 1980

REFERENCE

E.I. Lines CONDUITS CL 3600. Installation of concrete encased conduits.

SECTION F

MANHOLES

- DESIGN
- DIMENSIONS
- CONSTRUCTION
- PRE-CAST MANHOLES
- PCM REPEATER HOUSING MANHOLES
- MANHOLE COVERS
- EXTENDABLE MANHOLE COVERS AND FRAMES
- MANHOLE FITTINGS
- WARNING SIGNS
- CONCRETE SPECIFICATIONS
- PLACING CONCRETE
- DRAINING MANHOLES

MANHOLES

DESCRIPTION

Manholes are underground chambers constructed on cable routes to enable cable to be installed and withdrawn from conduits, to give access to the cables for jointing and maintenance and to house loading coils, repeaters and other equipment.

LOCATION

Locate manholes at the most suitable points for connection of lateral cables, pillar terminals and cross-connecting cabinets, loading coil pots and repeaters. Wherever practicable manholes should be spaced at about 230 metres apart. (See page A-4 "Manhole Spacing in Conduit Routes".)

At street corners construct manholes far enough back from the property lines to avoid disturbance if the corner is later truncated or splayed. (Minimum distance from property line - 3 metres.) Where the conduit route changes direction use preformed PVC bends to lead conduits into the manhole.

Keep manholes clear of driveways, property entrances and other locations where they may be crossed by vehicular traffic.

Site manholes so as to encroach as little as possible on the footpath space allocation of other authorities.

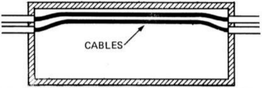
Align the manhole so that the cover is square and parallel to the property line.

METHODS OF CONSTRUCTION

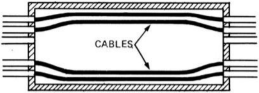
Manholes may be constructed from any of the following materials:-

- Poured concrete (ready mixed or mixed on site).
- Clay or concrete house bricks.
- Hollow concrete modular building blocks.
- Precast concrete slabs.
- Precast concrete manhole complete (rectangular shape shown on page F-7).

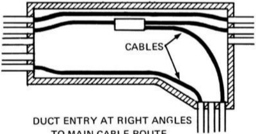
TYPICAL MANHOLE DESIGNS



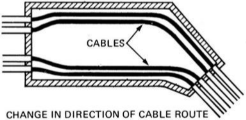
MANHOLE OFFSET FOR CABLE RACKING ON ONE WALL



CABLE RACKING ON BOTH WALLS



DUCT ENTRY AT RIGHT ANGLES
TO MAIN CABLE ROUTE



CHANGE IN DIRECTION OF CABLE ROUTE

<u>NOTE</u> PVC ducts may be splayed approaching the manhole so as to enter close to the side walls.

 DO NOT TREAD ON CABLES WHEN ENTERING OR LEAVING MANHOLES.

MANHOLE DIMENSIONS

Number of Ducts	Internal Dimensions		
	Length		Width (metres)
	Duct entry close to side walls (metres)	Duct entry in centre of end walls (metres)	
Up to 4	2.0	3.0	0.9
5 - 8	3.0	3.0	1.1
9 - 16	3.7	4.25	1.25
17 - 24	3.7	4.25	1.25
25 - 36	3.7	4.25	1.25
37 - 48	4.9	5.7	1.5
49 - 64	4.9	5.7	1.5

TYPICAL DIMENSIONS OF RECTANGULAR FOOTWAY MANHOLES

NOTES:

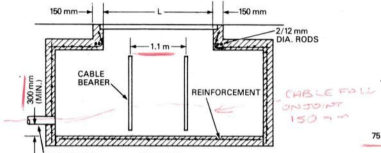
. The dimensions given in this table may be varied to suit local conditions and requirements or to conform with existing construction.

. Where conduits are arranged so as to enter close to the side walls the length of the manhole may be reduced as shown above.

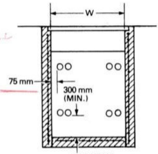
. Manholes to contain loading coils normally require a minimum width of 1.5 metres and underground repeater manholes 1.7 metres.

. Depth of manhole depends upon the depth at which conduits are laid and will normally be 300 mm to 450 mm below the lowest duct with a minimum depth of 1.1 metres.

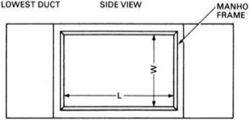
MANHOLE DIMENSIONS



SIDE VIEW



END VIEW



PLAN VIEW

Typical dimensions of footway manholes are given on page F-3.

Details of 'L' (Length of Opening) and 'W' (Width of Opening) are given in the table of manhole cover sizes on page F-8.

FOOTWAY MANHOLES

Manhole Depth (Metres)	Thickness of Concrete Required			Steel Mesh Reinforcement Required		
	Walls (mm)	Roof (mm)	Floor (mm)	Walls	Roof	Floor
Up to 1.5	125	125	100	No.F72	2 Layers No.F72	No.F72
1.5 - 2.0	150	125	125	No.F72	2 Layers No.F72	No.F72
2.0 - 2.5	175	125	150	2 Layers No.F72	2 Layers No.F72	No.F72
2.5 - 3.0	250	125	150	2 Layers No.F72	2 Layers No.F72	No.F72
or	200	125	150	No. F81	2 Layers No.F72	No.F72
Over 3.0	See Note					

SPECIFICATION FOR CONCRETE MANHOLES IN FOOTWAYS

Note. The thickness of concrete and the reinforcement required for manholes over 3 metres in depth depend upon the soil conditions and loading and will be determined by the Engineer in each case.

ROADWAY MANHOLES

Roadway manholes are constructed only where it is not possible to provide any alternative means of access to the cables. Footway entrances are provided wherever practicable.

Size and shape of manhole is similar to footway manholes (See page F-3).

Manhole Cover and Frame - Roadway type, double cover, 520 mm x 1050 mm (S.75/13).

Concrete thickness and reinforcement required depend upon the manhole size, nature of soil and traffic loading and will be determined by the Engineer.

CONCRETE CONSTRUCTION

It is important, particularly in deep manholes, to make provision to prevent collapse of manhole walls at the top and bottom due to earth pressures.

For the bottom of walls where the earth pressure is greatest, this is best achieved by pouring the walls first and the floor afterwards. Where this is not practicable, e.g. due to wet working conditions or a high water table a concrete base may be poured first and a false floor installed after completion of the walls.

In shallow manholes (i.e. up to 1.5 m deep) a satisfactory alternative construction procedure is to pour the floor first, leaving dowels of steel reinforcement projecting for the walls. Leave the outside part of the floor rough and clean to provide a key to the walls.

Wherever possible pour the roof slab concurrently with the walls. If this is not practicable leave the top of the walls clean and rough with steel mesh projecting about 300 mm to be later turned down into the roof slab.

Grade the manhole floor so that there is a fall towards the drain outlet. Cover the outlet with a metal grating. Provide a sump where there is no external drain. (See Draining Manholes, page F-20 - 23).

CONCRETE FINISH

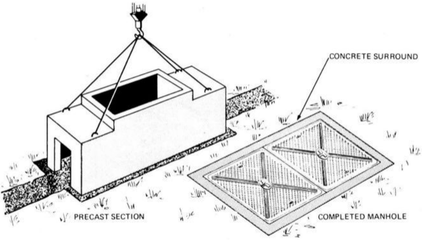
After stripping of forms the concrete should present a smooth finish free from honeycomb or voids. Where plastering is necessary to achieve this finish a 10 mm thickness should be applied. (See page F-15).

CONCRETE SPECIFICATIONS

Concrete specifications, tests and pouring practices are given on pages F-15 - F-18.

INDUSTRIAL GLOVES MUST BE WORN FOR PROTECTION WHEN HANDLING TIMBER, BRICKS, CAST CONCRETE, WIRE OR STEEL SECTION.

PRECAST CONCRETE MANHOLES



TYPICAL RECTANGULAR PRECAST CONCRETE MANHOLE

The precast manhole shell is set on a poured concrete floor and the ends built in with concrete around the ducts. (Typical prefabricated manhole Drawing CL 1206).
The manhole cover is fitted and concrete surround poured on site.

PRECAST CONCRETE MANHOLES

P.C.M. REPEATER HOUSING MANHOLE

Construction of P.C.M. repeater housing manholes should generally be in accordance with Drawing CL 1241. The drawing details two types of manholes capable of accommodating one or two repeater housings.

Where possible the repeater manhole should be immediately adjacent to the existing manhole. If this is not possible due to obstructions or insufficient cover over the conduits, the manhole may be separate and connected to the existing manhole by a conduit

MANHOLE COVERS

Number of Ducts	Approximate Opening Size		Number of Covers	Manhole Cover Serial/Item
	Length (m)	Width (m)		
Up to 8	1.2	.75	2	75/18
9 to 36	1.2	1.2	4	75/19
37 to 64	1.8	1.2	6	75/20
Roadway Manhole	1.05	.52	2	75/13

MANHOLE OPENINGS AND COVER SIZES REQUIRED

SETTING MANHOLE COVER

In permanent pavements set the frame in concrete so that the cover will be flush with ground level and conform with the slope of the footway.

In unmade footways set the cover at the proposed permanent level if practicable.

In rural areas, nature strips and other locations where permanent levels are not availabl set the cover so as to conform with the general level of the surrounding ground.

EXTENDABLE MANHOLE COVERS AND FRAMES

In addition to the standard manhole covers, the components listed below are available as separate items so that by using combination of side members it is possible to construct manhole frames to any desired length.

S.75/23 Cover
S.75/24 Cross Bar
S.75/41 End Member
S.75/42 Side Member, four cover
S.75/43 Side Member, six cover
S.75/44 Side Member, two cover

67/203 Bolt, M12 x 50, HEX HD, MS GALV
67/204 NUT, M12, HEX, MS GALV
67/205 WASHER, 12 mm

4 COVER FRAME

CROSS BAR

S.75/42 Side Member, four cover
S.75/43 Side Member, six cover
S.75/44 Side Member, two cover

CONCRETE SURROUND

Provide a concrete border 100 mm wide around the manhole cover and frame.

Where any section of a manhole surround is contained in a concrete footpath the surface should conform with that of the footpath.

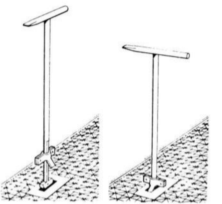
USE ONLY LOCKING TYPE MANHOLE KEYS TO LIFT MANHOLE COVERS. OBTAIN ASSISTANCE TO LIFT HEAVY COVERS.

MANHOLE COVERS

LIFTING MANHOLE COVERS

Use the locking type Manhole Key (S114/18) for lifting manhole covers and pit lids. The safety lugs on the key are designed to prevent it slipping out of the keyhole when the cover is being lifted.

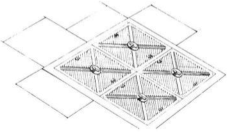
To avoid injury use the safe lifting practices described on page R-19.



LOCKING TYPE MANHOLE KEY (S114/18)

PLACE MANHOLE GUARDS AROUND OPEN MANHOLES.

TEST FOR THE PRESENCE OF DANGEROUS GAS BEFORE ENTERING ANY MANHOLE (SEE PAGE R-10).



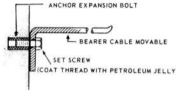
FOOTWAY MANHOLE FOUR COVER (S75/19)

LIFTING WITH A BENT BACK CAN CAUSE STRAINED BACK MUSCLES, LIGAMENTS, RUPTURED DISCS AND HERNIAS.

MANHOLE FITTINGS

CABLE BEARERS

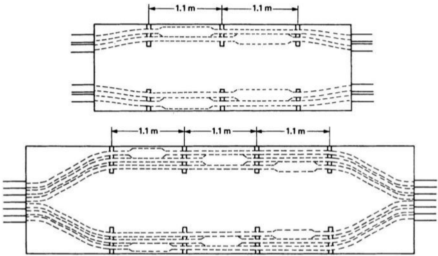
Support cables in manholes with cable bearers.
Bearer length depends on the number and size of cables to be housed (see table below).
Bearers may be attached directly to the manhole wall or be secured to a steel channel section (e.g. Unistrut or Millstrut) which is attached to the wall.
Mount the channel sections or cable bearers centrally on the side walls of the manhole, 1.1 metres apart, so that the cable joint will be level.
Where practicable the cable should have a fall of at least 150 mm to the duct.
Where space permits, install additional bearers so that cable joints may be staggered as shown on page F-12.
Fit the lowest bearers at least 150 mm above the bottom of the lowest duct.
Space bearers vertically about 230 mm apart.
Cover the bearers with Cable Bearer Slippers (S.438/54).
Slippers are supplied in 900 mm sections and cut to size as required.



ATTACHING CABLE BEARER TO WALL

Cable Bearers		Anchor Expansion Bolt		Set Screw	
Type	Ser/Item	Size	Ser/Item	Size(mm)	Ser/Item
1 Joint - 50 mm	426/4	12 mm	89/11	12 x 40	67/191
1 Joint - 75 mm	426/5	12 mm	89/11	12 x 40	67/191
1 Joint - 125 mm	426/6	16 mm	89/62	16 x 50	67/192
2 Joint - 250 mm	426/7	16 mm	89/62	16 x 50	67/192
3 Joint - 370 mm	426/8	16 mm	89/62	16 x 50	67/192
4 Joint - 480 mm	426/9	16 mm	89/62	16 x 50	67/192

CABLE BEARER TYPES AND SIZES



INSTALLING CABLE BEARERS IN LARGE MANHOLES

EAR MUFFS S.34/34 MUST BE WORN WHEN OPERATING OR WORKING IN CLOSE PROXIMITY TO EXPLOSIVE POWERED TOOLS.

MANHOLE STEPS AND LADDERS

All manholes must be provided with a means of access to enable workmen to enter without stepping on the cables.

Where only one side wall will be required for cables, steps may be set into the opposite wall during construction of the manhole.

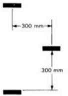
Two types of steps are available:-

. Step manhole, round section (S.426/20)- for poured concrete manholes.

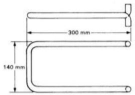
. Step manhole, flat section (S.426/19)- for brick manholes.

Where large cables will be installed on both side walls of a manhole, a removable steel ladder should be provided.

Attach fittings for securing the ladder to an end wall of the manhole.



POSITION FOR FITTING STEPS

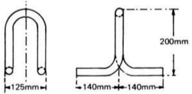


MANHOLE STEP (S.426/20)

ANCHOR IRONS

Anchor irons are provided in large and deep manholes for securing cable hauling equipment when installing or withdrawing cable.

Embed the irons in the floor or end wall opposite the ducts in the most suitable position for attaching hauling equipment. Normally four anchor irons are required.



ANCHOR IRON (S.426/18)

MANHOLE WARNING SIGNS

MANHOLE WARNING SIGN, ELECTRICITY (S.148/95)

MANHOLE WARNING SIGN, GAS (S.148/96)

ATTACHING SIGNS TO MANHOLE WALLS

Attach signs to concrete or brick walls with epoxy adhesive (Araldite, Type AW106 with Hardener Type HU953U).

Before attaching sign clean the wall.

Mix adhesive to manufacturer's instructions and apply to wall and back of sign. Fix sign to wall taking care to eliminate any air pockets behind it.

Where adhesive is unsatisfactory, fix sign to wall with 32 mm masonry nails.

MANHOLE WARNING SIGN, WATER (S.148/97)

CONCRETE SPECIFICATIONS

CEMENT

Portland Cement (Type A) is used for manhole construction and other Telecom applications. (1 bag cement = 40 kilogrammes, 25 bags cement = 1 tonne).

Rapid Hardening or High - Early Strength Cement (Type B) may be obtained for special applications e.g. where early strength is required or for very cold conditions.
Low Heat cement (Type C) is used only in mass concrete installations.
Cement which has been damaged by moisture or is air-slaked or lumpy must not be used.

COARSE AGGREGATE

. crushed stone or gravel from a quarry or gravel pit graded from 30 mm to 5 mm

. uncrushed gravel from a river bed or pit graded from 30 mm to 5 mm.

Gravel must comply with Australian Standard No.1465 (Dense Natural Aggregates For Concrete)
The nominal maximum size of aggregate must not be larger than 1/5 distance between forms nor larger than 3/4 distance between reinforcing bars or between reinforcing bars and forms.

FINE AGGREGATE

Naturally occurring sand or crushed rock or gravel or a combination thereof. Sand must be clean, sharp, hard and entirely free from salt or organic matter, in accordance with Australian Standard No.1465.

PLASTERING SAND

Required to be clean, sharp, hard, free from adherent coatings and contain no materials which adversely affect the strength of concrete or plaster. Must be suitable for use in plaster for rough concrete or in mortar for joining bricks or concrete blocks.

WATER

Should not contain excessive amounts of salts, dissolved organic matter or other impurities which could affect the setting or strength of the concrete.

CONCRETE MIXED ON SITE FOR MANHOLES AND SIMILAR WORK

Cement	Fine Aggregate	Coarse Aggregate	Max Water Content (buckets) per bucket of Cement
1	2.5	3.5	1 (see Note)

PROPORTIONS (BY VOLUME) FOR CONCRETE MIXED ON SITE

Note: Where sand is damp (i.e. it can be formed into a ball in the hand) the quantity of water may need to be reduced by up to 20 per cent.

Mixing Proportions	Cement (40Kg Bags)	Fine Aggregate	Coarse Aggregate
1 : 2.5 : 3.5	7.5 bags	$0.5m^3$	$0.75m^3$

MATERIALS REQUIRED TO MAKE ONE CUBIC METRE (APPROX) OF CONCRETE

READY MIXED CONCRETE

Order concrete to Australian Standard 1379, Method A, specifying -

- . 28 day compressive strength 15 Megapascals (MPa)
- . slump 100 millimetres (mm).

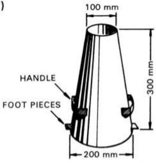
CEMENT RENDER

Mixing proportions:- 1 part cement, 2.5 parts fine aggregate.

TESTING CONCRETE (SLUMP TEST)

MOULD FOR SLUMP TEST

Mould manufactured from 1.6 mm galv. steel sheet.
Dimensions:- Base 200 mm diameter, Top 100 mm diameter, Height 300 mm
Fitted with handles and foot pieces.



SLUMP TEST MOULD

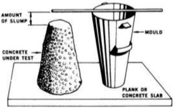
TAKING CONCRETE SAMPLE

Take sample immediately after concrete has been discharged from the mixer. For ready mixed concrete take samples at the ¼ and 3/4 points during discharge of the concrete.

Place mould on a flat surface such as a plank or slab of concrete and hold it firmly by standing on the footpieces while filling it with concrete.

Quarter fill the mould and puddle concrete with 25 strokes of a 15 mm diameter bullet pointed rod.

Complete filling in two more layers, puddling each 25 times without passing the rod through the layer below. Strike off the top so that the mould is completely filled.
Remove mould immediately and measure the amount of slump of the concrete.
For manhole construction the average slump should be between 100 mm and 150 mm. Concrete with a slump exceeding 150 mm is unsuitable.
Test batches frequently and increase or decrease water content to obtain correct mix.



MEASURING AMOUNT OF SLUMP

PLACING CONCRETE

FORMWORK FOR MANHOLES

Various types of formwork may be used, including -

. Prefabricated steel panels (e.g. Acrow Form or similar).
. Wooden frame sheeted with 150 mm x 25 mm hardwood.
. Angle iron or wooden frame sheeted with steel or 20 mm water resistant plywood.

An outer form will not be necessary in firm soils where there is no possibility of earth falling into the concrete during placement. The walls of the excavation must be carefully trimmed to give the required wall thickness for the manhole.
All concrete forms must be thoroughly wetted or oiled to facilitate stripping.

POURING AND COMPACTING CONCRETE

Place concrete in the formwork as soon as possible after mixing and before its initial set takes place.

Care is necessary to ensure that the coarse aggregate is not separated from the sand and cement when concrete is placed.

Where possible deposit rather than throw concrete into position. Do not drop concrete vertically from a height greater than 1.5 metres.

Fill formwork from the lowest point of the excavation starting at the corners. Place concrete in layers 150 mm to 300 mm thick.

During and immediately after placing, compact the concrete by continuous tamping and spading to force concrete under and around reinforcement without displacing it, work coarse aggregate back from the form to fill all voids and to expel all air bubbles.

Vibrators may be used to compact concrete on large installations.

CURING. Allow at least 2-3 days for walls and a week for roof before removing forms.

DRAINING MANHOLES

NEED FOR DRAINAGE

It is important that manholes be kept dry for the following reasons:-

- Risk of cable failure due to entry of water at joints and electrolytic or chemical corrosion.
- High cost of removing water from manholes.
- The ineffective time incurred during cable installation and maintenance while water is cleared from the manholes.
- The prevailing dampness which even after water is removed, contributes to adverse working conditions, reduces efficiency and increases the possibility of moisture penetration into an open joint.

GENERAL DRAINAGE PRINCIPLES

The extent to which manhole drainage is carried out and the method used will depend upon such factors as the type of country (hilly or flat), number of ducts to be installed, importance of the cables on the route and the nature of the ground. Apply the following principles wherever practicable:-

- All manholes must be drained where suitable conditions prevail and provided the costs are in keeping with the importance of the route.
- Where it is not practicable to drain all manholes, special efforts should be made to drain the following major types:-
  - manholes on duct routes of 4 way or more.
  - pillar and cabinet manholes.
  - loading manholes.
  - cable cut-over manholes.
  - manholes at the bottom of slopes.
  - manholes at exchange entrances.

DRAINING MANHOLES

DRAINAGE METHODS

Hilly Areas. Where a suitable fall exists drain manhole to a surface outlet e.g. street gutter. Lay drain pipes alongside cable ducts in the Telecom allocation and when shallow enough, run at an angle to emerge in the gutter. Provide a minimum fall of 1 in 100.

Flat Areas. Drainage to surface outlets is usually not practicable but it is often possible to drain the manhole to a suitable outlet such as a storm water drain. In such cases several manholes may be drained by laying drain pipes in the same trench either under or to the side and below the cable conduits so that one manhole is drained to the next and so on until the one which can be drained is reached. The minimum fall for under drains is 1 in 300 as for cable ducts.

OUTLETS FOR DRAINS

Street Gutter. Lay drain pipe as described above. Set outlet pipe neatly into kerb.

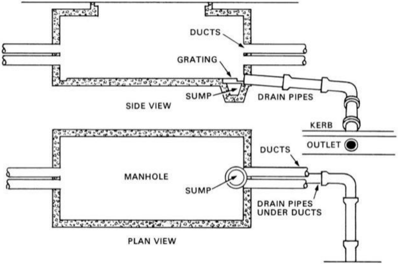
Storm Water Pipe. Approval of local authority must be obtained. (Reflux valve may be needed). Minimum fall for drain 1 in 60 or as specified by local authority.

Open Drain, Ditch or Creek. Take care to ensure that effluent will not cause soil erosion or flooding of low lying areas.

Sewer Pipe. Use this method only where it is vital to drain a manhole and no other suitable method can be used. Permission from the local authority must be obtained in each instance. A reflux valve is necessary to prevent any possibility of reverse flow. (See page F-22). NSW Drawing No. N.B. 4858, Sheet 1 and 2 provides details for installing reflux valves.

Sump Drainage. In sandy locations good drainage can often be obtained by leaving the bottom of the manhole sump open to allow water to soak away into the surrounding soil. The sump may be cast into the concrete floor or a short section of 230 mm pipe set vertically in the floor. In heavy soil where drainage is not possible or where the ground water table is above the floor level, seal the bottom of the sump with concrete. Cover the sump with a metal grating to keep out foreign matter.

DRAINING MANHOLES

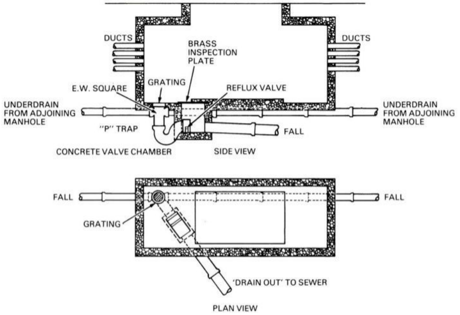


MANHOLE DRAINED TO SURFACE OUTLET

MINIMUM FALL REQUIRED FOR DRAINS

Drain to surface outlet - 1 in 100.

Under-drain, manhole to manhole-1 in 300.

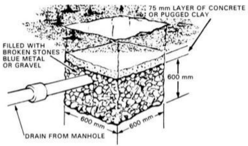


Issue 4, 1980 CONNECTING DRAIN TO SEWER VIA REFLUX VALVE

OUTLETS FOR DRAINS (CONT'D)

Drainage Pits. Where it is vital to provide some form of manhole drainage and none of the methods on page F-20 are suitable, investigate the possibility of providing a drainage pit in good porous soil within reach of the manhole.

Excavate a hole 600 mm x 600 mm to a depth sufficient to give the pipes from the manhole the required fall.
Fill the pit with broken bricks, gravel or coke.
Place a 75 mm layer of concrete or pugged clay over the pit to prevent soil being washed down among the stones.
The efficiency of the pit may be increased by exploding a small charge of gelignite a metre or more below the bottom of the pit to loosen the subsoil.



DRAINAGE PIT

PARTIAL DRAINAGE

Any of the methods described may be used to partially drain a manhole where complete drainage is impracticable or of prohibitive cost. In this way it is often possible to eliminate drainage along the ducts from manhole to manhole and to ensure that the majority of cables are above the high water line.

AVOID ACCIDENTS BY USING SAFETY EQUIPMENT AND CLOTHING PROVIDED FOR YOUR PROTECTION.

SECTION G

LARGE SIZE CABLES

- CABLE TYPES
- HANDLING DRUMS OF CABLE
- LONG DISTANCE TRANSPORT OF CABLE

CABLE TYPES

Serial	Type of Cable	Abbreviation	Use
	Large Size Cables (Over 100 Pairs)		
470	Paper Insulated, Unit Twin	PIUT	Subscribers Main and Junction Cables
472	Paper Insulated, Quad Local	PIQL	
473	Paper Insulated, Unit Twin (Aluminium)	APIUT	
475	Polyethylene Insulated, Unit Twin	PEIUT	Exchange entry cable
477	Cellular Polyethylene Insulated, Unit Twin	CPEIUT	Exchange entry cable
	Trunk and Special Purpose Cables		
480	Paper or Polyethylene Insulated Quad Carrier	PIQC or PEIQC	Inter-Exchange carrier cables
482	Coaxial Cable	CX	
491	Paper, or PVC Insulated Tail Cable	PIUT PISUT	Pillar Tails, Lead-Plastic Jointing
492	Polyethylene Insulated, Interruption	-	For temporary repairs and cutovers
493	Submarine Cable	-	For long distance underwater cables

CABLE TYPES CURRENTLY AVAILABLE

NOTE: Small size cables are listed on Page L-1.

CABLE CONDUCTORS

MATERIALS USED FOR CABLE CONDUCTORS

Soft Copper

Conductor Size
Diameter (Millimetres)
0.32
0.40
* 0.50
0.64
0.90
1.27

COPPER CONDUCTOR SIZES

Aluminium

Conductor Size	
Diameter (Millimetres)	Copper Equivalent
0.52	0.40 mm
0.81	0.64 mm
1.15	0.90 mm

ALUMINIUM CONDUCTOR SIZES

*NOTE: 0.50 mm copper conductor is obsolete but some cables are still in service

MATERIALS USED FOR CONDUCTOR INSULATION

Paper Insulation consists of either a helical lapping of paper strip approximately 5 mm in width or a paper strip applied longitudinally with the edges folded around the wire and glued. Conductors are identified by coloured ring markings (1,11,111,1111) printed on the paper.

Polyethylene Insulation is a uniform coating of polyethylene extruded over the conductors. Conductors are identified by the colour of the insulation which is in accordance with a standard colour code.

PVC Insulation is an extruded polyvinyl chloride coating which is used on some tail and lead-in cables because its higher melting point reduces the risk of damage during plumbing operations. Insulation colours are similar to polyethylene.

CABLE SHEATH MATERIALS

SHEATH MATERIAL	DESCRIPTION AND APPLICATION
Lead - Antimony Plain Lead	Used only in exceptional circumstances where polyethylene cable or moisture barrier sheathed cables are unsuitable.
Polyethylene PE	Used on small size polyethylene insulated cables. Carbon black is added to the polyethylene to prevent deterioration of the sheath due to the effects of sunlight.
Polyethylene MB	This is a polyethylene sheath bonded to an aluminium foil which is applied over a paper or polyethylene insulated cable core. The foil provides an effective water barrier. This cable can be transported for long distances by any form of transport.
Polyethylene/ Moisture Barrier PE/MB	This sheath consists of an inner polyethylene sheath over which is placed a moisture barrier sheath. It is suitable for direct ploughing and has an excellent lightning protection performance.

MATERIALS USED FOR SHEATHING CABLES

CHECK THAT CONES ON CABLE DRUM SPINDLES ARE SECURELY LOCKED AND THAT THE SPINDLE RETAINING PINS ARE FITTED TO KEEP CABLE DRUM AND SPINDLE SECURE IN CARRIER.

CABLE SHEATH PROTECTION

TYPE	CABLE SHEATH PROTECTION
Polyethylene Jacket (PJ)	Applied to lead sheathed cables for protection against electrolytic and chemical corrosion. The thickness of the lead is reduced and a bonding compound is used between the lead and the polyethylene jacket. This cable may be drawn into ducts or buried directly in the ground.
Hard Plastic Jacket (HJ)	This is an oversheath, normally Nylon, applied over the standard polyethylene sheath of small plastic cables for protection against insect attack. May also be applied to moisture barrier or lead sheath.
Steel Tape Armour (LW)	Used for buried cables where protection against mechanical damage and corrosion is required and the cable is not subject to strain. Also used for protection against low frequency induction.
Light Wire Armour (LW)	Used where cable is subject to strain and greater tensile strength than that provided by steel tape armouring is necessary e.g. marshland areas where there is a danger of damage to cable by cattle or vehicles, creek crossings which carry only moderate flow of water after heavy rain, rocky ground where adequate cover cannot be readily provided, soil where severe cracking occurs in dry weather. Used also for small size cables where steel tape cannot be fitted.
Heavy Wire Armour (HW)	Used where cable is subject to severe strain e.g. submarine cable for river or bay crossings.
Double Wire Armour (DW)	For submarine cable in severe conditions such as reef crossings, rocky bottoms, severe currents and tides or frequent heavy floods.

PARK MOTOR VEHICLES AND CABLE TRAILERS WHERE THEY WILL NOT OBSTRUCT PEDESTRIANS, DRIVEWAYS OR LANEWAYS.

APPLICATION OF PAPER INSULATED CABLES

SHEATH TYPE	APPLICATION AND CONDITIONS OF USE
Polyethylene Moisture Barrier (MB)	. For junction and subscribers cables. . Preferred sheath for large size cables. . May be installed in all types of conduits. . Not buried direct in the ground as it is susceptible to sheath punctures resulting in corrosion of Al tape.
MINIMUM USE Unprotected Lead (UA)	. For minor trunk, junction and subscribers cables. . Installed only in conduits. . Not drawn into steel or cast iron pipes because of likelihood of corrosion.
Polyethylene Jacketed, Lead (PJ)	. For minor trunk, junction and subscribers cables. . May be installed in conduits of all types including steel pipes. . May be laid directly in the ground in rural areas including locations where the soil is corrosive. . May be used where a corrosion hazard exists. . If termite attack is prevalent steel tape armouring or hard plastic jacket may be required.
Armoured, (ST, LW, HW, DW See Page G-4)	. Used where mechanical protection of cable is required. . Steel tape may also be used where protection against low frequency induction from power lines is necessary.

PAPER INSULATED CABLES - APPLICATION AND CONDITIONS OF USE

APPLICATION OF POLYETHYENE INSULATED CABLES

SHEATH TYPE	APPLICATION AND CONDITIONS OF USE
Polyethylene Sheathed (PE)	. Used for small size subscribers distribution cables. . May be drawn into pipes or buried directly in the ground. . Not used where ant or termite attack is prevalent. . May be used aerially lashed to a steel bearer wire with light gauge GI wire by a spinning machine. Only used where integral bearer aerial cable is not available.
Polyethylene Sheathed, Hard Plastic Jacketed	. Used for direct burial in areas subject to ant or termite attack. (All 0.64 mm and 0.90 mm lead-in cables have PEHJ sheaths).
Polyethylene Sheathed, Integral Bearer (IB)	. For use as aerial cable in urban or rural areas. . Compulsory for Joint Use construction on power poles. . Used where screening from nearby high voltage power lines is necessary. . May be erected on trunk poles without causing interference to carrier circuits. . Not installed where bush fires are a potential hazard.
Polyethylene Moisture Barrier	. Exchange entrance cables for direct termination on the MDF and for Tie cables between MDF's.

POLYETHYLENE INSULATED CABLES - APPLICATION AND CONDITIONS OF USE

CABLES - SERIAL AND ITEM NUMBERS

CABLE SERIALS

The Serial Numbers under which the various types of cable are supplied are listed on Page G-1, Large Size and Trunk cables and Page L-1 Small Size cables.

ITEM NUMBERS

The Item Numbers used for cables comprise four figures.

The first two digits (thousands and hundreds) are the Sheath Code and denote the sheath type and the protection provided.

The second two digits (tens and units) are the Core Code and denote cable size, i.e. number of pairs and the conductor diameter.

Examples of the use of cable sheath codes and core codes to form the Item Number are:

Serial 472/7046 - Sheath code 70 = Moisture barrier.
Core code 46 = 1000 pairs, 0.64 mm copper.

Serial 470/7141 - Sheath code 71 = Polyethylene, moisture barrier.
Core code 41 = 200 pairs, 0.64 mm copper.

The sheath types available and their code numbers are shown on Pages G-8 and G-9.

Large size cables and their code numbers are listed on Pages G-10 and G-11.

CABLE SIZE CLASSIFICATION (excluding carrier cables)

100 pairs or less - Small Size (Serials 460, 465, 467).

More than 100 pairs - Large Size (Serials 470, 472, 473, 475, 477).

Cable sizes are shown as Number of Pairs/Conductor Diameter in Millimetres e.g. 600/0.40.

CABLE - SHEATH CODE NUMBER

STOCK ITEM SHEATH CODE	TYPE OF CABLE SHEATH AND PROTECTION	ABBREVIATED TITLE
11**	Plain, lead, unprotected	UA
12**	Alloy lead, unprotected	AUA
13**	Plain lead, polyethylene jacketed	PJ
14**	Alloy lead, polyethylene jacketed	APJ
15**	Plain lead, steel tape armoured	ST
16**	Alloy lead, steel tape armoured - replaced by Item 18	AST
17**	Plain lead, steel tape armoured, polyethylene jacketed	STPJ
18**	Alloy lead, steel tape armoured, polyethylene jacketed	ASTPJ
19**	Plain lead, light wire armoured	LW
20**	Alloy lead, light wire armoured - replaced by Item 22	ALW
21**	Alloy lead, steel tape armoured, polyethylene jacketed, hard plastic jacketed. (obsolete)	STPJHJ
22**	Alloy lead, light wire armoured, polyethylene jacketed	LWPJ
25**	Alloy lead, heavy wire armoured - replaced by Item 26	HW
26**	Alloy lead, heavy wire armoured, polyethylene jacketed	HWPJ
27**	Alloy lead, double wire armoured	DW
28**	Alloy lead, double wire armoured, polyethylene jacketed	DWPJ
31**	Alloy lead, polyethylene jacketed, steel tape armoured, polyethylene jacketed.	PJSTPJ
32**	Alloy lead, polyethylene jacketed, light wire armoured, polyethylene jacketed.	PJLWPJ

CODE NUMBERS FOR TYPES OF SHEATH AND PROTECTION

STOCK ITEM CODE NO.	TYPE OF CABLE SHEATH AND PROTECTION	ABBREVIATED TITLE
38**	Alloy lead, polyethylene jacketed, hard plastic jacketed	APJHJ
39**	Plain lead, semi-conducting polyethylene jacket	SCJ
40**	Alloy lead, semi-conducting polyethylene jacket	ASCJ
50**	Polyethylene	PE
51**	Aluminium screen, poly-vinyl chloride sheath	ASPV
52**	Aluminium screen polyethylene, integral bearer	IB
53**	Polyethylene hard plastic jacketed	PEHJ
54**	Polyethylene, brass tape armoured, polyethylene jacketed	PEBTPJ
55**	Polyethylene, copper screen, hard plastic jacketed	PECSHJ
56**	Polyethylene, light wire armoured, polyethylene jacketed	PELWPJ
57**	Aluminium screen, polyethylene, integral bearer (heavy wire)	IBH
58**	Aluminium screen, polyethylene, hard plastic jacketed	ASPEHJ
59**	Polyethylene, aluminium screen, hard plastic jacketed	PEASHJ
60**	Polyethylene, copper screen, polyethylene bedding, light wire armoured, polyethylene jacketed	CSLWPJ
62**	Polyethylene copper screen, integral bearer	PECSIB
65**	Polyvinyl - chloride sheath - Type A	PV
66**	Polyvinyl - chloride sheath - Type B	PVB
69**	Aluminium screen, including 0.5mm tinned copper drain wire, polyvinyl - chloride sheath, Type B	ASPVB
70**	Moisture barrier	MB
71**	Polyethylene, moisture barrier	PEMB
72**	Polyethylene, moisture barrier, hard jacket	PEMBHJ

CABLES - SHEATH CODE NUMBERS

STOCK ITEM CODE NO.	TYPE OF CABLE SHEATH AND PROTECTION	ABBREVIATED TITLE
74**	Moisture barrier, hard plastic jacketed	MBHJ
75**	Moisture barrier, steel tape armoured polyethylene jacketed	MBSTPJ
76**	Moisture barrier, light wire armoured, polyethylene jacketed	MBLWPJ
77**	Moisture barrier, heavy wire armoured (or alternative double light wire armoured) polyethylene jacketed	MBHWPJ
80**	Polyethylene, hard plastic jacketed, light wired armoured, polyethylene jacketed	PEHJLWPJ

CODE NUMBERS FOR TYPES OF SHEATH AND PROTECTION

REMEMBER MACHINE OPERATORS CANNOT SEE EVERYWHERE AT ONCE AND ALL STAFF MUST OBSERVE SAFETY PRECAUTIONS WHEN WORKING ON OR AROUND OPERATING MACHINES.

CABLE JACKS WHERE USED SHOULD BE IN GOOD CONDITION, HANDLED CAREFULLY AND USED ONLY ON LEVEL GROUND.

LARGE SIZE CABLES - SIZES AVAILABLE

CABLE SIZE	CORE CODE NO	SHEATH TYPE NORMALLY AVAILABLE - CODE NO.			
		PIUT S470	APIUT S473	PEIUT S475	CPEIUT S477
600/0.32	**04	70	-	-	-
800/0.32	**05	70	-	-	-
1200/0.32	**07	70	-	-	-
1500/0.32	**17	70	-	-	-
1800/0.32	**09	70	-	-	-
2400/0.32	**11	70	-	70	-
2700/0.32	**12	70	-	70	-
3000/0.32	**13	70	-	70	-
3600/0.32	**14	70	-	70	-
4200/0.32	**15	70	-	-	-
150/0.40	**20	14,70,71	(0.52 Alum) 70,71	-	-
200/0.40	**21	14,70,71	" 70,71	70	70
300/0.40	**22	14,70,71	" 70,71	70	70
400/0.40	**23	14,70	" 70	70	70
600/0.40	**24	14,70	" 70	70	70
800/0.40	**25	14,70	" 70	70	70
1000/0.40	**26	70	" 70	70	70
1200/0.40	**27	14,70	" 70	70	70

LARGE SIZE LOCAL TYPE CABLES - COPPER AND ALUMINIUM CONDUCTORS

NOTE: Sheath Code numbers used in conjunction with the Core Code numbers are listed on pages G-8 and G-9.

LARGE SIZE SUBS CABLES - SIZES AVAILABLE

CABLE SIZE	CORE CODE NO.	SHEATH TYPES NORMALLY AVAILABLE - CODE NO.				
		PIUT S470	PIQL S472	APIUT S473	PEIUT S475	CPEIUT S477
1500/0.40	**37	70	-	(0.52 Alum)70	-	-
1800/0.40	**29	14,70	-	" 70	70	70
2400/0.40	**31	70	-	-	70	70
2700/0.40	**32	70	-	-	-	70
150/0.64	**40	14,70,71,75,76,77	-	(0.81 Alum)71,75	-	-
200/0.64	**41	14,38,70,71,72,75,76,77	-	" 70,71,72,75	70	70
300/0.64	**42	14,70,71	-	" 70,71,75	70	70
400/0.64	**43	14,70	-	" 70,75	70	70
600/0.64	**44	14,70	-	" 70,75	70	70
800/0.64	**45	14,70	-	" 70,75	80	70
1000/0.64	**46	70	70	-	-	-
1200/0.64	**47	70	70	-	-	70
1400/0.64	**48	-	70	-	-	-
150/0.90	**60	14,70,71,76,77	-	(1.15 Alum)70,71,75	70	70
200/0.90	**61	14,70,71,76,77	-	" 70,71,75	70	70
300/0.90	**62	70	-	" 70	70	70
400/0.90	**63	70	-	" 70	70	70
600/0.90	**64	70	70	-	-	70

LARGE SIZE LOCAL TYPE CABLES - COPPER AND ALUMINIUM CONDUCTORS

NOTE: . Cable sizes are to be shown as Number of Pairs/Diameter of Conductors in Millimetres, e.g. 600/0.40.

. Cable with 0.50 mm copper conductor is no longer supplied.

LARGE SIZE CABLES - EXTERNAL DIAMETER

NUMBER OF PAIRS IN CABLE	MAXIMUM EXTERNAL CABLE DIAMETER (millimetres)											
	0.32mm CONDUCTOR			0.40mm CONDUCTOR			0.64mm CONDUCTOR			0.90mm CONDUCTOR		
	PEMB	PJ	MB	PEMB	PJ	MB	PEMB	PJ	MB	PEMB	PJ	MB
150	-	-	-	30	28	27	41	39	37	54	52	49
200	-	-	-	33	31	29	45	43	41	61	59	56
300	-	-	-	38	36	34	53	51	49	70	68	68
400	-	-	-	42	40	38	59	57	54	80	78	75
600	41	39	36	49	47	45	69	67	64	92	90	89
800	-	-	-	55	53	52	78	76	72	-	-	-
1000	-	-	-	60	58	56	86	84	80	-	-	-
1200	53	51	48	65	63	61	92	90	86	-	-	-
1400	-	-	-	70	68	67	-	-	-	-	-	-
1500	-	-	-	-	-	69	-	-	-	-	-	-
1800	63	61	58	78	76	75	-	-	-	-	-	-
2100	-	-	-	83	81	80	-	-	-	-	-	-
2400	71	69	66	87	85	83	-	-	-	-	-	-
2700	-	-	-	92	90	88	-	-	-	-	-	-
3000	78	76	73	-	-	-	-	-	-	-	-	-
3600	85	82	79	-	-	-	-	-	-	-	-	-
4200	90	88	84	-	-	-	-	-	-	-	-	-

EXTERNAL DIAMETER OF LARGE SIZE PIUT CABLE SERIAL 470

NOTE: If the cable also has a hard jacket the maximum diameter is increased by 1 mm.

LARGE SIZE CABLES - EXTERNAL DIAMETER

NO. OF PAIRS	MAX.EXTERNAL CABLE DIAMETER(mm)	
	0.64 mm	0.90 mm
540	-	-
600	-	75
1000	69	-
1100	-	-
1200	74	-
1400	82	-

DIAMETER OF SER. 472, PIQL, MB

NO. OF PAIRS	MAX. EXTERNAL CABLE DIAMETER(mm)					
	0.52		0.81		1.15	
	MB	PEMB	MB	PEMB	MB	PEMB
150	30.0	35	41.9	48	58.2	64
200	33.2	39	47.0	53	65.9	72
300	39.6	45	56.6	63	79.2	86
400	45.0	51	64.0	71	87.6	94
600	53.8	60	77.2	84	-	-
800	61.8	68	87.6	94	-	-
1000	68.3	75	-	-	-	-
1200	74.0	81	-	-	-	-
1400	79.5	86	-	-	-	-
1800	87.6	94	-	-	-	-

DIAMETER OF SERIAL 473, APIUT, MB & PEMB CABLE

NO. OF PAIRS	MAX. EXTERNAL CABLE DIAMETER(mm)						
	0.32	0.40mm		0.64mm		0.90mm	
	S475	S475	S477	S475	S477	S475	S477
150	-	-	-	-	-	-	49
200	-	29	29	44	41	61	56
300	-	35	34	53	49	74	68
400	-	40	38	61	54	85	75
600	-	48	45	74	64	-	-
800	-	54	52	85	72	-	-
1000	-	60	57	89	80	-	-
1200	-	66	61	-	86	-	-
1400	-	71	67	-	-	-	-
1500	-	74	69	-	-	-	-
1800	-	80	75	-	-	-	-
2100	-	86	80	-	-	-	-
2400	80	89	83	-	-	-	-
2700	84	-	88	-	-	-	-
3000	86	-	-	-	-	-	-
3600	89	-	-	-	-	-	-

DIAMETER OF SERIAL 475, PEIUT, MB, CABLE AND SERIAL 477, CPEIUT, MB CABLE

NOTE: If the cable also has a hard jacket the maximum diameter is increased by 1 mm.

NO. OF PAIRS	MASS OF CABLES IN KILOGRAMS PER KILOMETRE								
	0.32mm Conductor		0.40mm Conductor				0.64mm Conductor		
	MB	PJ	MB	PJ or APJ	AST	PEMB	MB	PJ or APJ	PEMB
150	-	-	565	1480	-	688	1225	2830	1450
200	-	-	725	1845	3410	863	1605	3550	1845
300	-	-	1050	2470	4310	1195	2340	4940	2647
400	-	-	1370	3080	5165	-	3075	6250	-
600	1280	2955	1990	4245	-	-	4535	8800	-
800	-	-	2605	5415	-	-	5975	11295	-
1000	-	-	3215	6240	-	-	7275	13500	-
1200	2430	5180	3820	7575	-	-	8855	16170	-
1400	-	-	4250	8235	-	-	-	-	-
1500	-	-	4740	-	-	-	NOTE: 0.64mm conductor		
1800	3585	7245	5650	10705	-	-	continued on P-16		
2400	4715	9225	7457	13790	-	-	-	-	-
2700	-	-	8375	13255	-	-	-	-	-
3000	5850	11190	-	-	-	-	-	-	-
3600	6990	13150	-	-	-	-	-	-	-
4200	8115	15075	-	-	-	-	-	-	-

MASS OF CABLES, PAPER INSULATED, 0.32 mm, 0.40 mm AND 0.64 mm (S470)

PREVENT ACCIDENTS BY PLACING BARRICADES AROUND OPEN TRENCHES AND SPOIL HEAPS

LARGE SIZE CABLES - MASS

NO. OF PAIRS	MASS OF CABLES IN KILOGRAMS PER KILOMETRE								
	0.64 mm Conductor			0.90 Conductor					
	AST	ALW	HW	MB	PJ or APJ	PEMB	AST	ALW	HW
150	4835	5220	10340	2375	6005	2657	7775	8925	14254
200	5780	6750	11600	3115	6450	3433	10125	10825	16370
300	7580	8705	13950	4595	9065	-	15630	16500	20325
400	9870	10550	16040	5805	11635	-	-	-	-
600	-	15315	19730	8990	-	-	-	-	-
800	-	-	-	-	-	-	-	-	-
1000	-	-	-	-	-	-	-	-	-
1200	-	-	-	-	-	-	-	-	-

MASS OF CABLES, PAPER INSULATED, 0.64 mm AND 0.90 mm (S470 AND 472)

THE ARROW STENCILLED ON THE FLANGE OF A CABLE DRUM INDICATES THE DIRECTION IN WHICH IT SHOULD BE ROLLED.

No OF PAIRS	MASS OF CABLES IN kg/km		
	0.52 mm CONDUCTOR	0.81 mm CONDUCTOR	1.15 mm CONDUCTOR
150	429	905	1651
200	537	1163	2155
300	766	1679	3122
400	972	2192	4085
600	1399	3170	-
800	1826	4159	-
1000	2242	-	-
1200	2642	-	-
1500	3234	-	-
1800	3860	-	-

MASS OF ALUMINIUM CABLES, MOISTURE BARRIER SHEATHED (S473)

LARGE SIZE CABLES - MASS

NO. OF PAIRS	MASS OF CABLES IN KILOGRAMS PER KILOMETRE					
	0.40 mm CONDUCTOR		0.64 mm CONDUCTOR		0.90 mm CONDUCTOR	
	PEIUT	CPEIUT	PEIUT	CPEIUT	PEIUT	CPEIUT
150	-	-	-	-	2614	2300
200	830	700	1815	1836	3454	3100
300	1185	1050	2650	2300	5118	4500
400	1535	1350	3480	3100	6762	5900
600	2245	1950	5176	4500	-	8800
800	2910	2600	6839	5900	-	-
1000	3605	3200	-	-	-	-
1200	4307	3700	-	8800	-	-
1400	-	-	-	-	-	-
1500	-	-	-	-	-	-
1800	6354	5500	-	-	-	-
2100	-	-	-	-	-	-
2400	8405	7300	-	-	-	-
2700	-	8200	-	-	-	-
3000	-	-	-	-	-	-
3600	-	-	-	-	-	-

MASS OF CABLES, POLYETHYLENE INSULATED, MOISTURE BARRIER SHEATHED (SERIALS 475 AND 477)

LARGE SIZE CABLES - MASS OF DRUMS

METAL DRUM SIZE (mm)				
Flange Diam.	Barrel Diam.	Internal Width	External Width	MASS Kg
1200	600	1000	1170	140
1400	700	1000	1170	190
1600	800	900	1080	230
1800	1000	900	1100	360
2000	1200	1000	1210	425
2130	1220	1040	1220	435
2180	1450	860	1040	450
2250	1400	1000	1210	585
2400	1200	1000	1210	575
2400	1400	840	1040	565
2400	1400	1000	1210	595
2400	1450	1040	1220	615
2400	1450	1350	1520	660
2400	1400	1500	1700	705

MASS OF TYPICAL METAL DRUMS

WOODEN DRUM SIZE (mm)				
Flange Diam.	Barrel Diam.	Internal Width	Exter. Width	MASS Kg
1220	610	740	920	220
1420	760	740	970	315
1620	910	910	1140	480
1830	1070	910	1140	540
2060	1220	910	1140	650
2290	1220	910	1140	925
2440	1220	1220	1500	1120
2440	1680	1220	1550	1300
2510	1370	1220	1500	1395
2670	1520	1220	1520	1530
2740	1830	1220	1520	1635
2840	1830	1220	1520	1745
2950	1830	1220	1520	2035
3050	1830	1220	1520	2300

MASS OF TYPICAL WOODEN DRUMS

NOTE: . The above tables do not show all drum sizes or include the mass of drum battens. (Refer EI LINES Cables A 8031). The formula for batten allowance in Kg is:

$$25 \text{ mm Battens} = \frac{\text{Drum Diam. x Overall Width}}{16\ 000} \text{ kilograms.}$$

$$40 \text{ mm Battens} = \frac{\text{Drum Diam. x Overall Width}}{10\ 000} \text{ kilograms.}$$

. The actual size and mass of each wooden drum is permanently marked on the flange containing the cable exit hole and on the drum identification plate on metal drums.

HANDLING DRUMS OF CABLE

HANDLING CABLE AT STORES DEPOTS

Handling of cable at Stores is normally by mechanical means and various types of cranes, fork lifts etc. are used for the purpose.

Wire Rope Slings - Two leg slings as follows are suitable for most purposes:

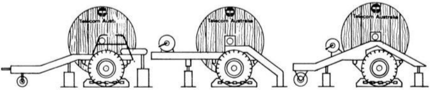
. Drums up to 2 tonnes - 14 mm dia. wire rope with the two legs each 1.2 m long.
Drums 2 to 5 tonnes - 29 mm dia. wire rope with the two legs each 1.8 m long.
Inspect wire rope slings regularly to ensure that they are in good condition.
Stand clear of the crane and cable drum while the crane is operating.

TRANSPORTING CABLE TO JOB

Single drums of cable are normally transported by means of cable trailers on which the drum is supported by a centre spindle.

For large scale cable installation projects a multiple cable drum transporter consisting of a semi-trailer carrying a number of palletised cable drum stands, is used.

In metropolitan areas small size is normally delivered to jobs by a stores vehicle carrying drums of various size cable and fitted with dispensing and measuring facilities.



TYPICAL CABLE TRAILERS

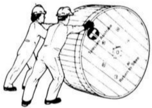
HANDLING DRUMS OF CABLE

DIRECTION OF ROLLING

When moving a drum, roll it so that the cable tends to tighten on the drum. The arrow stencilled on the flange of a new drum indicates the direction in which it should be rolled.

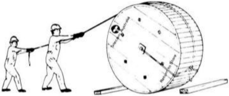
Where there is no arrow or the cable has been rerolled on a drum, roll the drum in the direction which allows the outer end of the cable to trail the direction of rotation. Secure the outer end of the cable by rope before rolling the drum.

SAFETY PRECAUTIONS



ROLLING DRUM BY HAND

Avoid back injury to spine by keeping the back straight and making maximum use of legs for thrust. Keep one foot forward to safeguard balance.



USE OF ROPE TO ROLL HEAVY DRUM

The rope gives a mechanical advantage which makes rolling the drum easier.

Keep chocks ready to prevent drum running back or getting out of control.

Advanced leg with knee bent applies thrust.

Rear leg placed well back safeguards balance. Arms and back remain straight.

LONG DISTANCE TRANSPORT OF CABLE

METHOD OF TRANSPORT

Lead sheathed cables may be transported by road or ship only. Rail transport is unsuitable as the excessive vibration can cause intercrystalline fracture of the lead sheath.

Plain lead sheathed cables should not be transported by road for more than 350 kilometres and alloy lead sheathed cable not more than 1000 kilometres.

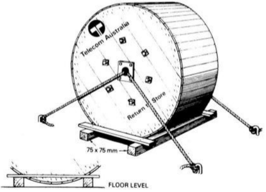
Plastic cables and moisture barrier sheathed cables may be transported by road, rail or ship over any distance.

Place cable under gas pressure before loading and check pressure on arrival at destination.

SECURING DRUMS DURING TRANSPORT

Securely chock drums to prevent them rolling during transport. Set the chocks so that the drum rests on the chocks and not on the floor of the truck. Nail scantlings across the chocks so that they cannot be spread. In railway trucks with wooden floors the chocks may be nailed to the floor.

Tie the cable drums securely to the truck with ropes to limit movement. Thread the ropes through the spindle hole and tie to suitable projections on the truck. Space drums so that they cannot bump into each other or other items on the truck.



METHOD OF CHOCKING AND TYING CABLE DRUMS

SECTION H

PREPARING DUCTS FOR CABLE INSTALLATION

- PREPARING DUCTS
- RODDING DUCTS
- VACUUM DRAW ROPING MACHINE
- INSTALLING DRAW LINE
- CLEANING DUCTS
- CLEANING OBSTRUCTIONS FROM DUCTS
- PROVING DUCTS
- LANCIER DUCT BORE MEASURING AND RECORDING INSTRUMENT
- CABLE HAULING ROPES
- EPOXY RESIN BONDED HAULING EYES
- CABLE GRIPS

PREPARING DUCTS

SELECTING DUCT

The duct in which cable is to be installed will normally be selected during the cable planning stage and indicated on cable hauling plans supplied by the Sectional Office.

In selecting the duct the guiding principles should be to :

. Use the lower ducts first (on mixed cable routes the lower ducts may be reserved for trunk or junction cables).
. Occupy the duct closest to the wall then work towards the centre of the manhole at each level.
. Avoid drawing cable into a duct which will obstruct later installation of cable in adjacent ducts.
. Where possible occupy the same duct position along the cable route.

Special conditions for coaxial cables are :

. Cable must always be installed in an empty duct.
. Under no circumstances may a second cable be drawn into the duct later.
. The cable should occupy the lowest available position in the duct route. (The low position provides some protection against mechanical damage).
. A spare duct must always be available.

PREPARING DUCT

Before installing cable it is necessary to ensure that the duct is clean and free from obstructions. Preparatory work for cable installation includes the following operations

. Rodding the ducts.
. Inserting draw line.
. Cleaning and proving ducts with mandrel.
. Setting up cable guides to protect cable during hauling.
. Drawing hauling rope into duct.

RODDING DUCTS

SECTIONAL CONDUIT RODS

Conduit rods are manufactured from thick walled rigid PVC tubing (length 3 metres, outside diameter 20 millimetres, S102/10).

The rods are joined by means of brass couplings with a male thread at one end of the rod and a female thread at the other end, which enable the rods to be screwed together as they are inserted in the duct.

Screw the rods up tight as they are coupled together. Twist them clockwise while pushing them into the duct to keep the threads tight.

Maintain the smallest possible entry angle to the rod at the duct mouth. Apply pushing force to the duct mouth to prevent rod splintering.

When rodding long sections screw a steel basket shaped endpiece to the first rod. Where the full section cannot be rodded hook the basket with a hook shaped endpiece attached to rods inserted from the far end and pull them through to the manhole.

When rodding ducts containing a cable fit a bulb shaped endpiece to the first rod to prevent the rods from spiralling around the cable.

Endpieces should have a hole drilled through them to enable the draw line or winch rope to be attached and drawn into the duct as the rods are withdrawn.

Rods should be kept out of direct sunlight when stored as they become brittle.

CONTINUOUS FIBREGLASS RODDER

This consists of a 125 metre continuous length of 5 mm diameter nylon jacketed fibreglass rod. The rod is stored, transported and dispensed from a lightweight dispensing reel and stand. The construction of the reel and stand is detailed on Drawing CL-1351.

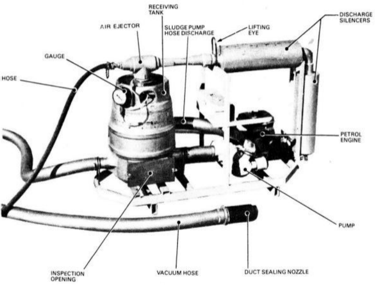
The complete rodder (S102/16) and the replacement fibreglass rod (S102/17) can be requisitioned under Serial 102 item 16 and 17 respectively. The rodder is designed primarily for use in distribution areas in pipe up to 50 mm diameter. Short lengths of 100 mm conduit can also be rodded.

RODDING WITH CONTINUOUS RODDER

To protect the nylon jacket to the fibreglass rod and to increase the effectiveness of the rodder an extension pipe 10 or 20 mm diameter inserted 75 mm into the pipe being rodded and extending approximately 150 mm out of the pit should be used. The pit cover should be placed in position so that it will wedge the extension pipe against the wall of the pit. Position the rodder 1 to 1.5 metres back from the pit. Unwind the rod at an even and steady pace to prevent any likelihood of the rod being damaged.

VACUUM DRAW ROPING MACHINE (VDRM)

This is a portable skid mounted unit used to install a draw rope in 100 mm unoccupied ducts to enable such operations as duct proving or cable hauling. The unit is normally carried on the tray of a truck and remains on the truck during roping operations.



THE VACUUM DRAW ROPING MACHINE

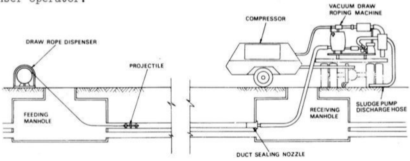
VACUUM DRAW ROPING MACHINE (VDRM)

The following equipment is required for use in conjunction with the VDRM :

. Draw rope (S675/294) polypropylene.
. Draw rope spool manufactured to Drawing CL-1353 or other suitable spool capable of holding the required length of draw rope.
. Dispensing spool stand manufactured to Drawing CL-1353 or an alternative stand which is free running and incorporates a brake capable of stopping the rotating reel.
. Portable radio for communication between party memebers is recommended for control of roping operations, however under some circumstances hand signals may be adequate.
. Compressor for supply of air.

A three man roping party is required for the satisfactory operation of the machine :

. A party supervisor who controls the progress of roping and operates the compressor.
. A duct nozzle operator.
. A rope dispenser operator.



TYPICAL LAYOUT OF PLANT FOR DRAW ROPING

VACUUM DRAW ROPING MACHINE

OPERATING PROCEDURE

Position the truck carrying the VDRM at the receiving manhole so that the duct sealing nozzle can be placed into the duct to be roped.

Locate the draw rope dispenser at the feeding end manhole in a position that will allow the rope to run freely.

The party supervisor should ensure that the staff and equipment are in position, when this has been achieved proceed as follows :

- Attach draw rope to the projectile and insert in the correct duct.
- Protect existing cables, duct entries and draw rope by fitting benders or guides etc.
- Start petrol engine on the VDRM and then the compressor.
- Insert the nozzle into the duct mouth at the receiving end manhole.
- Open the valve to supply compressed air to the ejector which generates a vacuum and draws the projectile along the duct.
- Arrival of the projectile can be detected when it contacts the vacuum hose nozzle.

OPERATING PROCEDURE (Continued)

The amount of vacuum generated and the amount of air pumped out of the duct effect the speed of the projectile and will be determined by the condition of the duct. Leaks between sections of conduits or cracks in the lengths will reduce the speed of the projectile.

The VDRM is capable of operating continuously in ducts containing water and debris. Should the projectile stop within the duct during roping operations the rope dispenser operator should :

- Radio or signal the compressor operator to shut off the valve supplying compressed air to the ejector.
- Wind the projectile back approximately 2 metres using the rope dispenser.
- Apply the brake on the dispenser and radio or signal the compressor operator to open the valve supplying the compressed air to the ejector.
- Allow the vacuum to build up in the duct and then release the brake, this will assist the projectile in overcoming any small blockages in the duct.

INSTALLING DRAW LINE

A light rope or wire to serve as a draw line is drawn into the ducts by using the VDRM or conduit rods. The draw line is used to pull cleaning devices and proving mandrels through the ducts and to draw in the cable hauling rope.

DRAW LINE TYPES AND SIZES

The following materials may be used as draw lines :

- Polypropylene Monofilament Rope (S675/294)
- 3.15 mm GI wire (S62/23)
- 1.6 mm GI wire (S92/23) Polyethylene covered.

Where draw lines for future cable installation are inserted during conduit laying use a Polypropylene rope or 1.6 mm Polyethylene covered GI wire. Uninsulated 3.15 mm GI wire should not be used as it is not sufficiently corrosion resistant to remain in the ducts for long periods.

POWER WINCHING OF DRAW LINE

A small motorised winch with a reel may be mounted on a truck (ie party truck or cable supply vehicle) to wind up the draw line and pull cleaning brushes, swabs and the winch rope through the ducts. (This avoids the hazards of pulling the line out along the footpath particularly in shopping centres).

Do not use a power winch to draw mandrels through ducts as they are extremely difficult to retrieve if they become jammed in the duct.

PLACE GUARDS AROUND ALL OPEN MANHOLES TO PREVENT PEOPLE STEPPING INTO THEM.

SET UP WARNING NOTICES, GUARDS, MARKER CONES (WITCHES HATS) AND FLASHING LIGHTS WHERE CABLE HAULING VEHICLES OR EQUIPMENT MUST BE LOCATED IN A POSITION WHICH COULD ENDANGER VEHICLUAR OR PEDESTRIAN TRAFFIC.

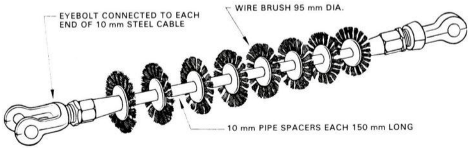
CLEANING DUCTS

Before installing cable the duct must be cleaned to remove any sand or other material which could damage the cable sheath during hauling. This applied to new as well as existing ducts.

Using a draw line pull a stiff brish (steel wire or fibre), rubber discs or hessian swabs through the ducts to sweep them clean. Always use a wire brush in metallic conduits.

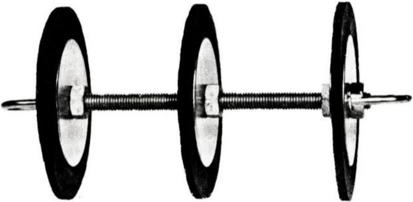
Attach a rope to the rear end of the brush so that it may be withdrawn if an obstruction is encountered.

A chain drawn through the ducts is also effective for loosening and removing deposits of silt or sand.



FLEXIBLE STEEL WIRE BRUSH

CLEANING DUCTS



HOLDER FOR RUBBER DUCT CLEANING DISCS

NOTE : Discs cut from flat rubber belting, three or four ply.

USE SAFE LIFTING PRACTICES WHEN REMOVING MANHOLE AND JOINTING PIT COVERS (SEE PAGE R-17).

CLEARING OBSTRUCTIONS FROM DUCTS

Rodding of ducts may be prevented by obstructions such as damaged conduits, tree roots or excessive sand or silt.

Where damaged conduits or tree roots are encountered use the rods to measure along the surface of the ground to the obstruction and excavate to repair and clear the conduits.

Sand or silt may be removed by means of a tube shovel or by flushing with water.

USE OF TUBE SHOVEL

The tube shovel is constructed of thin sheet steel with a coupling on one end for connection to the rods. Alternatively PVC or polyethylene pipe may be used as an improvised shovel.

Push the shovel into the duct to gather the sand and repeat until the duct is reasonably free of sand. Use a brush to clear the remainder.

TUBE SHOVEL

FLUSHING DUCTS WITH WATER

For best results this requires a good water supply and a large diameter hose (about 50 mm). Push hose into the duct with the rods or if rods have been pushed through, pull it in behind the rods. Take care that pressure does not build up in ducts.

Plug all other ducts to prevent silt being washed into them. Provide adequate manhole drainage or remove water by pumping.

PROVING DUCTS

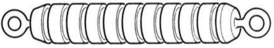
Where the conduits are old or any difficulty is anticipated in drawing in the cable pull a mandrel of appropriate size (larger than the cable diameter) through the duct to prove it.

Pull the mandrel through by hand. Attach a rope to the rear end so that it may be withdrawn if it becomes jammed.

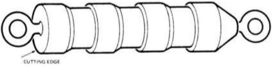
Minor obstructions such as the edges of slightly misaligned AC or conrete conduits or mortar at joints may be removed by means of a cutting mandrel which is pulled back and forth in a sawing motion across the obstruction until the material is chipped away and a clear passage obtained. Use brushes to clear the material from the duct.

Where doubt exists regarding the condition of a duct a 2 metre length of cable of the same diameter or slightly larger than the cable to be installed may be pulled through the duct to prove it. Attach a winch rope to the rear of the piece of cable so that it may be pulled out if it jams in the duct.

The actual diameter of PVC ducts in a section may be determined by drawing a duct bore measuring instrument eg "Lancier" through the ducts (see Page H-13).



PROVING MANDREL



CUTTING MANDREL

DO NOT DISCONNECT OR INTERFERE IN ANY WAY WITH ELECTROLYTIC BONDS IN MANHOLES.

LANCIER DUCT BORE MEASURING AND RECORDING INSTRUMENT

This instrument measures and records duct bore in the range 85 to 115 mm diameter on a waxed paper recording tape housed in the body of the instrument.

The recording tape is supplied on a reel and holds 10 metres of tape which will record 1000 metres of duct.

One instrument has been issued to Primary Works Section in each State and is available for use throughout the State. Prior to using the instrument reference should be made to Engineering Instruction LINES Conduits TE 1000.

Replacement rolls of recording tape and advice on maintenance of the instrument can be obtained from Engineering Department, Lines Construction Branch Headquarters, Construction Sub-Section.

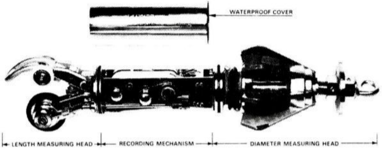
Typical uses are :

- Acceptance testing of duct bore on completion of conduit construction,
- Bore checking prior to cable hauling.
- Accurate location of duct deformation and/or restrictions.

To achieve an acurate record, the duct must be cleaned of all foreign matter such as stones, mud or silt by pulling through a round bristle brush with a polypropylene draw rope (S675/294) before measuring the duct.

To draw the instrument through the duct, fasten the rope to the hauling eye located on the diameter measuring head and similarly fasten a trailing rope to the length measuring head to provide a means of withdrawal if the instrument jams in the duct.

LANCIER DUCT BORE MEASURING AND RECORDING INSTRUMENT



LANCIER DUCT BORE MEASURING AND RECORDING INSTRUMENT

Before inserting the instrument in the duct fully depress the feelers on the measuring head to mark the "start" position on the tape. This is repeated on completion of each duct section to mark the "finish" position on the tape.

MOTORISED WINCHES MUST NOT BE USED TO DRAW THE INSTRUMENT THROUGH THE DUCT BECAUSE THE UNIT COULD BECOME JAMMED IN THE DUCT.

Draw the insturment at a SLOW UNIFORM SPEED by hand or by hand driven spool.

It is important not to draw the instrument backwards during recording if accurate length location is to be achieved. If it becomes necessary to draw the instrument backwards length location will be lost but diameter recording will not be effected.

CABLE HAULING ROPES

Construction of Rope	Core Matl.	Diam. (mm)	Tensile Strength of Wire (Megapascals)	Breaking Force (Kilonewtons)	Recommended Minimum Sheave Diameter (mm)
6 x 25	SWR	14	1770	124	336
6 x 25	FW	14	1770	114	336
6 x 36	WRC	13	1770	107	234
6 x 26	WRC	14	1770	124	336
6 x 19	WRC	13	1770	107	390

WIRE ROPES SUITABLE FOR CABLE HAULING

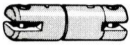
Ø 6 x 25 means 6 units of 25 strands each.
SWR - Steel Wire Rope
WRC - Wire Rope Core
FW - Filler Wire Strand Construction

GLOVES MUST BE WORN WHEN HANDLING CABLE HAULING ROPES. NEVER ALLOW ROPES TO RUN THROUGH THE HANDS EVEN WITH GLOVES ON.

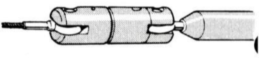
CABLE HAULING ROPE FITTINGS

SWIVELS

A swivel is fitted between the end of the winch rope and the cable grip or hauling eye.
The winch rope tends to rotate when pulling in cable and the swivel prevents the turning action being applied to the cable.
Only ball bearing swivels are to be used when hauling coaxial cable.
A new range of cable hauling swivels have been developed for use on small to large size cables. The size, capacity and typical use of the swivels are shown on Page H-18.



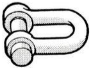
BALL BEARING SWIVEL



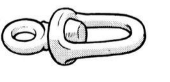
CONNECTION OF PULLING EYE, SWIVEL AND WIRE ROPE TERMINATION

SHACKLES

A narrow jaw "D" shackle or similar coupling device is used to connect the winch rope to the swivel or cable hauling eye where direct attachment is not possible.
Keystone and kidney links have insufficient strength for hauling large cables.



"D" SHACKLE



SWIVEL

CABLE HAULING ROPE FITTINGS

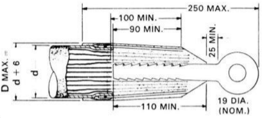
Swivel No N/S	Max Working Tension (kN)	Drawing No	Swivel Size				Max. Permitted Cable Size		Typical Use
			O.D. (mm)	Length (mm)	Pin Dia (mm)	Groove Depth (mm)	PIUT PEIUT	APIUT	
1	5	CL-1286	25	90	6	22	200/0.4	300/0.52 150/0.81	Small Size cables Plural Cabling
2	10	CL-1287	32	135	18	40	600/0.32 400/0.4 150/0.64	600/0.52 300/0.81 150/1.15	Small to medium Cables
3	20	CL-1288	42	172	18	46	1200/0.32 800/0.4 300/0.64	1400/0.52 600/0.81 300/1.15	Medium to large Cables
4	40	CL-1262	60	210	18	55	Large Size Cables	Large Size Cables	Large Size Cables

CABLE HAULING SWIVELS

EPOXY RESIN BONDED HAULING EYES

Epoxy resin bonded hauling eyes are the most effective way of attaching hauling ropes to large size multipair and coaxial cables having both lead and MB sheaths. They are well proven for installations of long cable lengths and for difficult hauls.

The normal hauling eye is of 13 mm diameter (for cables up to 50 mm diameter) or 19 mm diameter (for cables greater than 50 mm diameter) steel eye bolt with buttress thread inserted into the cable end and bonded to clean prepared conductors and the cable sheath by a casting of epoxy resin.



EPOXY RESIN BONDED HAULING EYE

To prevent fracture at the junction of epoxy resin and cable sheath, re-inforcement is used. For lead sheaths wire re-inforcement is sweated to the sheath. For MB sheath, wire mesh is wrapped tightly around the cable and the sheath lightly heated. This ensures that the polyethylene permeates through the mesh. The polyethylene is then flame heated to allow for better epoxy resin bonding. The wire re-inforcement and/or mesh is cast into the resin.

A special hauling eye for armoured cables is provided. Hauling eyes are normally fitted at the cable factory and are specified when the cable is ordered.

MARKING WINCH ROPE

To give forewarning of the arrival of the cable at intermediate manholes and at the end manhole wrap several turns of PVC tape around the winch rope at two points 2 metres and 5 metres from the end of the rope. Hauling may then be slowed while the epoxy resin bonded hauling eye passes around any curves in the intermediate manholes.

CABLE GRIPS

Three types of cable grips are used for attaching the hauling rope to the cable :

Fixed Grip - For cables up to 10 mm diameter only. The single hauling loop of this grip prevents it being slipped along the cable.

Slip Grip - For cables over 10 mm diameter. The double hauling eye enables this grip to be slipped along the cable as required. Two grips fitted in series may be used for heavy hauls.

Fleeting Grip - Split grip for pulling slack cable into intermediate manholes. May be fitted anywhere along the cable length.

FITTING FIXED OR SLIP GRIP ON CABLE

- Compress grip along its length to enlarge its diameter. Place it over cable and release, allowing it to extend along the cable.
- Press strands of grip firmly onto sheath. (Lead dresser may be used for this purpose).
- Bind mouth of grip securely with strong twine or marline.
- On jacketed cable place an additional tie around the grip over the lead sheath just ahead of the plastic covering.
- Where longitudinal spikes are used place an additional tie about 300 mm from the cable end.

FIXED GRIP - SINGLE PLY SINGLE EYE.

SLIP GRIP - DOUBLE PLY DOUBLE EYE.

FLEETING GRIP - SPLIT GRIP, DOUBLE EYE.

CABLE GRIPS

Serial and Item No	No	Type	Nature of Mesh	Length of Grip	Suited for Cable Dia.
114/1	00	Fixed Grip	Single Ply	610 mm	6 to 10 mm
114/2	0	Slip Grip	Double Ply	610 mm	10 to 20 mm
114/3	1	Slip Grip	Double Ply	685 mm	20 to 30 mm
114/4	2	Slip Grip	Double Ply	760 mm	25 to 40 mm
114/5	3	Slip Grip	Double Ply	915 mm	30 to 45 mm
114/6	4	Slip Grip	Double Ply	1 065 mm	40 to 60 mm
114/7	5	Slip Grip	Double Ply	1 300 mm	45 to 80 mm

CABLE GRIP TYPES AND SIZES

FLEETING GRIPS are not serialised and are obtained by local purchase.

(Suitable type - Kellems Split Grips, or similar).

Split Grips are available in two types :

Rod Closure - Single weave grip secured by a rod inserted through mesh loops at seam.

Laced Closure - Double weave grip secured by lacing seam with raw hide, marling (S639/20) or 1.6 mm GI wire. More suitable for heavy pulls than single weave grip.

PREPARING CABLE FOR GRIPS

LEAD SHEATHED DRESSED DOWN ONTO CONDUCTORS

This method is suitable for hauling lengths of lead sheathed cable up to 100 m. Prepare cable end as follows :

- On jacketed cable remove plastic for approx. 75 mm less than length of cable grip when on the cable. Remove armouring similarly and bind end.
- Remove cable end seal.
- Dress down sheath onto conductors for effective length of cable grip.
- Seal cable end.

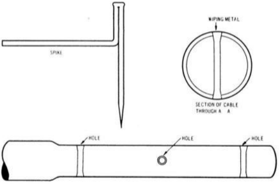
LEAD CABLE END DRESSED DOWN

LEAD SHEATH BONDED TO CONDUCTORS

Suitable for lead cables larger than 30 mm diam. and hauling lengths up to 250 m.

Prepare cable end as follows :

- Remove plastic jacket and dress down sheath as described above.
- Punch three holes through cable with spike.
- Pour molten stearine through each hole.
- Fill each hole with molten wiping metal and wipe flush with cable sheath.



BONDING SHEATH TO CONDUCTORS WITH TRANSVERSE LEAD PLUGS

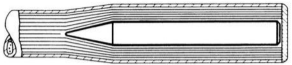
PREPARING CABLE FOR GRIPS

LONGITUDINAL STEEL SPIKE

Suitable for both lead and moisture barrier cables and hauling lengths up to 250 metres.

Prepare cable end as follows :

- On plastic jacketed lead sheathed cables remove jacket for 75 mm less than length of grip when on cable.
- Remove cable end seal.
- Drive a steel spike into the centre of the cable end after making sure that the end is straight. It is important that the spike be centrally located in the cable end.
- Seal the cable end.



SPIKE DRIVEN INTO CABLE END

The spike enlarges the cable diameter and the method is unsuitable for use where the new diameter is close to the diameter of the ducts.

Spike sizes for the various cable diameters are shown in the table below. The spikes are made from mild steel rod and have a 50 mm taper to a blunt point. They have no serial and item number and should be obtained locally. Cable jointers should recover the spikes during jointing operations.

Cable Diam. (mm)	12 to 20	Over 20 to 25	Over 25 to 40	Over 40 to 50	Over 50 to 60	Ove
Spike Size (mm)	230 x 10	230 x 12	230 x 16	230 x 20	300 x 25	300 x

SPIKE SIZES

REFERENCES

EI's LINES Conduits	TE 4110	Continuous Fibreglass Rodder.
	TE 4000	Vacuum Draw Roping Machine.
	TE 1000	Lancier Duct Bore Measuring and Recording Instrument.

SECTION I

HAULING CABLE INTO DUCTS

- HAULING CABLE INTO DUCTS
- CABLE HAULING COMMUNICATIONS
- SAFETY PRECAUTIONS WHEN HAULING CABLE
- CABLE INSTALLATION PLANS
- SUBSCRIBERS CABLE PLANS

HAULING CABLE INTO DUCTS

CABLE HAULING PLANS

For large cable installations a hauling plan is prepared in the District/Section Office for the guidance of the cable hauling party. The plan shows hauling sections and the numbers of the cable drums and cable lengths to be installed in each section.

In order to minimise the number of cable joints required the cable should be pulled through as many intermediate manholes as practicable.

Coaxial cable must be installed strictly in accordance with the cable hauling plan which is based on drum length advices from the cable factory. Lengths must not be reversed when hauling into the duct.

MAXIMUM HAULING TENSION

The maximum allowable hauling tension for pair cables with copper and aluminium conductors is calculated as follows:

COPPER	ALUMINIUM
TENSION = $150Pd^2$ newtons	TENSION = $50Pd^2$ newtons

(where P = number of pairs, d = conductor diameter in millimetres)

For copper conductors the hauling tension should never exceed 40kN. Hauling tension in excess of 40kN can cause damage to conductor insulation and/or cable sheath. The hauling tension is measured by a dynamometer fitted on a winch truck.

Large size cable should be fitted with an epoxy resin hauling eye to ensure that the tension is applied directly to the conductors.

Where hauling tensions are likely to be high the cable sheath must be well lubricated.

HAULING SPEED

Apply an even tension and avoid stopping and restarting as the pull required to move the cable from rest is much greater than is required to keep it moving. A hauling speed of approximately 30 metres per minute is desirable to prevent surging and to reduce tension.

HAULING CABLE DOWNHILL

To reduce hauling tension draw cable downhill where practicable. On steep gradients arrange for suitable braking on the cable drum to prevent the cable from accelerating beyond control. Secure the cable to prevent creep after installation.

HAULING CABLE INTO DUCTS

HAULING CABLE AROUND BENDS

Provide cable guides at changes of direction in manholes to maintain a smooth curve of maximum possible radius as shown on page I-9.

Arrange cable hauling sections so that any bends in the duct route are close to the end where the cable enters. Wherever practicable avoid hauling around bends close to the winch end as this considerably increases the hauling tension.

HAULING OVER EXISTING CABLE

Rod ducts using special "leader" screwed on to the end of the first rod to prevent the rods wrapping around the existing cable.

Prove the duct by drawing through a 2 metre length of test cable of the same size as the cable to be installed.

Particular care is necessary on long hauls where the cable is to be drawn through intermediate manholes to avoid damage to the existing cable. As damage is mainly caused by the winch rope swivel or hauling eye it is usually desirable for heavy pulls to shift the winch truck from manhole to manhole along the route so that the winch rope is pulled through only one section at a time.

NOTE:

AIR PRESSURE CHECKS

Large size cables will normally be maintained under pressure with air at 70 to 95 kilopascals during hauling. Check the pressure immediately before and after hauling.

Where a fall in pressure is observed check the cable ends for leaks (especially around hauling eye). If the hauling eye is found to be leaking air, remove it, seal the cable end and refill the cable with air as soon as possible. If the cable pressure is falling steadily and if no leak can be located, advise the Supervisor immediately.

Where the air pressure is satisfactory after hauling, it should be checked again after 24 hours and then weekly until the cable is jointed.

If the cable is cut at a manhole, seal the end promptly and refill cable with dry air to a pressure of 95 kilopascals.

LUBRICATION OF CABLE DURING HAULING

MOISTURE BARRIER CABLE AND PLASTIC JACKETED LEAD CABLE

Lubricate plastic sheathed cable with Talc powder mixed with water to form a thin paste. Petroleum jelly based Cable Covering Compound No. 3 (S91/6) must not be used on plastic sheathed or jacketed cables as it can have a detrimental effect on the polyethylene or nylon.

"Bentonite" Cable hauling lubricant is suitable for use on plastic sheathed or nylon jacketed cables particularly around bends and on long cable hauls.

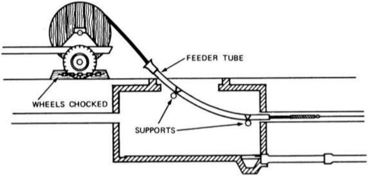
USE OF CABLE FEEDER TUBE

A feeder tube (flexible steel tubing or polyethylene pipe) is used to guide the cable into the duct. This protects the cable from damage against the edge of the manhole opening, helps control the rotation of the drum, provides a convenient point for application of lubricant, and protects existing cables in the manhole.
An alternative method of guiding cable into the duct is to use a cable hauling roller which is positioned at the edge of the manhole (See page I-12).

Remember : Staff with long hair must wear hair nets (S.34/100-103) while working in an environment where their hair may get caught in machinery.

SECURELY CHOCK THE WHEELS OF THE CABLE TRAILER AND WINCH TRUCK WHEN HAULING CABLE.

ARRANGEMENT OF EQUIPMENT AT CABLE DRUM END OF SECTION

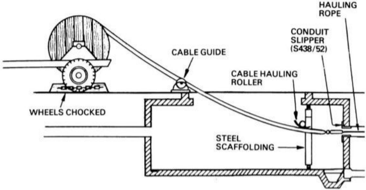


POSITION OF EQUIPMENT FOR DIRECT CABLE FEED

NOTES

- . Set up equipment and feeder tube (flexible steel tubing or polyethylene pipe) so that the cable flows to the duct in a smooth curve. Where the cable trailer cannot be located on the footway in line with the duct route it may be placed to one side of the manhole and the cable feeder tube positioned for side feeding.
- . Where necessary support the feeder tube by clamping to telescopic scaffolding.
- . Apply lubricant to cable as it enters the feeder tube.
  Inspect the cable for damage as it passes this point.
- . In most cases the cable may be pulled off the drum by the winch. On very heavy pulls the hauling tension can be reduced by turning the drum by hand.

ARRANGEMENT OF EQUIPMENT AT CABLE DRUM END OF SECTION



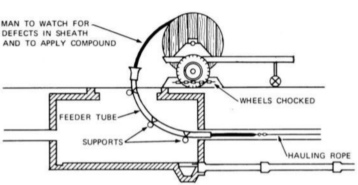
POSITION OF EQUIPMENT FOR DIRECT CABLE FEED

NOTES

- Position the portable cable hauling roller at the edge of the manhole to protect the cable sheath as it feeds from the drum into the conduit.
- The roller can also be used in long cable feeds or for guiding cables in tunnels or exchange cable wells.
- It is not intended to serialise the roller, however drawing CL-1384 has been prepared.
- A conduit slipper (S438/52) must be used to protect the sheathing from damage at the top of the duct mouth.

BEFORE ANY WORK IS COMMENCED OR ANY SPARK OR FLAME INCLUDING CIGARETTES IS BROUGHT NEAR AN UNDERGROUND OPENING, CHECK FOR GAS WITH A COMBUSTIBLE GAS DETECTOR.

ARRANGEMENT OF EQUIPMENT AT CABLE DRUM END OF SECTION

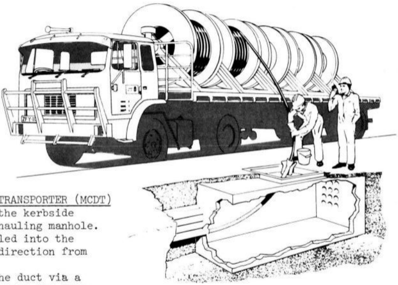


POSITION OF EQUIPMENT FOR LOOP FEED

NOTES

- Use this method where it is not possible to position the cable trailer for direct feed.
- Set up the equipment and feeder tube (flexible steel tubing or polyethylene pipe) so that the cable flows to the duct in a smooth curve.
- Support the feeder tube in the manhole where necessary.
- If necessary apply lubricant to the cable as it enters the feeder tube.
- Inspect the cable for any defects as its passes this point.

ARRANGEMENT OF EQUIPMENT AT CABLE DRUM END OF SECTION



MULTIPLE CABLE DRUM TRANSPORTER (MCDT)

- Park the MCDT at the kerbside adjacent to the hauling manhole. Cable can be hauled into the ducts in either direction from this position.
- Pass cable into the duct via a feeder tube. Support the tube in the manhole where necessary.
- If necessary apply lubricant to the cable as it enters the feeder tube.

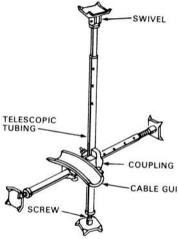
PULLING CABLE THROUGH INTERMEDIATE MANHOLES

USE OF CABLE GUIDES

Cables are installed in the greatest possible lengths to avoid joints. Where the cable passes through intermediate manholes ("pull-through" manholes) cable guides must be set up to assist in hauling the cable around bends or from one level to another.

Lengths of split steel tubing which have been bent to a smooth curve form effective cable guides. The steel bends may be clamped to scaffold type tubing which is set up in the manhole to give the cable flow desired.

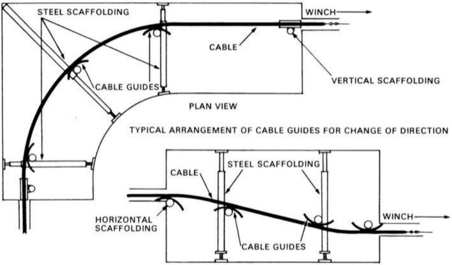
For coaxial cable installation where extra care is necessary to ensure that the cable is not compressed during hauling, a length of polyethylene pipe should be secured to the guides from duct to duct and the cable drawn through this. Where the outside diameter of the pipe is greater than the bore of the conduit a saw cut along the length of the pipe for about 100 mm will usually allow the end to be entered into the duct. The pipe may be cut from the cable later if desired or remain in position as extra protection for the cable.



TYPICAL STEEL CABLE GUIDE ON TELESCOPIC SCAFFOLDING

SAFETY VESTS ARE TO ENSURE THAT THE WEARER IS CLEARLY VISIBLE FOR SOME DISTANCE TO VEHICLE DRIVERS.

PULLING CABLE THROUGH INTERMEDIATE MANHOLES



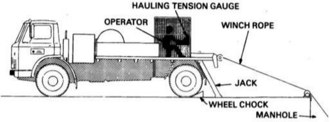
PLAN VIEW

TYPICAL ARRANGEMENT OF CABLE GUIDES FOR CHANGE OF DIRECTION

SIDE VIEW

TYPICAL ARRANGEMENT OF CABLE GUIDES FOR CHANGE OF DUCT LEVEL

ARRANGEMENT OF EQUIPMENT AT WINCHING END OF SECTION



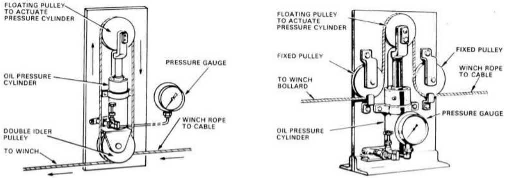
WINCH TRUCK SET UP FOR CAPSTAN HAULING

Position the winch truck so as to obtain a pull in line with the required duct. Where the angle of the winch rope is too steep, use one of the measures illustrated on page I-13 to reduce the angle of entry into the manhole.

If the distance between the edge of the manhole and the winch truck exceeds 3 metres, slip a length of plastic pipe over the winch rope so that if the rope should break under tension the pipe will prevent it lashing violently with possible injury to workmen.

AVOID STEPPING ON CABLES WHEN ENTERING OR LEAVING MANHOLES.

MEASURING CABLE HAULING TENSION



TYPICAL DYNAMOMETER ARRANGEMENTS ON CABLE HAULING TRUCKS

Dynamometers are used to indicate the hauling tension whenever coaxial cable is installed and for long hauls of multipair cable where there is a possibility of the safe hauling limit (see page I-1) being reached. They are not required where hydraulic winches are fitted, as hauling tension is shown on a gauge operated by hydraulic pressure from the winch motor.

Gauges which record the tension are mounted in a position readily visible to the winch truck operator. If during the haul there is a sudden rise in tension the winching should be stopped immediately and the cause investigated unless the cause of the increase is known (e.g. bend in conduit, change of direction in manhole etc.).

KEEP CLEAR OF WINCH ROPES UNDER TENSION
WEAR GLOVES WHEN HANDLING WINCH ROPES

ARRANGEMENT OF EQUIPMENT AT WINCHING END OF SECTION

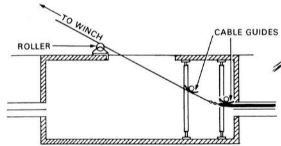
CABLE ENTRY TO MANHOLE

The arrangement of hauling equipment should provide for the cable to enter the manhole as close as possible to a direct line from the duct so as to avoid damage to the cable by the edge of the duct.

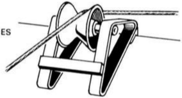
Where the full length of a large multipair cable or a coaxial cable required in the manhole cannot be drawn in a direct line from the duct the winch truck may be set up at the next manhole and the pull made from there. Alternatively a ball bearing pulley may be used to reverse the direction of the winch rope as shown on page I-15.

HAULING ARRANGEMENTS

Typical hauling arrangements are shown below and on Pages I-13 and 14.



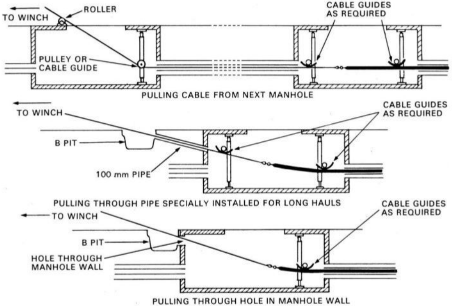
USE OF CABLE GUIDES AND ROLLERS



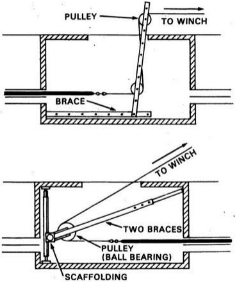
ROLLER

Use rollers to prevent winch rope rubbing against any part of the manhole or fittings.

ARRANGEMENT OF EQUIPMENT AT WINCHING END OF SECTION



ARRANGEMENT OF EQUIPMENT AT WINCHING END OF SECTION



USE OF BALL-BEARING PULLEY

SETTING UP CABLE IN MANHOLES

CABLE REQUIRED IN MANHOLE AT END OF HAULING SECTION

Draw cable into the manhole for 1 metre beyond the centre of the jointing position, making allowance for the cable to be set up on cable bearers around the manhole wall. An additional 600 mm of cable will be required if a hauling eye is fitted.

Where cable has been pulled through intermediate manholes and slack cable will be required for setting up in the manholes make allowance for this before cutting cable.

OBTAINING SLACK CABLE IN "PULL THROUGH" MANHOLES

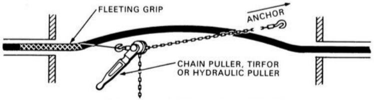
After dismantling cable guides it is usually possible to set up the cable in its final position on cable bearers by hand. Cables with a moisture barrier sheath should be clamped to the cable bearers using a Cable Clamp S.433/180.

Where slack cable cannot be pulled into the manhole by hand use the following methods:

Winch Truck - Locate winch truck close to manhole and use split fleeting grip to connect hauling rope to the cable. Where the angle of the hauling rope is too steep and the cable may be damaged on the edge of the duct use guide sheaves or a snatch block in the manhole so that the cable is pulled directly from the duct.

Hydraulic Puller, Ratchet Type Chain Puller or Tirfor Winch - Anchor puller so that the cable is drawn in the desired direction.

Use a fleeting grip to connect puller to the cable.



PULLING SLACK CABLE INTO MANHOLE

CABLE HAULING COMMUNICATIONS

COMMUNICATION POINTS FOR CABLE HAULING

Good communication between all members of the cable hauling party is essential. This is best arranged by providing radio equipment or loud speaking telephones at:

- The manhole at the cable drum end.
- Any intermediate manholes through which the cable will be drawn.
- The manhole at the winch end of the section.
- The winch truck operator.
- The party leader.

RADIO EQUIPMENT

Radio equipment is the most convenient means of communication particularly on long hauls. The winch truck should be fitted with a mobile unit with an extended loud speaker and microphone to the operators position. Portable units are required at the other positions listed above.

LOUDSPEAKING TELEPHONES

Loudspeaking telephones may be connected by a suitable (ie. 2 core electric flex is easy to handle and will lay flat) wire run out over the surface of the ground or where this would constitute a hazard to vehicular or pedestrian traffic, by hauling the wire into a spare duct.

SIGNAL FLAGS

Signal flags (red and green) may be used for short hauls. Flags must always be available as a back-up system for use in the event of failure of radio or telephone systems when a haul is in progress.

DUCT RODDING COMMUNICATIONS

Portable radio equipment or signal flags may be used for communication during rodding or mandrelling of ducts.

SAFETY PRECAUTIONS WHEN HAULING CABLE

Use the correct key to lift manhole covers. Obtain assistance to lift heavy covers. (See Section R). If available use the ezi lift manhole cover lifters.

Place manhole guards or barricades around all open manholes.

Do not locate equipment where it is likely to cause interference or injury to the public.

Before entering any manhole or tunnel check for the presence of gas with a combustible gas detector.

Do not tread on cables when entering or leaving manholes.

Park motor vehicles and trailers where they will not obstruct driveways or lanes.

Where there is any danger to traffic, or workmen, erect road warning signs in prominent positions. (Refer page R-2).

Use lane marker cones to divert traffic around obstructions.

Securely chock the wheels of the cable trailer and winch truck before hauling cable.

Keep clear of the moving parts of winch trucks and other mechanical aids.

Bend down nails in battens removed from cable drums or safely dispose of the battens so that nails cannot cause injury.

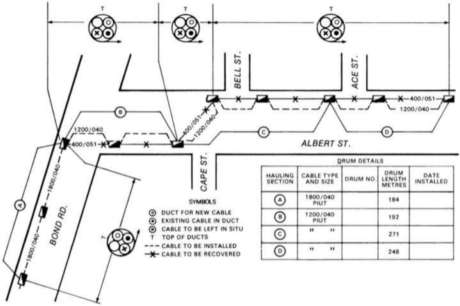
Withdraw any nails protruding from cable drum flanges after removal of battens to prevent injury to workmen or damage to the cable.

Clear the dirt from around manhole cover frames to ensure that the covers seat properly when replaced and do not present a hazard to pedestrians.

Remove all waste cable hauling lubricant from the footpath and road surfaces.

Beware of lead poisoning. Wash your hands thoroughly after handling lead covered cable.

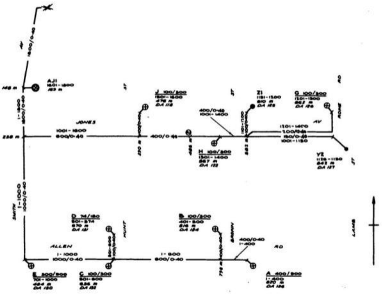
Where long lengths of winch rope are exposed, thread it through plastic pipe to arrest lashing if the rope should break during hauling.



DRUM DETAILS

HAULING SECTION	CABLE TYPE AND SIZE	DRUM NO.	DRUM LENGTH METRES	DATE INSTALLED
A	1800/040 PIUT		184	
B	1200/040 PIUT		192	
C	" "		271	
D	" "		246	

Typical Works Plan For Installation and Withdrawal of Large Size Cable



Extract From Typical Customers Main Cable Plan

PLAN SYMBOLS

Symbol	Description
Type of Cable	
PIUT	Paper Insulated Unit Twin
PITW	Paper Insulated Twin
PIMT	Paper Insulated Multiple Twin
PIQL	Paper Insulated Quad Local
PIQJ	Paper Insulated Quad Junction
PIQC	Paper Insulated Quad Carrier
PIQT	Paper Insulated Quad Trunk
APIUT	Aluminium Conductor, Paper Insulated Unit Twin
PEIUQ	Polyethylene Insulated Unit Quad
DIQC	Spiral Four Disc Insulated Quad Carrier
PEIQC	Polyethylene Insulated Quad Carrier
CPFUT	Cellular Polyethylene Insulated Jelly Fille Unit Twin

Symbol	Description
Type of Cable (Cont'd)	
PEIUT	Polyethylene Insulated Unit Twin
CX	Coaxial Pair or Tube
FG	Optical Fibre, Graded Index
FS	Optical Fibre, Stepped Index
Cable Sheath Type	
—UA—	Plain lead, unprotected
—PJ—	Plain lead, polyethylene jacketed
—ST—	Plain lead, steel tape armoured
—LW—	Plain lead, light wire armoured
—PE—	Polyethylene
—PECSHJ—	Polyethlyene, copper screen, hard plastic jacketed
—ASPE—	Aluminium screen, polyethylene

PLAN SYMBOLS

Cable Sheath Type (Cont'd)

Symbol	Description
—IB—	Aluminium screen, polyethylene, Integral Bearer
—IBH—	Aluminium screen, polyethylene, integral Bearer (Heavy Wire)
—MD—	Multi-pair Dropwire
—MB—	Moisture Barrier
—PEMB—	Polyethylene, Moisture Barrier
—MBHJ—	Moisture Barrier, Hard jacketed, jelly filled core.
—PEHJ—	Polyethylene, Hard jacketed, Optical Fibre core. NOTE: The type of cable information (FG or FS) specifies the optical fibre core.
—AL—	Aluminium
	Jute

Symbol	Description
Size of Cable, Conductor Diameter/Material and Type of Cable	
—100/0.52 APIUT—	100 pair cable with ϕ 0.52 mm aluminium conductors of paper insulated unit twin type
—100/0.64 PIUT—	100 pair cable with ϕ 0.64 mm copper conductors of paper insulated unit twin type.
—50/0.40 CPFUT—	50 pair cable with ϕ 0.40 mm copper conductors of cellular polyethylene insulated jelly filled unit twin type.
—4 CX + 4/0.90 T + 8/0.90 QC—	Coaxial cable with four tubes and paper insulated copper conductors consisting of : 4 twin type pairs, ϕ 0.90 mm 8 quad carrier type pairs, ϕ 0.90 mm NOTE : The types of pairs in a coaxial cable are described by : CX = coaxial pair or tube QC = a pair in a carrier quad QJ = a pair in a junction quad QT = a pair in a trunk quad T = a twin pair

PLAN SYMBOLS

Symbol | Description

Size of Cable, Conductor Diameter/Material and Type of Cable (Cont'd)

Optical fibre cable with three graded index optical fibres.

Cable Joints

General Symbol

Identified (All pairs identified)

Repair - sheath only

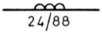
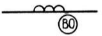
Repair - conductors jointed

Openable

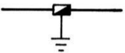
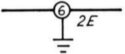
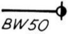
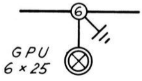
Elevated

Loading/Building out

Loading - General Symbol

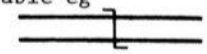
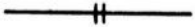
Symbol	Description
Loading/Building out (Cont'd)	
	Twenty four loading coils of eighty-eight millihenrys each.
	Building out capacitors - general symbol.
	Building out capacitor location at loading point.
	Building out capacitor location at joint.
Balancing	
	Unbalance correction capacitor location.
Earthing	
	General symbol for earth protection of underground plant.
	Qualifying Symbols:
E	SINGLE ROD ELECTRODE Note : Number of electrodes may be shown e.g. 2E

PLAN SYMBOLS

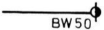
Symbol	Description
Earthing (Cont'd)	
BW	BURIED WIRE Note : Wire length may be shown e.g. BW 50 - (50 metres)
GPU	Gas protector Unit (Usually cabinet mounted)
	Examples:
	Underground cable protected by means other than buried wire or electrode at footway manhole.
	Underground cable protected by two electrodes at No. 6 pit.
	C.T.B. on outside wall protected by 50 metres of buried wire.
	Gas protector unit - cabinet mounted fitted with 6 x 25 pair protection units with three electrodes at No. 6 pit.

PLAN SYMBOLS

Form of Construction

Symbol	Description
	In conduit (multiway conduit or pipe)
	In tunnel
	Buried (laid in ground without extraneous protection) NOTE: Not used in case of armoured cable.
	In joint use trench. NOTE: Show more than one cable eg 
	Overhead (includes on wall)
	On joint use pole
	Under plank
	In wood troughing
	Buried (armoured cable only)

PLAN SYMBOLS

Symbol	Description
Cable Terminal Boxes on Telecom Pole	
	Unprotected
	Protected NOTE: - Number of electrodes may be shown e.g. 1E
	Unprotected - drop wire distribution
	Protected - drop wire distribution
On Outside Wall	
	Unprotected
	Protected NOTE: - Length of buried wire may be shown e.g. 50 metres.
On Inside Wall	
	Unprotected
	Protected

PLAN SYMBOLS

Symbol	Description
On Joint Use Pole	
	Unprotected
	Protected
	Unprotected - dropwire distribution
	Protected - dropwire distribution
Miscellaneous Cross Connecting Points	
	Pillar
	Cabinet
	Indoor cable terminal unit.
	Line concentrator

PLAN SYMBOLS

Symbol	Description
General	
	Cable cut and insulated
	Inoperative cable left in situ
	Drain
	Marker
	Exchange
Special Street Services	
PT	Public Telephone
PC	Police Call box
AC	Ambulance Call box
FC	Freeway assistance Call box
FA	Fire Alarm
TC	Taxi Call box

PLAN SYMBOLS

Symbol	Description
Boundary Lines	
	Exchange area boundary.
	Cabinet area boundary
	Distribution area boundary (For D.A. Key Reference Plan)
	Street, road etc boundary, property boundary or topographical boundary
	Boundary and alignments relating to adjacent D.A. if required.

Reference: TPH LINES GENERAL L6211 Issue 3, 1982
EI DRAFTING SYMBOLS C0100

SECTION J

WITHDRAWING CABLES FROM DUCTS

- WITHDRAWING CABLES FROM DUCTS
- INSPECTING SHEATH OF RECOVERED CABLE
- RE-ROLLING CABLE FROM DAMAGED DRUMS
- CABLES CROSSING WATERWAYS

WITHDRAWING CABLE FROM DUCTS

METHODS OF WITHDRAWING CABLE

The method most suitable for withdrawing cable will depend upon:-

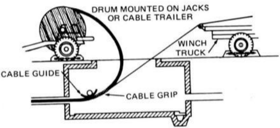
- The size of cable and length of section to be withdrawn.
- Whether the cable is to be reused or scrapped.
- Type and size of manhole and position of duct containing the cable.

Cable may be fleeted (i.e. drawn from the duct in a series of short pulls) or the full length drawn out in the one operation.

FLEETING CABLE WITH WINCH

Place the cable grip over the end of the cable to be withdrawn and push it into the duct as far as possible.
Attach hauling rope and pull cable as far as possible without damaging it on the manhole or fittings.
Release tension on the rope and slide the grip back along the cable and into the duct.

Repeat the operation until all of the cable has been withdrawn.



FLEETING CABLE WITH WINCH

BEFORE A CABLE IS WITHDRAWN IT MUST BE POSITIVELY IDENTIFIED TO ENSURE THAT A WORKING CABLE IS NOT CUT IN ERROR.

WITHDRAWING CABLE FROM DUCTS

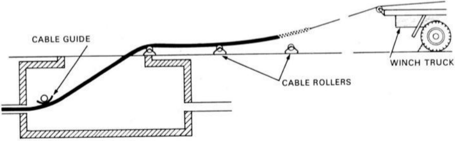
WITHDRAWING FULL LENGTH OF CABLE IN ONE OPERATION

This method may be used where the cable can be drawn out along the footpath and rolled on a drum later.

Set up the winch truck at a distance from the manhole slightly greater than the length of cable to be withdrawn. Alternatively, the winch truck may be located close to the manhole and slowly driven away when the winch has the cable moving.

Where the cable is to be reused provide cable guides in the manhole to prevent the cable being damaged and locate cable rollers at intervals along the route to prevent abrasion of the cable sheath on the footway.

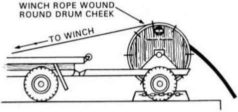
Roll the cable on a drum as the cable trailer is reversed along the route. Alternatively where the cable is to be scrapped it may be cut into lengths of about one metre for loading on a truck. Use of pallets for the cable will facilitate unloading at the depot.



HAULING CABLE OUT ALONG FOOTPATH

USE OF POWER DRIVEN CABLE DRUM

Mechanical means may be employed to turn a drum on a cable trailer so that the cable is winched directly from the duct onto the drum.
The method most commonly used is to secure special fittings to the outer edge of one of the cable drum cheeks to enable it to be turned by the winch rope.

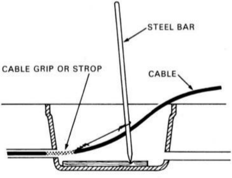


USE OF WINCH ROPE TO TURN DRUM

USE OF LEVER TO WITHDRAW CABLE

This method may be used for withdrawing a small cable which is tight in a pipe or fleeting larger cables in conduits.
Attach the lever to the cable by means of a short rope with a cable grip or rope strop around the cable.
A rope may be secured to the upper end of the lever to enable several men to assist in the levering action.

ONLY BY WORKING SAFELY TODAY, CAN YOU BE SURE THAT YOU WILL BE ABLE TO WORK TOMORROW.



USE OF LEVER

ROLLING RECOVERED CABLE ON DRUM

To avoid damage to cable required for re-use the barrel diameter of the cable drum should be at least;-

- Lead sheathed cable (including plastic jacketed) - 16 times diameter of cable.
- Moisture barrier polyethylene sheathed cable - 16 times diameter of cable.
- Polyethylene sheathed cable, small size - 20 times diameter of cable.
- Coaxial cable -1.1 metre.

To prevent crushing of the inner layers of cable the number of layers placed on a drum should be limited to;-

- Lead sheathed cable up to 25 mm diam. - 10 layers, over 25 mm diam. - 8 layers.
- Moisture barrier or plastic sheathed cable up to 25 mm diameter - 14 layers, over 25 mm diameter - 10 layers.

There must be a clearance of at least 50 mm between the top of the cable and the battens.
Where the cable is to be scrapped several lengths may be rolled on to the drum.
Before returning cable to Store mark drums with the following information:-

- Number of pairs in the cable and conductor diameter (e.g. 400/0.64).
- Type of cable (e.g. PIQL).
- Length of cable (where there are several lengths on drum show each length).
- Serial and Item Number of cable (e.g. 472/7046).

CUTTING SCRAP CABLE

Large size cable not required for re-use is normally cut to approximately 1 metre lengths for return to Store. Tools which may be used for cutting cable are an axe, modified dehorner or pneumatically or hydraulicly operated cable cutters.
Short lengths of small size cables may be rolled into coils about 600 mm diameter for return to Store.

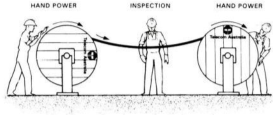
BEWARE OF LEAD POISONING. WASH YOUR HANDS THOROUGHLY AFTER HANDLING LEAD SHEATHED CABLE.

INSPECTING SHEATH OF RECOVERED CABLE

Recovered cable should be inspected for defects as shown below before it is re-used.

VISUAL INSPECTION (METHOD A)

Clean lead cable with kerosene as it is being rerolled. Wipe plastic sheath clean with a damp cloth. Carefully inspect cable for sheath defects. Use a cable jointers mirror to assist inspection.



METHOD 'A'

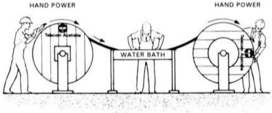
WATER BATH (METHOD B)

Place the cable under air pressure (70 to 100 kilopascals).

Pass cable through a water bath to detect any faults in the cable sheath.

During inspection, maintain sufficient air pressure within the cable to clearly indicate any leaks and to keep the water out. Check air pressure at intervals and repressurise the cable if necessary.

Where large quantities of cable are to be inspected a power operated winch may be used to turn the new cable drum.



METHOD 'B'

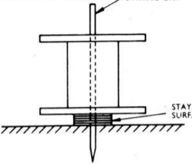
USE ONLY APPROVED SOLVENTS TO CLEAN THE SHEATH ON M.B. CABLES.

RE-ROLLING CABLE FROM DAMAGED DRUMS

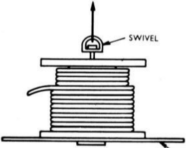
Where the drum is too badly damaged or rotted to be set on a centre spindle it may be placed on a turntable for re-rolling.

The improvised turntable illustrated will handle drums of cable up to 500 kilograms.

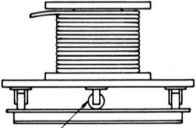
If there is no turntable and a hoist is available use the sling method. Support the underside of the drum by a large steel plate or beams placed diagonally. Place a swivel in the lifting chain so that the drum is free to rotate for removal of the cable.



TURNTABLE METHOD



SLING METHOD



IMPROVISED TURNTABLE

DESIGN OF CROSSING

The type of construction used for crossing waterways will depend on:

- Number of cables required (present and future)
- Type of waterway (creek, river, lake or bay etc.)
- Length of crossing
- Bank and bottom conditions (silt, clay, rock, coral etc.)
- Currents in waterway (due to tides, floods etc.)
- Nature of waterway traffic (small boats, ships, dredges etc.)
- Availability of alternatives to underwater crossing (bridges, viaducts etc.)

For crossings up to about 400 metres cables will normally be installed in conduits attached to bridges or laid beneath the bed of the waterway. Where conditions are suitable armoured cables may be laid directly in the bed of the waterway.

Armoured cables are always used for long distance submarine installations.

CABLES UNDER WATER

Cables installed under water may be unprotected moisture barrier or polyethylene sheathed if installed in conduits or armoured MB or lead sheathed cable if laid directly in the bed of the waterway. Specially designed submarine cables, Serial 493 are used for some long distance installations.

Where there is a danger of scouring due to strong currents or the possibility of damage due to ships anchors, dredging etc. the conduits or armoured cable should be buried at a safe depth. The method of burial will depend on the number of cables or conduits, the crossing conditions (length of crossing, depth of water, bottom conditions etc.) and the equipment available. Dredging, drag line excavator or other mechanical excavating equipment, water jetting or ploughing may be used.

TAKE CARE TO AVOID ACCIDENTS WHEN WORKING ON BOATS OR BRIDGES.

CABLES AND CONDUITS ON BRIDGES

Where bridges are available there are advantages in using them to support the cables because:-

- The installation is not affected by floods or other river conditions particularly where the cable is affixed to the bridge on the downstream side.
- Approaches to a bridge are normally suitable for conduit installation.
- Expensive excavation of river beds etc. is not necessary.

Cables attached to bridges should be moisture barrier or polyethylene sheathed. Lead sheathed cables should be avoided and only used where a plastic jacket is provided to reduce the possibility of intercrystalline fracture of the lead due to the bridge vibration.

Avoid cable joints on the bridge structure wherever possible. Where joints are necessary locate them on the bridge supports or piers in order to minimise the effects of vibration

The method of securing the conduits to the bridge will depend upon the number of conduits and the type of bridge construction but in all cases adequate fixing brackets should be provided to support the weight of the ducts and future cables.

It is sometimes possible to arrange with the bridge Authority for the provision of conduits or channels in the footways during construction of the bridge.

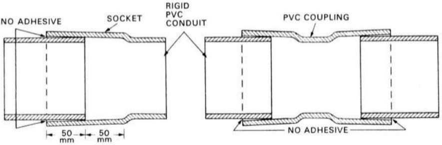
NOTE: The above conditions also apply to bridges across roads, railway lines etc.

CABLES AND CONDUITS ON BRIDGES (CONTINUED)

Where expansion joints are provided in the bridge structure, expansion joints should be allowed in the conduits at the same points.

For small expansion gaps with a movement of up to 40 millimetres, joints in PVC conduits should be made with the spigot end of one conduit inserted only half way into the socket of the next conduit allowing free movement in either direction. Adhesive is not applied to expansion joints.

Larger expansion gaps may be provided by the use of double ended PVC conduit couplings or by a close fitting sleeve over the conduit ends.



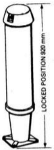
TYPICAL ARRANGEMENTS FOR EXPANSION JOINTS IN RIGID PVC CONDUITS
(Spigot ends of conduits inserted half way into sockets without adhesive)

SECTION K

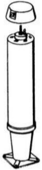
CABLE TERMINAL EQUIPMENT

- CABLE TERMINAL PILLARS
- CROSS CONNECTING CABINETS

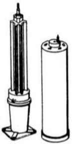
300 PAIR CABLE TERMINAL PILLAR



Locked Position



Cap off



Cover off

Terminal Unit, 100 pr

300 PAIR PILLAR TERMINAL, UNIT TYPE

The pillar will accommodate up to two 100 pair and two 50 pair terminal units which may be installed as required. Allocation of units to main and distribution cables can be varied to suit the layout required

CHECK FOR THE PRESENCE OF GAS BEFORE ENTERING MANHOLES

300 PAIR CABLE TERMINAL PILLAR-COMPONENTS

Item	Serial/ Item	Remarks
Pillar, 300 pr., unit type	430/50	Cast aluminium base and cover assembly. Order 100 and 50 pr, terminal units separately.
Terminal Unit, 100 pr., lead, 6 m	430/51	Cable tail 100/0.40 PILC, 6 metres
Terminal Unit, 100 pr., lead, 12 m	430/61	Cable tail 100/0.40 PILC, 12 metres
Terminal Unit, 100 pr., lead, 18 m	430/62	Cable tail 100/0.40 PILC, 18 metres
Terminal Unit, 100 pr., plastic, 6 m	430/52	Cable tail 100/0.40 Plastic, 6 metres
Terminal Unit, 100 pr., plastic, 12 m	430/63	Cable tail 100/0.40 Plastic, 12 metres
Terminal Unit, 100 pr., plastic, 18 m	430/64	Cable tail 100/0.40 Plastic, 18 metres
Terminal Unit, 50 pr., lead, 6 m	430/54	Cable tail 50/0.40 PILC, 6 metres
Terminal Unit, 50 pr., lead, 12 m	430/67	Cable tail 50/0.40 PILC, 12 metres
Terminal Unit, 50 pr., lead, 18 m	430/68	Cable tail 50/0.40 PILC, 18 metres
Terminal Unit, 50 pr., plastic, 6 m	430/53	Cable tail 50/0.40 Plastic, 6 metres
Terminal Unit, 50 pr., plastic, 12 m	430/65	Cable tail 50/0.40 Plastic, 12 metres
Terminal Unit, 50 pr., plastic, 18 m	430/66	Cable tail 50/0.40 Plastic, 18 metres
Terminal Unit, 50 pr., plastic, 6 m Additional Distribution	430/69	Cable tail 50/0.40 Plastic, 6 metres For use where more than 150 pairs are connected to plastic cable.
Terminal Unit, 50 pr., plastic, 18 m, Additional Distribution	430/71	Cable tail 50/0.40 Plastic, 18 metres For use where more than 150 pairs are connected to plastic cable.
Ring, Pillar Base Sealing	430/55	For replacement purposes.
Ground Gasket Malthoid	430/77	For sealing between pillar base and concrete footing.

PILLAR TERMINAL COMPONENTS

HANDLING TERMINAL UNITS:

To avoid damage to epoxy resin terminal block and cable during transport, do not unpack units from the factory pack until delivered to the pillar site for installation.

SELECTING SITE FOR TERMINAL PILLAR

LOCATION ON FOOTPATH

Choose a site for the pillar where :

- It will not be a dangerous obstruction to pedestrians.
- It will not be damaged by vehicles.
- It will least spoil the appearance of its surroundings.

Generally the most suitable position will be close to the property line.

Where there are wide footpaths and nature strips the pillar may be installed in the nature strip at least 600 mm from the kerb or if there is a line of trees it may be installed on this line provided it is at least 600 mm from the kerb.

Principles for siting of pillars close to the property line or in the nature strip will normally be the subject of agreement with the local authority for the area and local instructions will be issued by the Sectional Engineer.

LOCATION WITH RESPECT TO MANHOLE OR JOINTING PIT

Select the location of the pillar to permit the most satisfactory "flow" of main and distribution cables in the manhole or pit. Entry at a corner of the manhole is generally most suitable.

LOCATION AT STREET CORNERS

When selecting the site take into account any likely alterations to road alignments or levels which could necessitate shifting of the pillar at a later date.

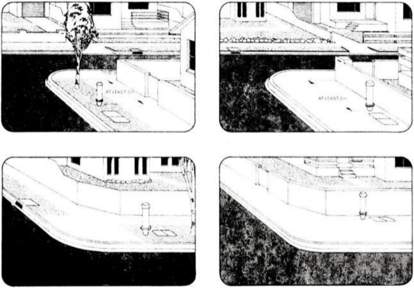
Locate pillar where it will not be subject to disturbance in the event of truncation or rounding of the corner (see Page K-4).

INSTALLING PILLAR IN MANHOLE

The pillar may be installed in a manhole in cases where it cannot be safely or conveniently located on the surface. The manhole must be effectively drained to ensure that dry conditions for the pillar are maintained.

USE THE CORRECT KEY TO LIFT MANHOLE COVERS. OBTAIN ASSISTANCE TO LIFT HEAVY COVERS.

INSTALLING TERMINAL PILLAR AT STREET CORNER



Keep the pillar at least 3 metres back from the junction of the building lines or if the corner is already rounded install it clear of the offset section as shown above.

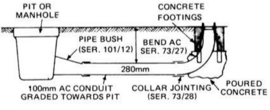
Issue 4, 1980

INSTALLING CONDUIT AND PILLAR FOOTING

Lay a 100 mm conduit between joint chamber and pillar. Conduit should drain towards the manhole or pit. Fit a 100 mm AC Bend (S73/27) to the pillar end of the conduit.
Place concrete around the conduit bend to within 200 mm of ground level.
Fit Precast Footing (S99/22) over the end of the conduit bend and work into its final position. Take care to ensure that the bolts are correctly placed and that the top surface is level.
Alternatively a 400 mm x 400 mm poured concrete base 230 mm deep may be provided.

MOUNTING PILLAR

Fit a 150 mm square malthoid gasket (S430/77) between the pillar and the concrete footing.
So that the terminal units will face the correct direction to allow free access to the tags, place the rear edge of the pillar base towards the property when the pillar is installed at the property line. On nature strips place this edge on the kerb side. The word REAR is embossed on the base of the pillar.



INSTALLING CONDUIT AND PILLAR FOOTING

INSTALLING 300 PAIR CABLE TERMINAL PILLAR

REMOVING AND REPLACING PILLAR COVER

The standard key fits all pillar terminals and cabinets.

To remove the cap, turn key in lock and spin the cap off. The key cannot be removed from the unlocked cap.

Unscrew captive nut on cover until cover is raised sufficiently to return sealing ring to its recess in the base. Then turn cover by hand until the thread disengages.

Lift cover clear of pillar and place it where sealing surfaces cannot be damaged.

Before replacing cover, check that the interior is clean and dry and sealing ring is correctly located in its recess.

Tighten the captive nut with a spanner to draw the cover down to the sealed position.

Check that the key is in the unlocked position before replacing the cap.

ARRANGEMENT OF UNITS IN PILLAR

Units are fitted so that main and distribution units alternate. Viewed from above the cable entry holes are allocated anticlockwise as follows :

Small hole - 50 pr. Unit, Plastic cable - Distribution.

Large hole - 100 pr. Unit, Lead or plastic cable - main.

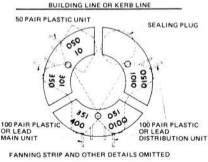
Large hole - 100 pr. Unit, Lead or plastic cable - Distribution.

Small hole - 50 pr. Unit, Lead cable for Main, or plastic cable for Distribution.

The 100 pr. lead and plastic units are identical and can be used in either large hole.

The 50 pr. lead and plastic units are different and can only be used in the correct hole.

"Additional" 50 pr. plastic units fit in the lead cable hole.



TYPICAL ARRANGEMENTS OF UNITS

FITTING UNITS

- Remove cap and cover from pillar.
- Remove appropriate fanning strip assembly by loosening the clamping plate.
- Remove sealing plug from appropriate cable entry hole. Return plug to store as scrap.
- If necessary provide a draw-wire from the cable entry hole to the joint chamber.
- Remove terminal unit from its carton and check that the sealing ring is in position on ferrule at bottom of unit. Thread or pull the cable tail from the pillar into the manhole or pit. Square the terminal unit by turning the cable and unit AS A WHOLE. Embossed lines on the base indicate the correct location. Extreme care is necessary to avoid damage to the seal between the epoxy block and cable sheath.
- Wipe surface of cable entry hole to ensure that it is clean and dry.
- Press terminal unit squarely and firmly into position so that the sealing ring rolls evenly between the aluminium ferrule and the walls of the cable entry hole and is compressed to form an effective seal. The cable tail or unit must not be twisted after the unit has been pressed into position. If a slight adjustment in position is necessary, raise unit about 20 mm until the sealing ring is free, then turn both unit and cable tail.
- Remove the two fixing screws from inserts in terminal unit, replace fanning strip and tighten clamping plate. Secure unit to fanning strip with the two screws.
- When the second 50 pr. unit is installed after the first 50 pr. unit is in use the jumpers make complete removal of the fanning strip impracticable. The new unit can, however, be installed by loosening locating screw and moving fanning strip aside.
- Push cable tails back onto bend of footing so that it will be easier to install the next unit.

JOINTING CABLE TAILS AND JUMPERING

Refer Linemen's Handbook, Cable Jointing No 1.

120 AND 180 PAIR CABLE TERMINAL PILLARS

The 120 pair (40+80) and 180 pair (60+120) pillars have been superseded by the 300 pair unit type pillar but many are still in service.

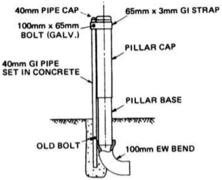
RECOVERY OF COMPONENTS

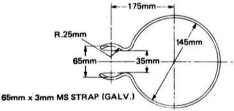
When pillars are replaced return components such as caps, canisters, wing nuts and bolts to the store to be held for maintenance purposes.

USE OF PILLAR SUPPORT

Where pillars are installed in areas where children congregate to play, or in places where people lean on them e.g. near bus stops, faults may occur due to fracture of the cable tails caused by movement of the pillar in the ground.

In such cases installation of a support post as illustrated effectively limits movement of the pillar and provides protection against deliberate vandalism.



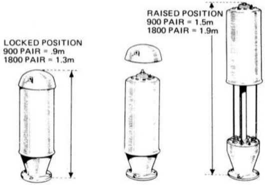


CABLE TERMINAL PILLAR SUPPORT

900 AND 1,800 PAIR CROSS-CONNECTING CABINETS

CONSTRUCTIONAL DETAILS

Both 900 and 1800 pair cabinets are cylindrical and are the same diameter.
The same bases and caps are used in both cabinets but the 1800 pair cover is 410 mm longer than the 900 pair cover.
All caps are fitted with identical locks.
Removal of the cap gives access to a captive nut which when unscrewed allows the cover to be raised. It is automatically latched and held in the raised position.
The cabinets will accommodate up to nine terminal units (100 pair for 900 pair cabinet and 200 pair for 1800 pair cabinet) to provide the combination of main and distribution pairs required.
Units may be added or removed as desired.



. Locked . Cap off . Cover Raised

900 PAIR CROSS CONNECTING CABINET

CROSS-CONNECTING CABINETS - COMPONENTS

Item	Serial/ Item	Remarks
Cabinet, Cross-Connecting 900 pr. Unit Type	430/9	Cast aluminium base and cover assembly supplied with sealing plugs, sealing rings identification labels and 150 mm asbestos cement bend. Order terminal units separately.
Terminal Unit 100 pr. lead, 6 m tail	430/12	For use in 900 pr. cabinet. Cable tail 100/0.40 PIUT, 6 m long.
Terminal Unit 100 pr. lead, 12 m tail	430/37	Cable tail 100/0.40 PIUT, 12 metres long
Terminal Unit 100 pr. lead, 18 m tail	430/38	Cable tail 100/0.40 PIUT, 18 metres long.
Terminal Unit 100 pr. plastic, 6 m tail	430/23	Cable tail 100/0.40 plastic, 6 metres long.
Terminal Unit 100 pr. plastic, 12 m tail	430/41	Cable tail 100/0.40 plastic, 12 metres long.
Terminal Unit 100 pr. plastic, 18 m tail	430/42	Cable tail 100/0.40 plastic, 18 metres long.
Cabinet, Cross-Connecting 1800 pr. Unit Type	430/10	Cast aluminium base and cover assembly supplied with sealing plugs, rings, identification labels and 150 mm asbestos cement bend. Order terminal units separately.
Terminal Unit 200 pr. lead, 6 m	430/21	Cable tail, 200/0.40 PIUT, 6 metres long.
Terminal Unit 200 pr. lead, 12 m	430/39	Cable tail, 200/0.40 PIUT, 12 metres long.
Terminal Unit 200 pr. lead, 18 m	430/40	Cable tail, 200/0.40 PIUT, 18 metres long.
Ground Gasket Malthoid	430/76	For sealing between cabinet base and concrete footing.

SELECTING SITE FOR CROSS-CONNECTING CABINET

LOCATION ON FOOTPATH

Subject to agreement of the local authority, apply the following guiding principles :

Where there is an established footway and a nature strip at least 1.5 metres wide :

Install cabinet in the nature strip at least 600 mm from the edge of the footway. Where there is a pole line or street line place cabinet on this line provided it is at least 600 mm from the kerb.

If there is no established footway or the nature strip is less than 1.5 m wide

Install cabinet approx. 600 mm from the kerb.

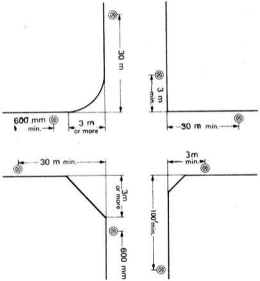
At street corners

Keep cabinets well clear of corners to allow for future widening or splaying. Place them at least 30 metre from the corner of the left side, looking away from the corner, as vehicles making right hand turns sometimes run off the left hand side of the road shortly after turning.

Do not locate the cabinet where it is a dangerous obstruction to pedestrians, where it may be damaged by vehicles or where it spoils the appearance of its surroundings.

LOCATION WITH RESPECT TO JOINTING CHAMBER

Place cabinet in a position which permits satisfactory "flow" of cables in the jointing chamber. Where the cabinet cannot be installed on the surface it may be placed in an effectively drained manhole.



SITES AT STREET CORNERS

INSTALLING 900 AND 1,800 PAIR CROSS-CONNECTING CABINETS

INSTALLING CABINET FOOTING AND CONDUIT

Construct a concrete footing around the 150 mm AC pipe bend. The surface must be level to ensure that the cabinet will be vertical.

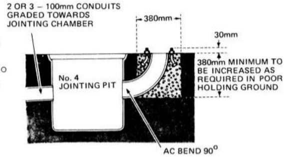
Use a template to set the holding down bolts (12 mm x 150 mm) in the correct position.

Provide a No. 4 pit at the cabinet footing to facilitate installation of the tail cables.

Lay two or three 100 mm conduits to the manhole or No. 6 or 7 jointing pit.

Alternatively AC troughing may be laid or a concrete race constructed between the bend and the manhole.

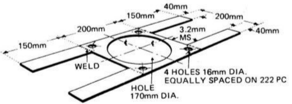
Where the cabinet is within 1 metre of a manhole a concrete bell may be constructed for the cable entry.



TYPICAL INSTALLATION

MOUNTING CABINET

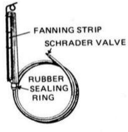
Place a malthoid gasket (S430/76) with 165 mm diameter centre hole and 4 holes for mounting bolts between cabinet base and concrete. The cap and cover of the cabinet need not be removed when bolting down as it is immaterial which way the cabinet faces.



TEMPLATE FOR FOOTING

FITTING TERMINAL UNITS

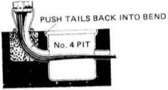
. Remove cap and take cover right off cabinet. Keep the cover clean and do not allow sealing surfaces to be damaged or interior to become damp.
. Determine entry holes for terminal units. Alternate main and branch units around the base in an anticlockwise direction starting from the lowest reading branch unit (normally opposite the kerb line) followed by the lowest reading main unit, etc.
. Remove sealing plugs from the cable entry holes. Return plugs to Store as scrap metal.
. Remove the guard wires if any are fitted in the positions to be used.
. Clean and dry the surfaces of cable entry holes.
. Remove terminal unit from box. Check that sealing ring is in position on the bottom of the unit and that the jumper guard/fanning strip is firmly screwed to the unit.
. Thread or pull cable tail from cabinet to manhole. Use a draw wire if necessary. Square the terminal unit by turning both the unit and the tail. The embossed lines on the cabinet base indicate the correct location. Use extreme care when squaring the unit or the seal between the epoxy terminal block and the cable sheath will be broken thus allowing moisture to enter the tail cable.



TERMINAL UNIT 100 PAIR LEAD

FITTING TERMINAL UNITS (CONT'D)

- Press terminal unit firmly into position so that the sealing ring rolls evenly between the ferrule and the sides of the cable entry hole and is compressed to form an effective seal.
- Check that the unit is correctly positioned. Do not attempt to twist terminal block after it has been pressed into position. If adjustment is necessary raise unit about 25 mm until ring is free and then turn both block and cable tail.
- Remove split pin from jumper guard/fanning strip, insert wire into the support plate at top of the centre column and refit the split pin.
- Push cable tail into the rear of the bend in the cabinet footing, so that it will be easier to install the next unit.



INSTALLING TAIL CABLES

- Repeat above steps for all other terminal units.
- Place cable tails under 70 kilopascals gas pressure.
- Refit guard wires in any remaining unoccupied positions. These will prevent the cover contacting the tags or damaging jumpers.
- Place a bag of silica gel inside cabinet.
- Replace the cover and cap on the cabinet.

JOINTING CABLE TAILS, JUMPERING, ETC

Refer Linemen's Handbook, Cable Jointing No 1.

Issue 4, 1980

REFERENCES

E.I. LINES Cables TC 3201
Cross Connecting Cabinets 900 Pair and 1800 Pair

E.I. LINES Cables TC 3301
Cable Terminal Pillar 300 pair unit type

SECTION L

SMALL SIZE CABLES

- SMALL SIZE CABLES
- TYPES AND SIZES AVAILABLE
- EXTERNAL DIAMETER OF CABLES
- MASS OF CABLES

NOTE: ONLY USE PAPER INSULATED CABLES WHERE THEY CAN BE EFFECTIVELY KEPT UNDER AIR PRESSURE

CABLE TYPES

Serial	Type of Cable	Abbrev.	Use
460	Paper Insulated, Unit Twin	PIUT	Subscribers distribution and rural junction cable.
463	Paper Insulated Aluminium Unit Twin	APIUT	Subscribers distribution and rural junction cable.
465	Polyethylene Insulated, Unit Twin	PEIUT	Preferred type for urban subscribers distribution.
467	Cellular Polyethylene Insulated Filled Core, Unit Twin	CPFUT	Preferred type for rural, subs and junction cable.
490	Polyethylene or Cellular Polyethylene unit twin Insulated Lead-in	PEIQLI CPFQLI	2 Pair Lead-in to subs premises
491	Paper, polyethylene or PVC Insulated Tail Cable	PIUT PISUT	Pillar tails, lead-plastic jointing loading coil tails.

CABLE TYPES CURRENTLY AVAILABLE

NOTE: Cables up to 100 pair (excluding carrier cables) are classed as Small Size, 150 pair and over as Large Size.

CONDUCTOR SIZES Soft copper - 0.40 mm, 0.64 mm, 0.90 mm (0.50 conductor cable is obsolete).

CONDUCTOR INSULATION Conductors are insulated with paper (helically or longitudinally applied), polyethylene or PVC (See page G-2). PVC is used only in some tail cables.

SHEATH TYPES PIUT cables normally have moisture barrier or polyethylene jacketed lead sheath. PEIUT cables have polyethylene sheaths. CPFUT cables have moisture barrier sheath construction.

SHEATH PROTECTION See page G-4 for types of sheath protection and their application.

SMALL SIZE CABLES - SHEATH CODE NUMBERS

Sheath Code	Type of Cable Sheath and Protection	Abbrev. Title
14**	Alloy Lead, Polyethylene Jacketed	APJ
16**	Alloy Lead, Steel Tape Armoured - replaced by Item 18	AST
18**	Alloy Lead, Steel Tape Armoured, Polyethylene Jacketed	ASTPJ
22**	Alloy Lead, Light Wire Armoured, Polyethylene Jacketed	LWPJ
25**	Alloy Lead, Heavy Wire Armoured	HW
26**	Alloy Lead, Heavy Wire Armoured, Polyethylene Jacketed	HWPJ
27**	Alloy Lead, Double Wire Armoured	DW
31**	Alloy Lead, Polyethylene Jacketed, Steel Tape Arm'd, Polyethylene Jacketed	PJSTPJ
32**	Alloy Lead, Polyethylene Jacketed, Light Wire Arm'd, Polyethylene Jacketed	PJLWPJ
38*	Alloy Lead, Polyethylene Jacketed, Hard Plastic Jacketed	APJHJ
50*	Polyethylene	PE
51*	Aluminium Screen, Polyethylene	ASPE
52*	Aluminium Screen, Polyethylene, Integral Bearer	IB
53*	Polyethylene, Hard Plastic Jacketed	PEHJ
56*	Polyethylene, Light Wire Armoured, Polyethylene Jacketed	PELWPJ
57*	Aluminium Screen, Polyethylene, Integral Bearer (Heavy Wire)	IBH
59*	Polyethylene, Aluminium Screen, Hard Plastic Jacketed	PEASHJ
60*	Polyethylene, Copper Screen, Polyethylene Bed., Light Wire Arm'd, Polyethylene Jacketed	CSLWPJ
61*	Polyethylene, Copper Screen, Polyethylene Bed., Double Wire Arm'd, Polyethylene Jacketed	CSDWPJ
70*	Moisture Barrier	MB
71**	Polyethylene, Moisture Barrier	PEMB
74*	Moisture Barrier, Hard Plastic Jacketed	MBHJ

SMALL SIZE CABLES - SHEATH TYPES AVAILABLE

NOTE: A full list of sheath code numbers is given on pages G-8 and G-9.

Cable Size	Core Code No.	Sheath Types Normally Available - Code No.		
		PIUT Serial 460	PEIUT Serial 465	CPFUT Serial 467
10/0.40	**21	14	50,52,53	50,53
20/0.40	**22	14	50,52,53	50,53
30/0.40	**23	14	50,52,53	50,53
50/0.40	**24	14,71	50,52,53	50,53
70/0.40	**25	14,71,72	50,52,53	50,53
100/0.40	**26	14,70,71,72	50,52,53	50,53
6/0.64	**40	-	50,53,80	70,74
10/0.64	**41	14,38,76	50,52,53,80	70,74
20/0.64	**42	14,38,75,76	50,52,53,80	70,74
30/0.64	**43	14,38,71,72,75	50,52,53,80	70,74
50/0.64	**44	14,38,71,72,75	50,52,53,80	70,74
70/0.64	**45	14,38,71,72,75	50,52,53,80	70,74
100/0.64	**46	14,38,70,71,72,75,76,77	50,52,53,80	70,74

SMALL SIZE CABLES - 0.40 mm AND 0.64 mm CONDUCTORS
Cable sizes are shown as Number of Pairs/Conductor Diameter in Millimetres e.g. 100/0.64.

SMALL SIZE SUBS CABLE - SIZES AVAILABLE

Cable Size	Code Code No.	Sheath Types Normally Available - Code No.		
		PIUT Serial 460	PEIUT Serial 465	CPFUT Serial 467
6/0.90	**60		50,53	70,74
10/0.90	**61	14,38,75,76	50,52,53,56	70,74
20/0.90	**62	14,38,71,72,75,76	50,52,53,56	70,74
30/0.90	**63	14,38,71,72,75,76	50,52,53	70,74
50/0.90	**64	14,38,71,72,75,76	50,52,53	70,74
70/0.90	**65	14,38,71,72,75,76	50,52,53	70,74
100/0.90	**66	14,70,71,72,75,76,77	50.53	70,74

SMALL SIZE CABLES - 0.90 mm CONDUCTORS

NOTES:

1. Cable sizes are shown as Number of Pairs/Diameter of Conductors in Millimetres, e.g. 100/0.40, 70/0.90 etc.

2. Sheath type code numbers are listed on page L-2.

CHECK WOODEN CABLE DRUMS CLOSELY FOR NAILS OR PROTRUDING FASTENINGS WHICH COULD CAUSE INJURY WHILE UNWINDING CABLE.
ACCIDENTS DO NOT JUST HAPPEN - THEY ARE CAUSED BY NEGLECT OR IGNORANCE.

SMALL SIZE CABLES - EXTERNAL DIAMETER

NO. OF PAIRS	MAXIMUM EXTERNAL DIAMETER CONDUCTORS 0.40 mm APJ	MB	PEMB	0.64 mm APJ	MB	PEMB	0.90 mm APJ	MB	PEMB
10	14	-	16	17	-	19	20	-	22
20	16	-	18	20	-	22	25	-	27
30	18	-	20	22	-	24	28	-	30
50	20	-	22	25	-	27	33	-	35
70	22	-	24	28	-	30	38	-	40
100	25	24	27	32	32	34	44	41	46

MAXIMUM EXTERNAL DIAMETER OF PIUT CABLES
SERIAL 460

CABLE SIZE	CORE CODE	SHEATH TYPE	MAX EXTERNAL DIAMETER (mm)
100/0.52	**26	70**	25
100/0.81	**46	70**	35
100/1.15	**66	70**	48

MAXIMUM EXTERNAL DIAMETER OF APIUT CABLES
SERIAL 463

NO. OF PAIRS	MAXIMUM EXTERNAL DIAMETER CONDUCTORS 0.40 mm S465	S467	0.64 mm S465	S467	0.90 mm S465	S467
6	7.9	7.9	10.2	13.0	13.8	16.6
10	9.2	9.2	12.0	15.1	15.9	19.4
20	11.2	11.2	15.8	19.7	21.3	25.5
30	13.2	13.2	18.8	22.5	26.4	28.8
50	16.0	16.0	23.9	26.5	32.8	34.8
70	18.8	18.8	28.0	30.0	39.4	39.8
100	22.4	22.4	33.3	34.0	46.2	46.2

MAXIMUM EXTERNAL DIAMETER OF CPFUT (S467) MOISTURE BARRIER SHEATH CABLE AND PEIUT (S465) POLYETHYLENE SHEATH CABLE

PLAN YOUR WORK SO THAT IT WILL BE DONE WITH THE MINIMUM AMOUNT OF OBSTRUCTION AND INCONVENIENCE TO OTHER PEOPLE.
CLEAN UP PROPERLY WHEN THE JOB IS COMPLETED. ENDEAVOUR TO LEAVE THE JOB SITE AT LEAST AS TIDY AS IT WAS BEFORE THE WORK WAS COMMENCED.

MASS OF SMALL SIZE PLASTIC CABLES

No. Of Pairs	Mass of Cables In Kilograms Per Kilometre								
	0.40 mm Conductor			0.64 mm Conductor			0.90 mm Conductor		
	PE	IB	PEHJ	PE	IB	PEHJ	PE	IB	PEHJ
6	-	-	-	70	145	85	125	195	140
10	55	125	65	105	185	125	190	280	210
20	100	175	115	205	280	225	390	500	425
30	135	205	155	300	405	330	575	690	615
50	205	280	230	485	595	520	955	1130	1005
70	290	395	320	675	845	720	1325	1505	1385
100	415	520	445	955	1130	1005	1865	2120	1935

AVERAGE MASS OF PLASTIC CABLES, PEIUT, SERIAL 465

Abbreviations:

PE - Polyethylene
IB - Polyethylene, Integral Bearer
PEHJ - Polyethylene, Hard Plastic Jacketed

THE ARROW STENCILLED ON THE FLANGE OF A CABLE DRUM SHOWS THE DIRECTION IN WHICH IT SHOULD BE ROLLED.

MASS OF SMALL SIZE LEAD CABLES

No. Of Pairs	Mass of Cables In Kilograms Per Kilometre								
	0.40 mm Conductor			0.64 mm Conductor			0.90 mm Conductor		
	MB	APJ	*PEMB	MB	APJ	*PEMB	MB	APJ	*PEMB
10	-	390	-	-	545	-	-	785	-
20	-	540	-	-	780	-	-	1195	-
30	-	635	-	-	955	-	-	1520	-
50	-	800	-	-	1285	-	870	2190	-
70	-	960	-	615	1620	-	1180	2830	-
100	410	1180	-	860	2095	-	1630	3750	-

* MASS OF PEMB CABLES CURRENTLY NOT AVAILABLE

AVERAGE MASS OF PAPER INSULATED (PIUT), SERIAL 460

NOTE:
- The actual mass of drum of cable is shown on the cable identification plate.
- The mass of empty cable drums is shown on page G-17.
- Methods of handling and transporting drums of cable are described on pages G-18 to G-20.

AVOID LEAD POISONING. AFTER HANDLING LEAD CABLES WASH YOUR HANDS AND FACE THOROUGHLY BEFORE EATING A MEAL OR ROLLING OR SMOKING A CIGARETTE.

MASS OF SMALL SIZE PLASTIC CABLES

No. Of Pairs	Mass of Cables in Kilograms Per Kilometre			
	0.64 mm		0.90 mm	
	MB	MBHJ	MB	MBHJ
6	120	138	195	218
10	169	191	293	320
20	293	320	524	559
30	407	439	749	791
50	633	672	1229	1281
70	857	901	1619	1677
100	1156	1211	2259	2327

AVERAGE MASS OF CELLULAR, POLYETHYLENE INSULATED FILLED CORE, UNIT TWIN CABLES, CPFUT, SERIAL 467

SECTION M

DISTRIBUTION CABLES

- DESIGN
- INSTALLING DISTRIBUTION CABLES
- EXCAVATING TRENCHES
- SHARING TRENCHES WITH POWER AUTHORITY

DISTRIBUTION CABLES - DESIGN

DISTRIBUTION SYSTEMS

Fully Underground System. Underground cables, normally in pipe, are provided on both sides of the street and are tapped where direct leads to customers are required. In residential areas jointing pits are installed on every second property line to enable a lead-in cable to be provided for each customer. Pipes may be installed in the section of footpath allocated for Telecom plant or in a common trench with power cables.

Underground Cable with Isolated Terminal Poles (I.T.P.'s). Underground cables, normally terminal boxes which are mounted on poles. The poles may be either Telecom or JOINT USE power poles. Selected cable pairs are terminated in each box and connection to customers on both sides of the street is made by drop wire.

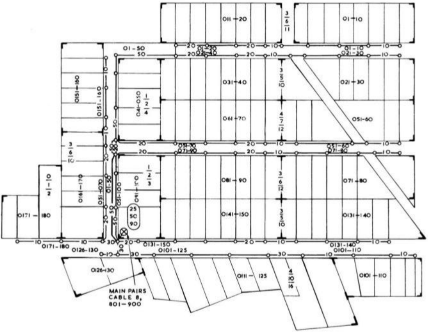
Aerial Cable with Isolated Terminal Poles. Aerial cable is erected on poles (either Telecom or Joint Use power poles) on one side of the street. The cable is looped through untailed terminal boxes, normally fitted on each pole and connected to customers on both sides of the street by drop wire. Full details of this type of construction are given in the Linemen's Handbook, Aerial Lines.

DISTRIBUTION AREA LAYOUT

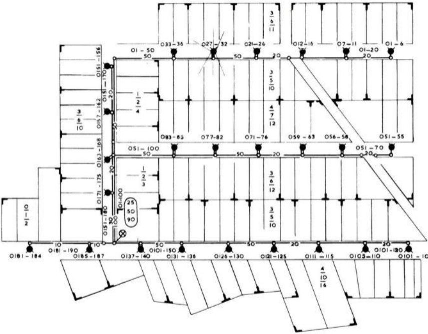
The cable layout for new areas such as housing estates is prepared in the Sectional Office when the area is sub-divided so that the method of construction, cable sizes and route can be properly co-ordinated. Reference to this plan enables the correct cable to be installed progressively in accordance with the demand for service.

IF YOU OBSERVE ANY FAULTY OR DANGEROUS PLANT, FOR EXAMPLE BROKEN OR MISSING JOINTING PIT COVERS, MAKE IT SAFE IF POSSIBLE THEN INFORM YOUR SUPERVISOR OR LINES OFFICER IMMEDIATELY.

DISTRIBUTION CABLES



TYPICAL DISTRIBUTION AREA LAYOUT - FULLY UNDERGROUND CABLE



TYPICAL DISTRIBUTION AREA LAYOUT - UNDERGROUND CABLE SERVING I.T.P.'s

CABLE TYPE

Unprotected plastic cable is normally used for distribution cables except in areas where ant or termite attack is prevalent. Hard jacketed plastic cable is usually laid in such cases but in some areas where insect attack is severe, armoured cable may be used. Details of cable types, their application and the sheath protection available, are given in Section L.

CONDUCTOR DIAMETER

To ensure that transmission and signalling standards are met, the correct conductor diameter must be used.

In metropolitan areas 0.40 mm conductor will generally predominate but in the outlying sections of an exchange area 0.64 mm and 0.90 mm conductor may be necessary to meet transmission and signalling limits.

CABLE SIZE

To permit services to be connected with a minimum of cable replacement or rearrangement for a period of at least 20 years, cables in residential areas are provided on the basis of 1, 1.25 or 1.5 pairs per house or building block according to the type of area and the likely telephone density. Cable for business, industrial and flat areas is normally provided on a basis of 1.5 times the 20 year telephone survey figure.

The number of cable pairs required is calculated as above and the next available size above the requirement is installed.

Underground cables which are to be looped up isolated terminal poles are limited to 50 pair.

Details of small size cables and their Serial and Item numbers are given in Section L.

THE BEST SAFETY DEVICE IS COMMON SENSE - USE IT

USE OF PIPE FOR DISTRIBUTION CABLES

Urban Areas - Pipes are installed to accommodate all plastic underground cable in urban areas.

Lead-in Cables - Pipe must be provided in all cases.

Cables Laid Beneath Paved Surfaces or Across Roads - Pipe must be provided in all cases.

Cables in Trenches Shared with Other Services - Pipe must be provided in all cases.

Cables on Buildings or Structures such as Bridges etc. - Pipe should be provided to protect the cable from mechanical damage where necessary.

Rural Areas - Cable will normally be buried directly in the ground except for the situations described above and any other locations where pipe is necessary for protection against mechanical damage.

The types and sizes of pipe available and methods of installation are described in Section N.

USE OF JOINTING PITS

Jointing pits should be installed for the following purposes:

- To accommodate cable joints.
- To accommodate slack cable left for future jointing.
- To accommodate pipe at branches in the route and at severe changes in direction or levels.
- As surface markers to indicate the location or turning point of cable.

The types and sizes of jointing pit available and methods of installation are described in Section O.

LOCATION ON FOOTWAYS:

The allocation of footpath space for services is usually fixed by local agreement between the various Authorities. In these areas Telecom pipes and cables must be installed within the space allotted. Distribution cables should be installed to one side of the allocated area to allow for future installation of conduits should they become necessary.

Where there is no agreed allocation of footpath space, distribution cables should be installed on an alignment where they will not interfere with other services and are least likely to be disturbed or damaged by subsequent paving or footpath installation or maintenance operations. For fully underground cable distribution, a position close to the property line is most suitable while cables serving I.T.P.'s are best laid close to the kerb but clear of poles and trees.

Whenever practicable, excavation and reinstatement of expensively paved surfaces should be avoided. Use horizontal borers or pipe pushers to install pipes under roads and driveways etc.

In cases where cable exists in a street, cable extensions should preferably be laid on the same footpath alignment.

LOCATION ON PRIVATE PROPERTY:

Choose a direct route to the point of entry to the building which will ensure freedom from disturbance or damage by future building operations, driveway and path construction etc.

Consult the owner or occupier of the premises regarding the location of service pipes and other likely obstructions and get details of any proposed works. Obtain his concurrence in the proposed route.

Where the cable being laid on private property is not to provide service to the owner or occupier of the premises Form E717A "Advice of Construction on Private Property" must be sent to the owner advising him of Telecom's intention.

Whenever practicable, avoid crossing gardens but if this is necessary, choose a location and depth (300mm minimum cover) where the cable will not be damaged by garden tools, stakes etc.

For further details regarding construction on private property see page C-2.

EXCAVATING TRENCHES FOR DISTRIBUTION CABLES

PRELIMINARY ACTION BEFORE COMMENCING EXCAVATION

Determine the location and depth of other Authorities services in the line of the proposed trench by enquiry from the authorities concerned and where necessary by digging pilot holes.

Obstacles in footways may be indicated by drain outlets in gutters, gas and water meters or pipes on private property, manhole covers, drain gratings, stopcocks and special markers.

The use of a pipe locating instrument will assist in determining the precise position of metallic pipes or cables.

At least 14 days notice must be given to the authority concerned of the intention to excavate on public property. (See page B-1 for details of Form E717A procedure).

SAFETY PRECAUTIONS WHEN EXCAVATING

When laying out tools and material select positions which will not endanger vehicular or pedestrian traffic.

Guard all excavations by barrier posts, rails or manhole guards and provide appropriate warning lights at night.

Place road warning notices in prominent positions to warn traffic where there is any danger. Control traffic by flagmen where necessary.

Keep well clear of moving parts when working with ditching machines and other mechanical aids.

When excavating near power cables observe diligently the special precautions set out on page C-8.

Protect yourself against injury by wearing the proper clothes, footwear and safety aids.

If the walls of a trench contain glass, wire or other sharp objects remove them carefully and promptly.

See Section C for other safety precautions and action necessary to preserve good relations with other authorities and the general public.

EXCAVATING TRENCHES FOR DISTRIBUTION CABLES

MACHINE EXCAVATION OF TRENCHES

Ditching machines should preferably be used for the excavation of trenches providing soil conditions and the terrain are suitable.

Small size pipes and cables can be installed in a trench about 100 mm in width and trenching machines should be fitted to cut to this width.

In difficult excavating conditions a compressor and associated pneumatic tools will be required.

Do not use ditching machines or pneumatic tools close to power cables.

HAND EXCAVATION

Hand excavation may be necessary for lead-in cables and for street cables where soil conditions or obstructions etc. do not permit machine excavation, or where suitable machines are not available.

Use a 100 mm wide trenching shovel (S112/24) to remove soil from the narrow trench.

Hand excavation is essential when trenching close to power cables. Use only wooden handled tools until the power cables have been fully exposed. (See page C-7).

EXCAVATING PAVED SURFACES

To avoid trenching across sealed roads, concrete driveways and similar obstructions use horizontal boring or pipe pushing machines (See page D-1) provided soil conditions are suitable and space is available to manoeuvre the machine and pipes.

Pneumatic pavement breakers are necessary to cut road or paved footway surfaces where boring equipment cannot be used.

Use a concrete saw (See page B-3) to provide a straight edge on either side of the trench line so that concrete can be reinstated neatly.

KEEP CLEAR OF MOVING PARTS WHEN WORKING WITH DITCHING MACHINES AND OTHER MECHANICAL AIDS.

DEPTH OF COVER OF CABLE AND PIPE IN URBAN AREAS

To protect distribution cables against mechanical damage the following minimum depths of cover must be provided:-

Footways	- 450 millimetres (Where shallow rock or other obstacles are encountered a reduced cover of 300 mm may be permitted for cable in pipe).
Road Crossings	- 450 millimetres below the drain invert. (For unsealed roads a cover of at least 600 mm should be aimed at to avoid interference through subsequent road grading, drainage and other maintenance operations).
Private Property	- 300 millimetres.

It should be noted that these depths are minimum only and where any particular hazard exists the cables must be laid at sufficient depth to avoid damage.

In determining the depth of cover in unmade footpaths and roads, due allowance must be made for any likely change in surface level when the permanent footpath or road is constructed. Details of proposed final levels should be obtained from the local authority responsible for footpath and road construction.

Depths for cables installed in a common trench with power cables are given on page M-15.

DEPTH OF COVER FOR BURIED CABLES IN RURAL AREAS - See page Q-2.

EXCAVATING IN SHOPPING AREAS

Organise the job so that it is completed as quickly as possible and with the minimum inconvenience to the public. Arrange for prompt reinstatement of footpath surface.

Guard all excavations with barrier posts and rails and provide temporary bridges across the trench at suitable positions. Leave a passageway for pedestrians.

Observe the other precautions listed on Page C-4.

EXCAVATING IN LAWNS

When excavating trenches in lawns, first soak the lawn thoroughly to facilitate removal of turfs.

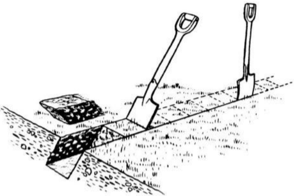
Cut out the turfs in squares using a garden spade and preserve them carefully for subsequent replacement.

In dry hot weather cover the turfs with bags or a tarpaulin to prevent drying out.

Ram the backfilled soil well and finish level with the lawn surface when the turfs have been replaced.

Water the replaced turfs on completion of reinstatement.

Remove paving stones with care to avoid breakage or chipping of the edges.



USE OF SPADE TO REMOVE TURFS

ORNAMENTAL GRAVEL AND PEBBLE PATHS AND DRIVEWAYS

Carefully remove gravel or pebbles and put in a heap far enough away from the trench to prevent it becoming mixed with the excavated soil. Replace in position after back-filling and ramming the trench.

CONCRETE SLABS

Lift slabs wherever practicable, taking care to avoid damage to the edges. Carefully reset in position when reinstating the trench.

TAKE CARE NOT TO DAMAGE GARDENS, SHRUBS, TREES ETC.
CLEAN UP PROPERLY AND LEAVE THE JOB SITE IN A NEAT AND TIDY CONDITION.

SHARING TRENCHES WITH POWER AUTHORITY

AGREEMENT WITH POWER AUTHORITY

Conditions for the sharing of common trenches with a Power Authority for the installation of distribution cables are arranged by local agreement. Details setting out the agreement are published in the Code of Practice and Recommendations, titled Sharing of Trenches. This publication is available from your State Distribution Officer. Telecom pipes are normally installed by the Power Authority in conjunction with the laying of power cables but other arrangements are permitted. The footpath alignment utilised may be either that of Telecom or the Power Authority according to the terms of the agreement.

POWER AUTHORITY PLANT

Power cables which may be laid in a common trench consist of High Voltage (HV) Distribution Cables (max. 22kV), Low Voltage (LV) Supply Mains, Street Light Cables, Lead-In Cables and Pilot Cables. Joint enclosures (underground pits or aboveground cabinets) are provided as required.

TELECOM PLANT

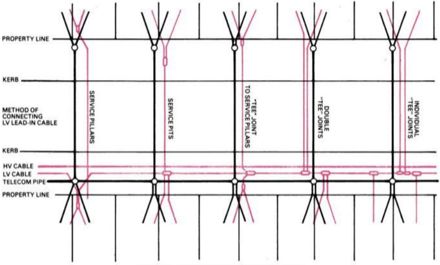
Pipes will normally be limited to rigid PVC or AC up to 100 mm diameter for street cables and 20 mm for lead-in cables. (The pipes installed should be of a type readily distinguishable from those of the Power Authority).
Jointing pits (except No's 6, 8 and 9) are installed as required.

In special cases larger conduits or jointing pits may be installed by arrangement with the Power Authority.

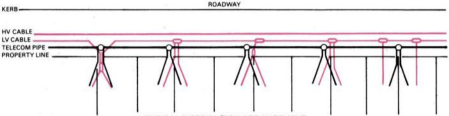
Normally not more than 2 pipes may be installed in footways, with a single pipe across roads and for lead-in to customers premises.

Only plastic sheathed cables may be installed.

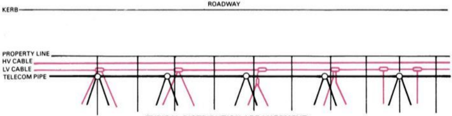
SHARING TRENCHES WITH POWER AUTHORITY



TYPICAL DISTRIBUTION ARRANGEMENT
-CABLES ON ONE SIDE OF STREET



TYPICAL DISTRIBUTION ARRANGEMENT
- CABLES ON BOTH SIDES OF STREET IN FOOTPATH



TYPICAL DISTRIBUTION ARRANGEMENT
- CABLES ON BOTH SIDES OF STREET INSIDE PROPERTY LINE

SHARING WITH POWER AUTHORITY

INSTALLATION OF POWER CABLES

Power cables are to be laid with a depth of cover not less than that shown in the table below and located in the trench to provide for maximum practicable lateral separation from Telecom distribution pipes.

Location	Type of Construction	HV Distribution Cable	LV Supply Main, Street Light, and Control Cables	LV Lead-in Cables
Footway	With protective cover	600 mm	450 mm	450 mm
	Without protective cover	750 mm	450 mm	450 mm
Roadway	With protective cover	750 mm	600 mm	600 mm
	Without protective cover	900 mm	750 mm	750 mm
Customers Premises	With protective pipe	not applicable	not applicable	300 mm
	With other protective cover	not applicable	not applicable	450 mm

MINIMUM DEPTH OF COVER FOR POWER CABLES

INSTALLATION OF TELECOM PIPES AND CABLES

Pipes for distribution cables are to be laid in one side of the trench at a level above the power cables and with as much separation as the width of trench permits (See table, page M-15). Preferably they should be to one side of the cover slabs or protective covering over the power cables and remote from the side in which the HV cables are laid.

Typical arrangements of Telecom and power cables in a common trench are shown on Pages M-16 and M-17.

DEPTH OF COVER OVER TELECOM PIPES

The depth of Cover Over pipes and the separation required from power cables are shown in the table below. The separations shown apply to plant laid longitudinally in a common trench. When cables cross e.g. lead-in cables on private property, lesser separations are permitted if a protective covering is installed over the power cables at the crossing point.

Location	Minimum Depth of Cover	Minimum Separation from Power Cables			
		HV Distribution Cable		LV Supply Main, Street Light and Control Cables	
		With Prot. Cover	Without Prot. Cover	With Protective Cover	Without Prot. Cover
Footway	300 mm	300 mm	450 mm	100 mm	100 mm
Roadway	450 mm	300 mm	450 mm	100 mm	100 mm

MINIMUM DEPTH OF COVER AND SEPARATION OF TELECOM PIPES FROM POWER CABLES

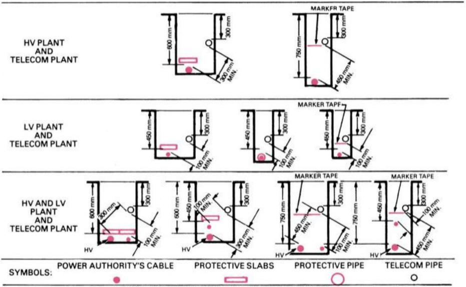
NOTE: LV Lead-in Cables: Minimum depth of cover - 300 mm; Minimum separation from power cables 100 mm if protective cover is not provided. Where both Telecom and power cables are enclosed in pipe separation is not required.

Jointing Pits

Install jointing pits offset from the line of the trench so that they are not directly above the power cables. Do not obstruct access to the Power Authority's jointing enclosures or road crossing pipes. Pits should be located at least 10 metres from the earthing system of a Distribution Transformer.

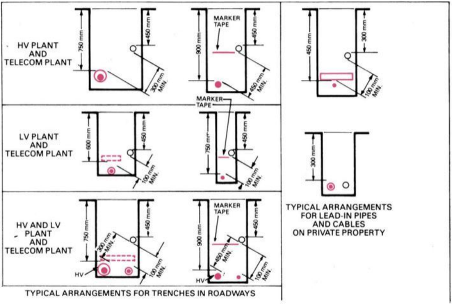
Should a pit need to be inside this distance the Power Coordination Section should be consulted.

SHARING TRENCHES WITH POWER AUTHORITY



TYPICAL ARRANGEMENTS FOR TRENCHES IN FOOTWAYS

SHARING TRENCHES WITH POWER AUTHORITY



TYPICAL ARRANGEMENTS FOR TRENCHES IN ROADWAYS

TYPICAL ARRANGEMENTS FOR LEAD-IN PIPES AND CABLES ON PRIVATE PROPERTY

SECTION N

INSTALLING PIPE FOR DISTRIBUTION CABLES

- DETERMINING PIPE SIZE
- RIGID PVC PIPE
- GALVANISED IRON PIPE (GI)
- BENDING GI PIPE
- LAYING PVC AND GI PIPES
- LEAD-IN PIPES TO CUSTOMERS PREMISES

INSTALLING PIPE FOR DISTRIBUTION CABLES

To accommodate, protect or to add additional cable, distribution cables in urban areas are normally installed in pipe.

Rigid PVC pipe is installed except where the higher mechanical strength of GI pipe is necessary or within the gradient area of any likely High Voltage power system fault. PILC cable must not be installed in GI pipe unless plastic jacketed.

Pipe Type and Size	Serial/ Item	Average Internal Diameter (mm)	Average Wall Thickness (mm)	Length (m)
10 mm PVC	73/262	12	2.45	3
20 mm PVC	73/263	23	1.70	6
30 mm PVC	73/264	29	2.10	6
35 mm PVC	73/265	37	2.60	6
40 mm PVC	73/266	42	2.95	6
50 mm PVC	73/267	53	3.65	6
10 mm GI	74/1	13	2.35	3
20 mm GI	74/3	22	2.65	6.5
40 mm GI	74/6	42	3.25	6.5
50 mm GI	74/7	53	3.65	6.5

RIGID PVC AND GI PIPES - TYPES AND SIZES

NOTE : Both rigid PVC and GI pipes are supplied with a socket fitted at one end.

DETERMINING PIPE SIZE FOR DISTRIBUTION CABLES

In general pipe should be sized to cater for the initial cable plus a second cable of the same diameter.

Cable Size (Pairs)	RIGID PVC PIPE SIZE				GI PIPE SIZE			
	0.40 mm PEIUT		0.64 mm PEIUT		0.40 mm PEIUT		0.64 mm PEIUT	
	Single Cable	Two Cables	Single Cable	Two Cables	Single Cable	Two Cables	Single Cable	Two Cables
2	10 mm	10 mm			10 mm	10 mm		
6			20 mm	30 mm			20 mm	40 mm
10	10 mm	20 mm	20 mm	30 mm	20 mm	40 mm	20 mm	40 mm
20	20 mm	30 mm	20 mm	35 mm	20 mm	40 mm	20 mm	40 mm
30	20 mm	30 mm	20 mm	40 mm	20 mm	40 mm	40 mm	50 mm
50	20 mm	35 mm	30 mm	50 mm	20 mm	40 mm	40 mm	Over 50 mm
70	20 mm	40 mm	35 mm	Over 50 mm	40 mm	50 mm	40 mm	Over 50 mm
100	30 mm	50 mm	35 mm	Over 50 mm	40 mm	Over 50 mm	40 mm	Over 50 mm

SIZES OF PIPE REQUIRED FOR ONE OR TWO PLASTIC (PEIUT) CABLES

NOTES

- Pipe used for street distribution is to be not less than 20 mm diameter.
- Pipe provided at road crossings is to be not less than 35 mm diameter.
- Pipe for 2 pair lead-in cables to customer's premises is to be 10 mm diameter.

RIGID PVC PIPE

USE OF PVC PIPE

This pipe is light, comparatively flexible, easy to joint and provides a good measure of protection against mechanical damage by hand tools. Its main applications are :

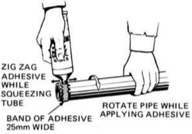
- 10 mm pipe - for customers 2 pr. lead-in cables between the distribution joint and customers premises.
- 20 mm - 50 mm pipes - for distribution cables in streets and also for protection of cables on walls, structures and poles.
- 35 mm pipe - for looped plastic cables serving untailed terminal boxes on I.T. poles. It will accommodate cables up to 50/0.40.

JOINTING PIPES

1. Lay out the pipes so that plain and socketed ends are adjacent.
2. Use up short lengths by making one the first pipe in the section.
3. Wipe the inside of the socket and outside of the plain end with a rag or cotton waste. If the pipes are dirty or greasy, soak the rag or cotton waste in methylated spirits before use.
4. Apply a 25 mm wide band of Jointing Adhesive, PVC pipe (S73/279) to the spigot (or male) end of the pipe, zigzagging tube while rotating the pipe or using the spreader provided to distribute the adhesive evenly.
5. When adhesive has been applied all round the pipe, insert the spigot (or male) end into the socket and apply light pressure for a few seconds, thus allowing adhesive to spread around the joint. Wipe away surplus adhesive with a rag or cotton waste.
6. If it is necessary to move the pipes after jointing, this must be done before the adhesive begins to set, ie. within ten minutes of application. During the period of setting, ie. about 30 minutes, the joints must not be disturbed.

Issue 4, 1980

RIGID PVC PIPE



JOINTING PVC PIPE

NOTE : Jointing adhesive and methylated spirits are highly flammable substances; no smoking or naked flame is permitted while using these materials.

BENDING PIPES :

PVC pipes 50 mm diameter and under are relatively flexible and may be bent during laying but curves of less than 3 metres radius should not be attempted.
Preformed bends are available for use with riser pipes on poles, entries to buildings, etc. (300 mm radius 90° bends): 10 mm pipe (S73/269), 20 mm pipe (S73/271), 30 mm pipe (S73/272), 35 mm pipe (S73/273), 40 mm pipe (S73/274) and 50 mm pipe (S73/276).

GALVANISED IRON PIPE (GI)

USE OF GI PIPE

This pipe provides a high degree of protection against mechanical damage and is to be installed wherever the risk of damage is severe, eg., where cables must be laid at a shallow depth, or installed in exposed positions on bridges, walls, etc.

GI pipes also have applications where electrical shielding is required for protection against lightning or low frequency induction from power lines but are not normally installed in common trenches with power cables.

Lead sheathed cables drawn into GI pipe must be plastic jacketed to avoid sheath corrosion.

JOINTING PIPES

Each length of pipe is threaded at both ends and has a coupling screwed on one end. Lay out the pipes along the ground beside the trench so that the threaded ends will mate with coupling ends.

Before jointing ensure that the coupling is at least hand tight and that the threads of both pipes are clean and undamaged.

Screw the threaded end of the pipe into the coupling of the next pipe until it is hand tight then tighten firmly with a pipe wrench.

To thread a pipe for jointing secure it in a pipe vice (S133/15) and use Stocks and Dies (S133/9) to cut the thread.

Remove burrs from the inner edges of pipes with a round file.

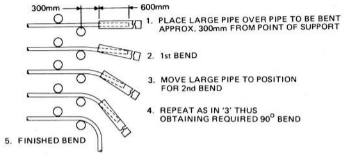
BENDING PIPES

Bend pipes to the required radius around posts, trees or other suitable supports. A typical method is shown on page N-6.

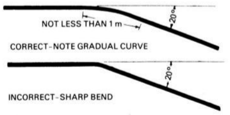
A pipe bending machine may be used where one is available.

Avoid sharp bends which may impede the drawing in of cable. Where possible spread the bend over at least a metre of pipe as shown on page N-6. Except for 10 mm diameter pipe, 90° bends should have a minimum radius of 300 millimetres.

BENDING GALVANISED IRON PIPE



USE OF LARGE PIPE AS LEVER TO BEND PIPE AROUND SUPPORTS



MAKING GRADUAL CURVE IN GI PIPE

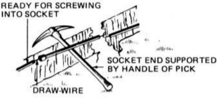
LAYING PIPES IN TRENCH

Where there are no obstructions such as water or other service pipes crossing the trench above the level at which the pipe is to be laid, the pipe lengths may be jointed at ground level and then lowered into the trench.

Otherwise, the pipes must be threaded beneath the obstruction after jointing or placed in position and jointed in the trench.

Use cut ends of pipe as the first pipe in each section.

At jointing pits insert the end of the pipe so that about 40 mm protrudes into the pit. Remove burrs from the inner edges of the pipe with a round file.



JOINTING PIPE IN TRENCH

Fit a pipe ferrule - 10 mm (S101/2), 20 mm (S101/4), 40 mm (S101/7), 50 mm (S101/9) on the end GI pipe to protect the cable.

Where a draw wire is required for pulling in cable (See page P-1) insert it in the pipe progressively as each length is jointed.

BACKFILLING AND REINSTATEMENT

Replace the excavated soil over the pipes and ram firmly. Provide a slight mound at the surface to allow for subsequent settling down during consolidation.

Remove all surplus soil and scrap material leaving the job site thoroughly clean on completion of the work.

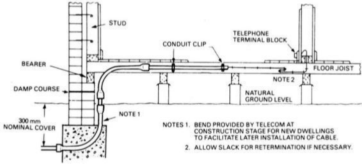
Arrange with the local authority for reinstatement of sealed or concrete surfaces as required.

LEAD-IN PIPES TO CUSTOMERS PREMISES

INSTALLING LEAD-IN CABLE IN PIPE

All cables entering customers premises must be enclosed in pipe from the footpath jointing chamber (manhole or pit) to the point of entry to the building to protect the cable against mechanical damage. Use 10 mm PVC or GI pipe for 2 pair cables.

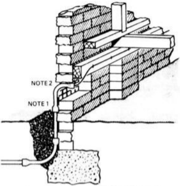
Where practical lay pipe in a direct line to the nearest point of entry to the position for the telephone. If possible keep clear of gardens, pathways and other locations where the pipe may be disturbed by the activities of the householder.



TYPICAL LEAD-IN TO NEW BRICK VEENEER DWELLING

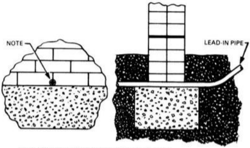
BEWARE OF DOGS AT CUSTOMERS PREMISES. THEY MAY BITE.

LEAD-IN PIPES TO CUSTOMERS PREMISES



NOTES 1. FIT CONDUIT CLIP TO SUPPORT PIPE CLOSE TO WALL. TRIM FOUNDATION IN VICINITY OF LOWER BEND IF NECESSARY.
2. PROTECT CABLE AT PIPE MOUTH BY WRAPPING WITH PVC TAPE.

TYPICAL ENTRY TO BRICK DWELLING THROUGH VENTILATOR



NOTE SELECT POSITION FOR ENTRY AT JOINT IN BRICKWORK ABOVE CONCRETE FOUNDATION. MAKE HOLE AT MORTAR SEAM WITH MASONRY DRILL.

ALTERNATIVE ENTRY TO BRICK DWELLING WHERE VENTILATOR IS NOT AVAILABLE

Attach pipes to walls & floor bearers by means of the appropriate size conduit saddle or pipe clip fastened by GI clouts, coach screws or suitable masonry anchors.
Space the supports about a metre apart.
Obtain customers permission before drilling a hole or running cable in a location where it may be considered objectionable.

LEAD-IN PIPES TO CUSTOMERS PREMISES

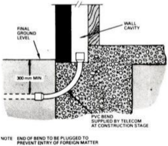
LAYING PIPE UNDER CONCRETE FLOOR

Install the pipe for the lead-in cable during construction of the building. The Line Supervisor should arrange with the builder to install a pipe in a suitable position for cable entry.

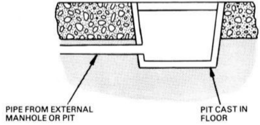
Lay rigid PVC pipe or GI pipe to a point inside the building as close as possible to the proposed location of the telephone. The pipe should emerge alongside a wall or partition and project approximately 150 mm above the floor.

The jointing pit outside the building shown in the drawing below will only be required where the length of lead-in or number of bends makes the pit necessary for the cable hauling.

An alternative method for larger installations (shops, factories, etc.) is to arrange for a pit and duct to be cast in the floor during construction of the building.



ENTRY PIPE TAKEN ABOVE FLOOR LEVEL



JOINTING PIT CAST INTO FLOOR

SECTION O

JOINTING PITS

- PIT SIZES AND USES
- CONSTRUCTIONAL DETAILS
- PIT COVERS
- MOULDED AC PITS, COVERS AND ACCESSORIES
- INSTALLING PITS
- PIT LIFTING HANDLES

CABLE JOINTING PITS

Changes are being made to cable jointing pits. Reinforced concrete pits have been superseded and will be replaced by hand moulded or injection moulded asbestos cement (AC) pits.

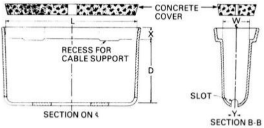
Because the "old range" hand moulded AC pits and reinforced concrete pits are still in situ, Pages O-1 to O-7 have been retained and Pages O-8 to O-17 will detail the new range of pits, covers and accessories.

Types A,B,C and D pits. These pits are for use with small size cables, a slot in the bottom of A,B and C pits allows them to be installed over buried cable loops. No slot is provided in the Type D pit which is normally used with pipe. Type A pit is too small for most cables but has some application for lead-in cables where a pit is required on private property and also for use as a cable marker.

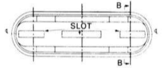
Sizes	Serial/ Item	Material	Internal Measurements (millimetres)			Typical Max. Cable Sizes		Location, Application etc.
			L	W	D	Plastic	Lead	
A	99/16	AC	380	75	180	10/0.40	-	In customers premises for lead-in cable and for cable markers.
B	99/17	AC	530	100	280	50/0.40 20/0.64 10/0.90	30/0.64 10/0.90	In footpaths for small size buried cables.
C	99/18	AC	685	125	430	100/0.40 70/0.64 30/0.90	70/0.64 30/0.90	As for Type B pit but for larger cables.
D	99/27	AC	685	250	560	As for	C pit	In lieu of Type B and C pits where cable is installed in pipe.

CABLE JOINTING PITS A, B, C AND D - SIZES AND USES

CABLE JOINTING PITS - TYPES A, B, C AND D



Pit Type	Dimensions (mm)				
	L	W	D	X	Y
A	380	75	180	30	20
B	530	100	280	40	25
C	685	125	430	45	40
D	685	250	560	50	-



CABLE JOINTING PITS - TYPES A, B, C AND D - CONSTRUCTIONAL DETAILS

Note : When AC pits are installed over a cable loop cut out the material which divides the slot into sections.

CABLE JOINTING PITS - TYPES NOS. 2, 3 AND 4

Pits 2, 3 and 4 which were designed for small PILC cables have been largely superseded by Types B, C and D.

The No. 3 pit is particularly suitable where pipe entries are required in the two ends and side of the pit.

The No. 4 pit is 760 mm deep to allow adequate cover for a 100 mm pipe at roadcrossings.

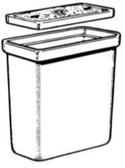
Sizes	Serial/ Item	Material	Internal Measurements in mm			Typical Max. Cable Sizes		Location, Applications etc.
			L	W	D	Plastic	Lead	
2	99/3	AC *FAC	610	305	305	70/0.64	70/0.64	For replacement of damaged No. 2 pits.
3	99/4	AC	460	230	460	50/0.40 20/0.64 10/0.90	30/0.64 20/0.90	For PILC cables in pipe or buried, also for plastic cables where B, C or D pits are not suitable.
4	99/4	AC	610	305	760	100/0.40 70/0.64 30/0.90	70/0.64 30/0.90	As for No. 3 but for larger cables. Depth adequate for road-crossing.

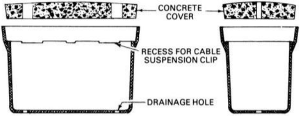
CABLE JOINTING PITS - SIZES AND USES

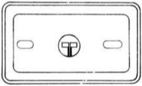
*FAC = Fibrous asbestos cement.

PREVENT PEOPLE STEPPING INTO OPEN PITS BY ERECTING GUARDS BEFORE LIFTING THE COVER.

3
4 ROAD X DEPTH
6 2 PIPES.
8 2 ROAD X DEPTH







DIMENSIONS (mm)			
PIT No	2	3	4
LENGTH AT TOP	610	460	610
WIDTH AT TOP	305	230	305
DEPTH	305	460	760

CABLE JOINTING PITS NOS. 2, 3 AND 4 - CONSTRUCTIONAL DETAILS

WHEN DRIVING TELECOM VEHICLES OBSERVE ALL TRAFFIC LAWS AND REGULATIONS.
EXTEND THE COURTESY OF THE ROAD TO OTHER DRIVERS.

CABLE JOINTING PITS NOS. 6, 7 AND 8

Nos. 6, 7 and 8 jointing pits will normally be used on minor conduit routes where construction of manholes is not justified.

They may also be used at pillar terminals to accommodate joints in pillar tail cables.

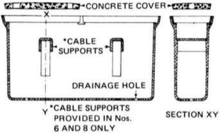
As these pits are made from asbestos cement sheeting they are not suitable for installation in locations where heavy vehicles may pass over them.

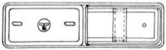
A removable crossbar (S.99/24) is provided to support the two reinforced concrete lids.

Sizes	Serial/ Item	Material	Internal Measurements in mm			Typical Max. Cable Sizes		Location, Application etc.
			L	W	D	Plastic	Lead	
6	99/25	AC	1295	460	610	200/0.40 200/0.64 All small cables.	2x400/0.40 2x300/0.64	In footways on one or two 100 mm conduit routes. Also as pillar pit.
7	99/26	AC	915	460	460	200/0.40 200/0.64 All small cables.	300/0.40 200/0.64	Intermediate pit for single 100 mm conduit laid at 450 mm depth or with buried cable. Also as pillar pit.
8	99/23	AC	1295	460	840	As for No. 6	As for No. 6	Additional depth provided for road-crossings with up to two 100 mm conduits.

CABLE JOINTING PITS NOS. 6, 7 AND 8 - DIMENSIONS AND USE

CABLE JOINTING PITS - TYPES 6, 7 AND 8





DIMENSIONS (mm)			
PIT No.	6	7	8
LENGTH AT TOP	1295	915	1295
WIDTH AT TOP	460	460	460
DEPTH	610	460	840
THICKNESS	10	10	10

CABLE JOINTING PITS NOS. 6, 7 AND 8 - CONSTRUCTIONAL DETAILS

CABLE JOINTING PIT COVERS

CONCRETE COVERS

Jointing pits are supplied complete with concrete covers.
Covers are serialised separately so that they may be ordered as replacements.
Key slots are provided to enable covers to be lifted with standard lifting keys.

STEEL COVERS

Steel covers are available for pit ranges 0 to 8 for extra protection in locations where isolated vehicular traffic may damage concrete lids.
Steel lids are not provided for A, B, C and D pits which are less vulnerable to damage.

Type of Pit	Jointing Pit Cover		
	Material	Serial/Item	Number Required per Pit
A	Concrete	99/19	1
B	Concrete	99/20	1
C	Concrete	99/21	1
D	Concrete	99/28	1
0	Concrete	99/8	1
0	Steel	99/11	1
3	Concrete	99/6	1
3	Steel	99/12	1
2 & 4	Concrete	99/7	1
2 & 4	Steel	99/13	1
6 & 8	Concrete	99/9	2
6 & 8	Steel	99/14	2
7	Concrete	99/10	2
7	Steel	99/15	1

REPLACEMENT COVERS FOR CABLE JOINTING PITS

MOULDED ASBESTOS CEMENT PITS

The new range of hand moulded or injection moulded asbestos cement pits supersede reinforced concrete pits.

The letter H or J preceding the pit size number indicates that the pit has been hand or injection moulded.

i.e. H2 = Hand Moulded No. 2 pit
J2 = Injection Moulded No. 2 pit.

HAND MOULDED PITS

Sizes	Serial/ Item	Internal Measurements (mm) L	W	D	Maximum Cable Sizes PEIUT	PEIUT HJ	Maximum Pipe Sizes	Location Applications Etc
1	99/42	460	160	310	30/0.40 10/0.64 6/0.90	30/0.40 10/0.64	35mm	In private property for lead-in cable or as a cable marker. Will provide 300mm depth of cover over 35mm pipe and can accommodate a small openable joint (with reduced cable capacity).
		Substitute for Pits in Current Range A, B, 1, O						
2	99/43	600	205	470	100/0.40 50/0.64 20/0.90	50/0.40 20/0.64 10/0.90	50mm	In footways in association with Distribution cable, in pipe or buried.
		Substitute for Pits in Current Range 2, C, 3 Vic D						

Sizes	Serial/ Item	Internal Measurements (mm) L	W	D	Maximum Cable Sizes	Maximum Pipe Sizes	Location Applications Etc
H1	99/46	460	160	310	As for Item 42	35mm	For replacement purposes excluding cover.
		Substitute for Pits in current range. A, B, 1, 0					
H3	99/44	685	250	550	As for Item 43	100mm	As for No. 2 pit, the extra depth caters for 80mm and 100mm pipe.
		Substitute for current D size Pit					
H4	99/45	610	305	760	As for Item 43	100mm	As for No. 2 pit, the extra depth caters for 100mm pipe at road crossings.
		Substitute for current size 4 Pit					

PLACE GUARDS AROUND PITS OR MANHOLES BEFORE REMOVING COVERS TO PREVENT STAFF OR MEMBERS OF THE PUBLIC STEPPING INTO THEM.

PROVIDE RED LIGHTS OR EQUIPMENT WHICH COULD CREATE A PEDESTRIAN OR TRAFFIC HAZARD WHEN LEFT OVERNIGHT.

MOULDED ASBESTOS CEMENT PITS

Sizes	Serial/ Item	Internal Measurements (mm) L	W	D	Maximum Cable Sizes PEIUT PEIUT HJ	Maximum Pipe Sizes	Location Applications Etc
H2	99/47	600	205	470	As for Item 43	50mm	For replacement purposes excluding cover.
		Substitute for Pits in current range. 2, C, 3 VIC D					
H3	99/48	685	250	550	As for Item 43	100mm	Hand moulded asbestos cement pit body. For replacement purposes excluding cover.
		Substitute for current D size Pit					
H4	99/49	610	305	760	As for Item 43	100mm	Hand moulded asbestos cement pit body. For replacement purposes excluding cover.
		Substitute for current Size 4 Pit					

Sizes	Serial/ Item	Internal Measurements (mm) L	W	D	Maximum Cable Sizes PEIUT	PEIUT HJ	Maximum Pipe Sizes	Location Applications Etc
H6	99/55	1240	460	610	70/0.90 100/0.64	70/0.90 100/0.64	2 x 100mm	In footways for cables associated with the Large Screw Type Openable Joint and cabinet or pillar tail cables installed in 1 or 2 100mm pipes.
		Substitute for Current Size 6 and 7 pits						
H8	99/56	1240	460	840	As for Item 55		2 x 100mm	As for No. 6, with additional depth catering for road crossings with up to two 100mm pipes.
		Substitute for Current Size 8 Pit						
H9	99/57	1920	460	840	600/0.40 PIUT MB 200/0.64 PIUT MB 300/0.52 APIUT MB		2 x 100mm	As for No. 6 and 8 Pits, for large size cables, particularly moisture barrier cables where the installation of a manhole is not warranted.
		No current Equivalent Pit						

MOULDED ASBESTOS CEMENT PITS

Sizes	Serial/ Item	Internal Measurements (mm)			Maximum Cable Sizes	Maximum Pipe Sizes	Location Applications Etc
		L	W	D			
H6	99/76	1240	460	610	As for Item 55	2 x 100mm	Precast asbestos cement pit body (including cable supports and crossbar) for replacement purposes.
		Substitute for Current Size 6 and 7 Pits					
H8	99/77	1240	460	840	As for Item 55	2 x 100mm	Precast asbestos cement pit body (including cable supports and crossbar) for replacement purposes.
		Substitute for Current Size 8 Pit					
H9	99/78	1920	460	840	As for Item 57	2 x 100mm	Precast asbestos cement pit body (including cable supports and crossbar) for replacement purposes).
		No current Equivalent Pit					

MOULDED ASBESTOS CEMENT PITS

Sizes	Serial/ Item	Internal Measurements (mm)			Maximum Cable Sizes	Maximum Pipe Sizes	Location Applications Etc
		L	W	D			
J1	99/51	450	160	310	As for Item 42	35mm	Injection moulded asbestos cement pit complete with cover for use in foot-paths or private property in association with lead-in cable.
		Substitute for Pits in Current Range A, B, 1, O					
J2	99/52	600	205	470	As for Item 43	50mm	Injection moulded asbestos cement pit complete with cover for use in foot-paths in association with distribution cable installed in pipe or buried.
		Substitute for Pits in Current Range 2, C, 3, VIC D					

INJECTION MOULDED PIT

ALWAYS ENSURE THAT SAFE WORKING PRACTICES AND SAFETY EQUIPMENT IS USED

MOULDED ASBESTOS CEMENT PITS

Sizes	Serial/ Item	Internal Measurements (mm)			Maximum Cable Sizes	Maximum Pipe Sizes	Location Applications Etc
		L	W	D			
J3	99/53	685	250	550	As for Item 43	100mm	Injection moulded asbestos cement pit complete with cover for use in foot-paths in association with distribution cable installed in 80mm or 100mm pipe.
		Substitute for Current D Size Pit					
J4	99/54	610	305	760	As for Item 43	100mm	Injection moulded asbestos cement pit complete with cover as for No. J3 pit but extra depth caters for road crossings.
		Substitute for Current Size 4 Pit					

SAFETY SHOES OR BOOTS FITTED WITH PROTECTIVE TOE CAPS MUST BE WORN

WHEN LIFTING OR CARRYING HEAVY OBJECTS.

MOULDED ASBESTOS CEMENT PITS

Sizes	Serial/ Item	Internal Measurements (mm) L	W	D	Maximum Cable Sizes	Maximum Pipe Sizes	Location Applications Etc
J1	99/72	450	160	310	As for Item 42	355mm	Injection moulded asbestos cement pit body. For replacement purposes excluding cover.
		Substitute for Pits in current Range A, B, 1, 0					
J2	99/73	600	205	470	As for Item 43	50mm	Injection moulded asbestos cement pit body. For replacement purposes excluding cover.
		Substitute for Pits In Current Range 2, C, 3, Vic D					
J3	99/74	685	250	550	As for Item 43	100mm	Injection moulded asbestos cement pit body. For replacement purposes excluding cover.
		Substitute for Current D Size Pit					
J4	99/75	610	305	760	As for Item 43	100mm	Injection moulded asbestos cement pit body. For replacement purposes excluding cover.
		Substitute for Current Size 4 Pit					

Other Items are :

- . S.99/66 Bracket, Cable Support GI — For replacement purposes on jointing pits Nos. H6, H8 and H9.
- . S.99/67 Crossbar, Cast iron — For replacement purposes on jointing pits Nos. H6, H8 and H9.

SIZE	SERIAL/ ITEM	DESCRIPTION	APPLICATION
J1	99/58	Cover, Pit No. J1 Reinforced Concrete	For replacement of covers on Cable Jointing Pit No. J1
J2	99/59	Cover, Pit No. J2 Reinforced Concrete	For replacement of covers on Cable Jointing Pit No. J2
J3	99/60	Cover, Pit No. J3 Reinforced Concrete	For replacement of covers on Cable Jointing Pit No. J3
J4	99/61	Cover, Pit No. J4 Reinforced Concrete	For replacement of covers on Cable Jointing Pit No. J4
H6, H8 H9	99/62	Cover, Pit No. H6, H8 and H9 - Reinforced Concrete	For replacement of covers on Cable Jointing Pits H6, H8 and H9

SIZE	SERIAL/ ITEM	DESCRIPTION	APPLICATION
J2	99/68	Cover, Pit No. J2 Cast iron	For use with S99/52 where concrete cover is unsuitable, high wear or high load locations
J3	99/69	Cover, Pit No. J3 Cast iron	For use with S99/53 where concrete cover is unsuitable, high wear or high load locations
J4	99/70	Cover, Pit No. J4 Cast iron	For use with S99/54 where concrete cover is unsuitable, high wear or high load locations
H6,H8 H9	99/71	Cover, Pit No. H6, H8 and H9 - Cast iron	For use with S99/55-57 where concrete cover is unsuitable, high wear or high load locations

CABLE JOINTING PIT COVERS (Cont'd)

A STRAIGHT BACK IS NOT NECESSARILY A VERTICAL BACK. THE BODY IS INCLINED FORWARD DURING MANY LIFTING OPERATIONS BUT THE SPINE MUST ALWAYS REMAIN STRAIGHT.

INSTALLING JOINTING PITS AT STREET CORNERS

INSTALLING PITS IN CABLE RUNS

Install pits in the line of the trench at all points where cable joints are required or slack cable is to be accommodated for subsequent jointing.

DIRECT UNDERGROUND LEADS

Locate jointing pits at every second property line so that two premises may be served from each pit.

GATEWAYS AND DRIVE ENTRANCES

Wherever practicable keep jointing pits clear of gateways, driveways and other locations where they may be subjected to vehicular traffic.

Where an alternative location is not available and it will be crossed by light vehicles only, the pit may be installed, provided it is reinforced by a concrete surround 100 mm wide and 125 mm deep. Steel lids should be fitted on pits No. 0-8.

INTERFERENCE WITH OTHER AUTHORITIES PLANT

Avoid locating jointing pits over the service pipes or cables of other authorities.

USE OF PITS AS TURNING CHAMBERS

Pits may be provided at sharp angles in pipe routes to facilitate cable drawing if the use of preformed pipe bends is impracticable.

PITS AT ROAD CROSSINGS

To provide the required depth of cover for pipes at road crossings, No. 4 or No. 8 pits will normally be necessary.

Where possible lay the pipes across the roadway with sufficient fall to permit water to drain from the pipes.

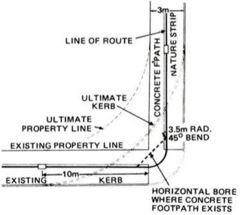
DO NOT EXPOSE YOURSELF TO THE RISK OF INJURY OR CREATE CIRCUMSTANCES WHICH COULD CAUSE AN ACCIDENT TO OTHER PEOPLE.

When installing jointing pits at street corners consider the possibility and extent of future roadway alterations, e.g. cutting short or splaying of corners, provision of left hand turning lanes etc., which might mean resiting the pit. Locate pits at a sufficient distance from the corner to avoid the likelihood of later disturbance.

Lay cable or pipe at sufficient depth to avoid disturbance during roadwork.

Note:-

The dimensions shown in this drawing are for explanatory purposes only and will vary for particular cases.



TYPICAL INSTALLATION OF JOINTING PITS AT STREET CORNERS Issue 4, 1980

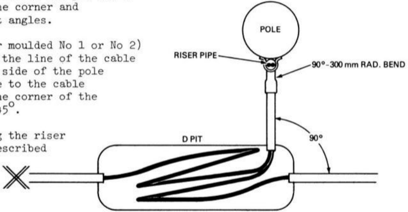
INSTALLING JOINTING PITS AT CABLE TERMINAL POLES

Install a jointing pit adjacent to the pole so that the cable lead to the terminal box is kept as short as possible.

Locate a Type D (or moulded No 2) pit on the exchange side of the pole so that the pipe to the cable terminal leaves the pit via a side wall, close to the corner and approximately at right angles.

Where a Type B or C (or moulded No 1 or No 2) pit is used set it in the line of the cable route on the exchange side of the pole so that the riser pipe to the cable terminal box leaves the corner of the pit at approximately 45°.

The method of attaching the riser pipe to the pole is described on page P-4.



TYPE D PIT INSTALLED FOR PLASTIC CABLE TO CABLE TERMINAL BOX

Note:- Provide a loop of cable on each side of the cable terminal box feed. House cable neatly in vertical loops in the pit.

TO LIFT HEAVY OR AWKWARD OBJECTS USE MECHANICAL AIDS OR GET HELP.

CABLE ENTRY TO JOINTING PITS

TYPES A, B, C AND D PITS (Nos 1 and 2 Moulded Pits)
Locate pits directly over the cable trench so that the cable or pipe enters at the centre of the ends. Slots are provided in the end of the base in Types A, B and C pits.

Enter pipe for lead-in cable close to one end of the pit.

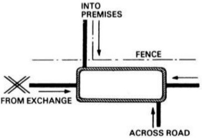
Where pipes for branch cables lead-off at right angles to the route use the wider Type D or No. 3 (or Moulded No 2) pit to permit better cable flow in the pit.

NO. 2, 3, 4 AND 7 PITS (or Moulded No 2, 3, 4 and 6 pits)
Locate pits just off the trench line so that the cable or pipe entries are as close as possible to a corner of the pit. Do not enter pits in the centre of a wall. For PILC cables, when exchange cable entry is on the left, all other cables enter on the right, and vice versa. LEAVE ON THE RIGHT.

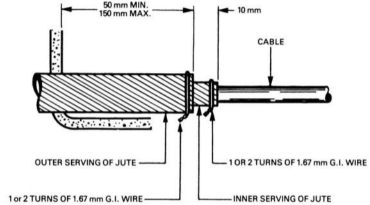
NO. 6 AND 8 PITS
Install pits directly over the trench line. Where conduits are laid fit pipe bushes in the end or side walls to facilitate cable hauling. (See page 0-23).

CABLE AND PIPE ENTRY HOLES
Make holes in asbestos cement pits with the point of a pick or other sharp pointed tools and ream to the required size.

SEE PAGE R-44 "SAFE WORKING PRACTICES FOR ASBESTOS CEMENT PRODUCTS"



PIPE ENTRIES TO D PIT

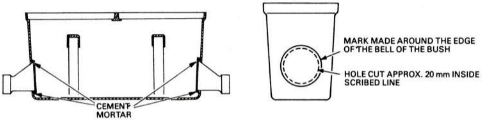


MAKING OFF CABLE ARMOURING IN JOINTING PIT

DISPOSE OF WASTE CABLE ARMOURING SAFELY BY BURYING IT IN THE CABLE TRENCH.

USE OF PIPE BUSHES

Install pits directly over the trench line. Where conduits are laid, fit pipe bushes in the pits to facilitate cable hauling. If conduits lead off at right angles to the main route fit pipe bushes in the side wall close to one end of the pit.



JOINTING PITS NO. 6 AND NO. 8 - FITTING PIPE BUSHES

TYPES AVAILABLE

Serial 101/12 - Pipe Bush 100 mm, One Way - For terminating a single 100 mm pipe.
Serial 101/14 - Pipe Bush 100 mm, Two Way - For terminating two 100 mm pipes.

METHOD OF FITTING

- Place bush in position on outside of pit and mark around edge of bellmouth.
- Cut a hole approximately 20 mm inside the scribed line.
- Fit pipe bushes from the inside of the pit and fix them in position with cement mortar.

SETTING JOINTING PITS IN GROUND

PREPARING FOUNDATION

Pack soil under the pit location firmly with a rammer to prevent the pit from sinking. Bed the pit in sand or loam and tamp well.

ALIGNMENT AND DEPTH OF SETTING

Align pits parallel to the kerb line or fence line to avoid an unsightly appearance.

Set pit so that the top is flush with ground level and conforms with the general slope of the footpath.

SETTING TYPES A, B, C, AND MOULDED 1 AND 2 PITS

These pits can be set directly in cable trench with little extra excavation and the cables passed through the slot in the bottom of the pit and arranged in vertical loops.

SETTING TYPE D AND NOS. 2-9 PITS

Invert pit in correct location and mark the outline of its edge on the pavement. Make the excavation line 25 mm larger than the pit on all sides.

Where pipe bushes are fitted in No. 6 and No. 8 pits excavate an extra 300 mm at both ends.

PIPE ENTRY

Insert pipe so that about 40 mm of pipe protrudes into pit. Remove burrs from inner edge of pipe.

BACKFILLING AROUND PIT

Fill in around pits with sand or loam so that the pits are firmly set.

PROTECTION AGAINST DAMAGE

Where extra protection is required reinforce the sides of the pit with a concrete surround 100 mm wide and 125 mm deep. In some cases a steel frame set in concrete may be necessary.

Where Nos. 1-9 pits are installed in locations where they may be subjected to light vehicular traffic steel covers should be fitted. Do not install pits where they will be crossed by heavy vehicles.

HANDLING PITS

Precast jointing pits are brittle and must be handled with care to avoid breakage.

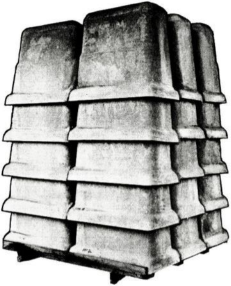
Do not drop pits or handle them roughly during loading or unloading operations or when stacking them.

Concrete lids are particularly liable to damage and must be handled and stacked with care.

Always use Lifting Keys to remove covers from pits.

Use safe lifting practices when lifting and carrying jointing pits. See Page 0-26. Keep a straight back and make the maximum use of leg muscles when lifting.

Stack all pits of one size together. The height of the stack should be no greater than that which will allow the top pit to be removed without undue strain.

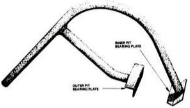


STACKED JOINTING PITS

BEFORE REPLACING JOINTING PIT COVERS CLEAR ANY DIRT FROM AROUND THE TOP OF THE PIT SO THAT THE COVER SEATS CORRECTLY AND DOES NOT PRESENT A HAZARD TO PEDESTRIANS.

HANDLING AND STORAGE OF JOINTING PITS

Pit Lifting Handles (S116/190) are designed as an aid for handling pits. A minimum of two handles must be used to handle a cable jointing pit.



PIT LIFTING HANDLE

The outer pit bearing plate of the handle must be placed underneath the pit cover seat flange to prevent the handle from slipping up and off the pit.

PIT TYPE	MINIMUM NUMBER OF MEN
No. 1	Two men with handles
No. 2	" " " "
No. 3	" " " "
No. 4	" " " "
No. 6	Four men with handles
No. 8	" " " "
No. 9	Normally two handles and a Mechanical Aid.
	(NOTE : A minimum of six men with handles are required to manually lift a No. 9 pit)

TABLE 1 - MINIMUM NUMBER OF PIT LIFTING HANDLES TO BE USED FOR MANUAL LIFTING OF CABLE JOINTING PITS

MANUAL HANDLING OF Nos 6, 8 AND 9 PITS USING PIT LIFTING HANDLES

Moving the larger pits manually requires a co-ordinated approach to ensure the safety of the staff concerned.

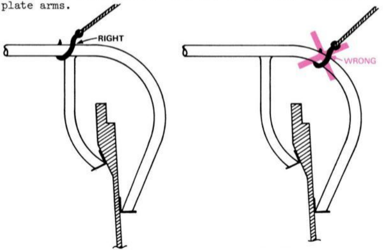
- A Lines Supervisor or a designated person must have control of the lifting operation.
- Position the members of the lifting team, (four men for Nos 6 and 8 pits, six for No. 9 pit) so that the weight of the pit is evenly distributed.
- The men should stand beside the pit facing the direction of travel with their outside leg forward.
- The pit lifting handles should be positioned on the pit so that the outer pit bearing plate is correctly engaged on the pit flange.
- The commands for lifting the pit shall be "Ready" and then "Lift". On the command of "Lift", all men shall lift the pit using their leg muscles while maintaining a straight back.
- On the command "Forward" all men shall move off with the inside leg in the direction required.
- On arrival at the worksite, the commands "Ready to Stop" and then "Stop" shall be given. On the command "Lower" all men shall lower the pit to the ground.
- Positions of the lifting party shall then be re-arranged to enable the pit to be lowered into the prepared excavation.

LOWERING SMALL PITS INTO EXCAVATIONS

Position your body to ensure that the weight of the pit is taken mainly by the legs in accordance with the correct lifting and handling procedures.

USING PIT LIFTING HANDLES WITH A MECHANICAL AID

A pair of pit lifting handles may be used to lift and lower the larger sizes of cable jointing pits in conjunction with a mechanical aid and a sling. For safety reasons it is important that the sling is positioned correctly with the sling hooks engaging the tee formed by the bearing plate arms.



CORRECT POSITIONING OF THE SLING FOR LIFTING

LOWERING 6 AND 8 PITS INTO EXCAVATIONS

A suitable method for lowering No. 6 and 8 pits into trench excavations is as follows: Mechanical assistance is required for placing No. 9 pits.

- Use two suitable wooden planks approximately 150 mm x 25 mm x 2500 mm long.
- Position the two planks on the ground approximately 800 mm apart so that they almost traverse the excavation.
- Use the handles to place the pit onto the planks. Remove the handles and lay the pit onto its side, with the base of the pit at the edge of the excavation.
- Using four men, one at each plank and one at each end of the pit, the pit may be satisfactorily lowered into the excavation. The two men shall lift their respective planks simultaneously and the other men shall guide the pit into the excavation.
- The handles may be used to locate the pit in its final position.

REFERENCE : EI LINES Conduits TE 4100

SECTION P

DRAWING CABLES INTO PIPES

- DRAW WIRES AND CABLE GRIPS
- INSTALLING CABLE IN TERMINAL POLES
- SEALING PLASTIC CABLE ENDS
- LAYING TEMPORARY CABLE ACROSS ROADS

Issue 4, 1980

DRAWING CABLES INTO PIPES

DRAW WIRES

Small plastic cables can usually be pushed through short sections of pipe but the larger plastic cables require the use of a draw wire.

Use 1.6 mm GI wire (S 62/24) as draw wire for small cables and for short sections and 3.15 mm GI wire (S 62/23) for larger cables and longer sections.

If some time will elapse between laying the pipe and drawing in the cable, use a polypropylene rope (S 675/294) or an insulated draw wire, eg 1.6 mm GI wire, polyethylene covered (S 92/23) to reduce the likelihood of breaks in the draw wire due to corrosion.

Insert the draw wire or rope in the pipe progressively as each length is laid and jointed.

Use a Continuous Fibreglass Rodder or small diameter rods to insert a draw wire or rope in an existing pipe.

CABLE GRIPS

Use standard cable grips (see Section H) to attach the draw wire to the end of cables exceeding 10 mm diameter.

Fit the grip over the cable without removing the end cap. Draw the mesh tightly over the sheath and bind the ends firmly as illustrated on page P-2.

The following method may be used for cables less than 10 mm diameter :

Over lap the cable end with 600 mm of 1.6 mm GI draw wire and spiral twist the wire around the cable with turns of approximately 50 mm pitch.

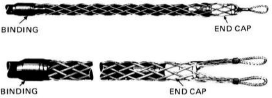
Secure by binding with PVC tape at the ends and several intermediate places.

This method which is illustrated on page P-2 is particularly suitable for drawing 2 pair lead-in cables into 10 mm pipe.

Epoxy resin bonded hauling eyes are not fitted to small size plastic cables.

After removing the cable grip check that the end seal has not been disturbed.

DRAWING CABLES INTO PIPES



SECURING CABLE GRIPS ON PLASTIC CABLES

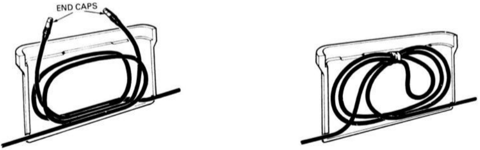
ATTACHING DRAW WIRE TO SUBSCRIBERS LEAD-IN CABLE

Handle cable carefully during installation to ensure that it is not damaged. On no account tread on cable or leave it where vehicles may run over it.

DRAWING CABLES INTO PIPES

DRAWING IN CABLE

Pull cable into the pipe by hand, drawing through intermediate pits where practicable.
Where the route changes direction at a pit, guide the cable to avoid damaging the sheath at entry to the pipe.
After drawing in the full section pull forward a loop of cable (3.5 m length between pit entry points) at intermediate pits where lateral or lead-in cables may be connected later. Arrange the cable in a vertical coil in the pit.
Where ends of cable are to be left in a pit for jointing, provide a length 1.8 m from the point of entry into the pit on each cable and coil in the pit.
Provide sufficient cable beyond the end of the lead-in pipe at customers premises to allow the cable to be run to the telephone socket.



(a) Cable Ends. (b) Cable Loop.

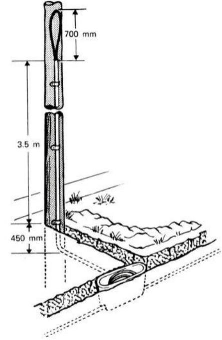
HOUSING SLACK CABLE IN JOINTING PITS

INSTALLING CABLE ON TERMINAL POLES

Where plastic cable is to be looped through an untailed terminal box draw sufficient cable into the jointing pit to allow a loop to be extended to the required height on the pole.
Provide a loop of cable in the pit on each side of the terminal box feed.
Coil the cable in vertical loops in the pit.
Details of jointing pit and riser pipe installation are given on page 0-20.
Secure the pipe to the pole with conduit saddles spaced approximately 1 m apart.
Push the bight of the cable loop through the pipe until it projects 700 mm above the pipe end on the pole.
Where free ends of cable are to be jointed in the untailed terminal box they should be similarly installed in the pipe, cut to length and the ends sealed with temporary end caps.
The method of installing untailed terminal boxes is described in the Linemens Handbooks, Cable Jointing No 1 and Aerial Lines.

WEAR A SAFETY BELT WHEN CLIMBING POLES.

YOUR LIFE MAY DEPEND UPON IT.



LOOPING CABLE TO UNTAILED BOX ON I.T.P.

SEALING PLASTIC CABLE ENDS

POLYETHYLENE END CAPS

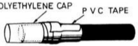
Fit Polyethylene caps to temporarily seal the ends of plastic cable during storage and installation. When the cable is cut at the store or during installation in the field it must be sealed immediately. Do not draw cable into pipes with the ends unsealed.

Push the cap on to the cable end until a firm fit is obtained and secure it with several turns of PVC tape around the cable and cap.

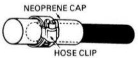
Leave space between the cable end and the top of the cap to prevent the cap being damaged or loosened by wires protruding as a result of temperature change or movement of the cable.

Cap Size	Serial/Item	Plastic Cable Size
00	433/109	2/0.40, 2/0.51
0	433/110	2/0.64
1	433/111	10/0.40, 10/0.51
2	433/112	30/0.40, 10/0.64
3	433/113	50/0.40, 30/0.51, 20/0.64, 10/0.90
4	433/114	50/0.51, 30/0.64
5	433/115	100/0.40, 70/0.51, 20/0.90

POLYETHYLENE END CAP SIZES



POLYETHYLENE CAP

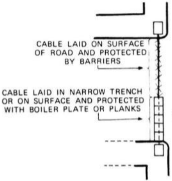


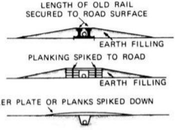
NEOPRENE CAP

NEOPRENE END CAPS

Small size plastic cables are supplied from the manufacturer with the cable ends sealed with neoprene end caps held in place by hole clips. Use these caps for sealing cable ends on drums held in Store.

LAYING TEMPORARY CABLE ACROSS ROADS





CABLE LAID ACROSS ROAD WITH PASSAGE FOR TRAFFIC

ELEVATIONS OF VARIOUS METHODS OF CONSTRUCTING BRIDGE OVER TEMPORARY CABLE LAID ON SURFACE OF ROAD

ERECT WARNING SIGNS WHEN WORKING ON ROADWAY. USE MEN WITH RED FLAGS OR STOP/GO BANNERS TO CONTROL TRAFFIC WHERE NECESSARY.

SECTION Q

INSTALLING BURIED CABLES IN RURAL AREAS

- INSTALLING BURIED CABLES
- SAFETY PRECAUTIONS WHEN WORKING IN RURAL AREAS
- INSTALLING ABOVE GROUND JOINTING POST
- CABLE MARKERS
- INSTALLING CABLE MARKERS

INSTALLING BURIED CABLES IN RURAL AREAS

As a general practice cables in rural areas will be buried directly in the ground except where protection against mechanical damage is required, e.g. under roadways.

CABLE TYPES INSTALLED

Unprotected plastic cable is to be installed for customers cables except where ant or termite attack is prevalent, in which case hard jacketed plastic cable is necessary.

Polyethylene insulated filled cable is the preferred type for use in rural areas.

Armoured lead covered cable (see Cable Sheath Protection, page G-4) is used only where electrical protection or protection against mechanical damage is required.

LOCATION OF CABLE ROUTE

In rural areas cable may be installed on public roads reserves or on private property. Factors influencing the selection of the route are:-

- extent of timber clearing necessary.
- existence of water or gas pipe lines, other telephone cables, etc.
- location of houses or other structures.
- land use such as cultivated crops, orchards, pastures, etc.
- power line exposures.
- drainage structures such as irrigation canals, drains, erosion control banks and levees etc.
- natural obstacles such as creeks, rocky outcrops, etc.

On public roads reserves cable is normally installed close to the property line but far enough from the fence to permit the operation of mechanical aids capable of laying the cable at the required depth. A distance of about 2 metres is adequate in most cases.

Where a suitable location on public property is not available, e.g. where extensive clearing would be involved, it may be necessary to install the cable on private property. Choose a direct route, acceptable to the property owner which will provide security for the cable and freedom from future disturbance. Form E717C must be sent to the property owner advising him of Telecom's intention.

Indicate the location of the cable with marker posts erected at intervals along the route. (See page Q-14).

INSTALLING BURIED CABLES IN RURAL AREAS

METHOD OF INSTALLATION

Cable is installed by means of a plough attached to a tractor or in trenches dug by hand or an excavating machine. Pipe crossings should be provided under paved roads. Cable joints are accommodated in jointing pits or above ground jointing posts.

DEPTH OF BURIAL

The minimum depths for buried cable in rural areas are shown in the tables below:-

Category	Type of Cable	Minimum Depth
4	Customer service leads	0.5 metre
3	Customer cables	0.75 metre
2	Trunk cables	1.0 metre
1	Trunk cables (broad band)	1.25 metre

MINIMUM DEPTH OF BURIAL IN SOIL OR NON-CONTINUOUS ROCK

NOTE: Soil is defined as sand, gravel, loam or silt.
Non-continuous rock is stones or boulders (floaters) set in soil.

Category	Type of Cable	Minimum Depth
4	Customer service leads	0.25 metre
3	Customer cables	0.5 metre
2	Trunk cables	0.75 metre
1	Trunk cables (broad band)	1.0 metre

MINIMUM DEPTH OF BURIAL IN CONTINUOUS ROCK

NOTE: This is rock in continuous strata which can only be removed by ripping or blasting.
Where continuous rock is covered by soil, the minimum depth can be obtained from page Q-3.

INSTALLING BURIED CABLE IN RURAL AREAS

DEPTH OF BURIAL - CONTINUOUS ROCK COVERED BY SOIL

Where continuous rock covered by soil is encountered lay the cable with at least 0.25 metre of rock cover, provided this depth is not less than the depth shown in the table on page Q-2 for continuous rock or greater than the depth shown for installation in soil.

Example showing the Use of Tables on page Q-2.

Installation of trunk cable (See drawing below)

Cable type - Single Quad Carrier Cable.

Category shown in tables - No. 2.

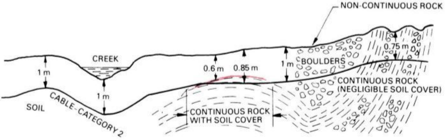
Depth of installation:-

In soil - 1 metre.

In continuous rock with 0.6 m soil cover - 0.6 m + 0.25 m = 0.85 m

In non-continuous rock (boulders) - 1 metre

In continuous rock with negligible soil cover - 0.75 metre.



INSTALLATION DEPTH OF TRUNK CABLE IN VARIOUS SOIL CONDITIONS

INSTALLING BURIED CABLES IN RURAL AREAS

CREEK CROSSINGS

Keep the following factors in mind when selecting location of crossing:-

. Avoid crossing at bends in the creek to minimise the possibility of bank erosion.

. Choose, if possible, locations where the banks are naturally sloped to minimise earth work during cable installation.

The depth of cables under creek bends is influenced by the amount of scouring which could occur. In normal circumstances, the depth recommended for soil conditions (page Q-2) should suffice, with a minimum depth of 0.75 metre.

PROVISION OF JOINTING PITS

Install jointing pits only at lead-off points to customers (or prospective customers), branch cable joints, end of drum lengths, loading points and at major road crossings. Provide a double loop of plastic cable at each pit for jointing. Above ground jointing posts may be installed instead of jointing pits (See page Q-8).

LAYING CABLE IN TRENCH

A suitable bedding must be provided for plastic cables to prevent damage during and after laying. The bottom of the trench must be free of sharp stones and if necessary, a bedding of 50 mm of fine soil or sand provided.

Lay cable in as long a continuous length as possible so that the minimum number of joints is necessary. Provide slack cable for looping at jointing pits, above ground jointing posts or untailed terminal boxes on poles.

Where there are no obstructions, e.g. pipes crossing the trench, draw the cable trailer (or drum-carrying truck) along the route paying off the cable either directly into the trench or alongside where it can be lifted into the trench by hand.

DO NOT OBSTRUCT ROAD DRAINS OR WATER COURSES WITH EXCAVATED MATERIAL OR FELLED TIMBER. TAKE CARE NOT TO DISTURB PERMANENT MARKS OR SURVEY PEGS.

DRAWING CABLE UNDER OBSTRUCTIONS

Where it is necessary to lay the cable under service pipes or other obstructions crossing the trench, or through pipes provided under driveways or roads, place the cable drum at the end of the trench and pull the cable off by hand.

This method is also suitable where short lengths of cable are laid directly in the trench.

Draw the cable down hill if possible. For heavy cables or long lengths, place cable rollers at intervals along the route to reduce the hauling tension on the cable.

Avoid kinking the cable or drawing it around sharp angles or against objects which could damage the sheath.

Pass the cable end under the obstructions and push it through short pipes. A draw wire will be required to pull the cable through long lengths of pipe.

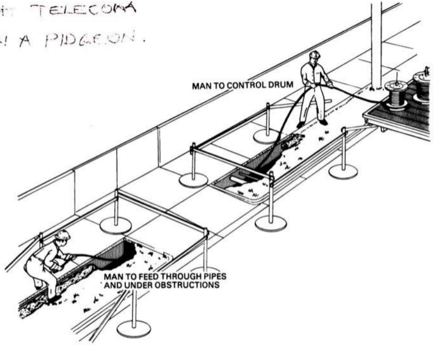
Where long sections are involved the cable may be pulled in convenient sections by fleeting through intermediate jointing pits.

On completion of the section pull forward the necessary slack cable for looping in intermediate pits and for leads to isolated terminal poles.

ON DAYS OF HIGH FIRE DANGER LINE PARTIES IN AFFECTED AREAS SHOULD PHONE THEIR DEPOT EVERY HOUR.

IF A FIRE IS OBSERVED, ASCERTAIN ITS EXTENT AND GIVE AS MUCH INFORMATION AS POSSIBLE TO THE LINES OFFICER OR SENIOR LINES OFFICER.

FIGHT TELECOM
TRAIN A PIDGEON.



DRAWING CABLE UNDER OBSTRUCTIONS

SAFETY PRECAUTIONS WHEN WORKING IN RURAL AREAS

USE OF CRAWLER TRACTORS

It is the responsibility of each Telecom staff member whose activities include operating, transporting, supervising or assisting in works in the vicinity of operating crawler tractors to be aware of the work hazards which exist in these circumstances. Staff must ensure that:-

- precautions are observed at all times in the interests of their personal safety and that of the public
- the only Telecom staff authorised to operate crawler tractors are those experienced plant operators holding a current operators Certificate of Competency issued by the Automotive Plant Section
- on-site safety briefings are given by the Lines Supervisor to alert new or less experienced party members to hazards particular to tractors and the work situation.

Route Clearing and Tree Felling

Safety helmets and safety boots shall always be worn by the tractor operator and all other Telecom staff present.

When working on public roads sufficient flagmen must be in attendance and/or barricades erected to keep traffic and pedestrians out of the work area.

A danger area (a radius from the tree being felled equal to twice its height) shall be maintained free of people and traffic during a felling operation. Where necessary, sufficient flagmen and/or barriers and approved warning signs shall be used.

Determine the safest direction for felling the tree, consider the possible hazard of a second tree falling or limbs from other trees breaking and falling also.

The Supervisor must ensure that all other persons are clear of the danger area before allowing the tractor operator to commence felling the tree.

After felling the tree and before re-entering the danger area make sure that broken limbs that could still fall are not left hanging on other trees.

Additional safety items shall be worn if your Supervisor considers it necessary.

SAFETY PRECAUTIONS WHEN WORKING IN RURAL AREAS

Before burning off undergrowth or felled timber check that, where required, a permit has been obtained and appropriate authorities notified.

Take care when burning off undergrowth or filled timber. Stack spoil and filled timber clear of gutters, road drains and watercourses.
Be particularly careful to avoid starting bushfires. Don't throw down lighted matches or cigarettes.

Place material and equipment where it will not endanger members of the public or stock.

Do not obstruct property entrances for longer than necessary. Close property gates.

Refer Section C for other safety precautions and public relations aspects.

BUSHFIRES ARE USUALLY SOMEONE'S CARELESSNESS. DON'T LET IT BE YOURS.

TRACTORS MUST BE FITTED WITH AN EFFICIENT SPARK ARRESTER AND A HAND CHEMICAL FIRE EXTINGUISHER.

USE

The above ground jointing post (S.77/86) may be used as a jointing enclosure for plastic cables in rural areas. It also serves as a marker post to indicate the location of the cable.

DESCRIPTION

The post assembly comprises three pieces:-

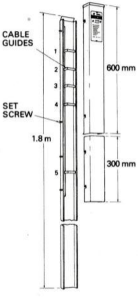
. Support channel, 1.9m long, containing cable guides.
. Lower cover, 300 mm long.
. Upper cover, 600 mm long, fitted with a marker plate to indicate the presence of Telecom cables.

LOCATION

Install post at points where it is necessary to joint cables i.e. end of cable drum lengths, lead-off points to customers and jointing points for lateral cables.
Where future joints may be required e.g. for connection of additional customers or lateral cables the cable may be looped through the post without removal of the sheath.

ERECTING POST

Install post in the cable trench in conjunction with the laying of the cable. Provide sufficient slack cable to reach 80 mm from top of post in its installed position.
Excavate a hole to 1.1 metres below ground level and set channel in position so that when the covers are fitted they will be readily accessible and the warning notice clearly visible. Where cable is installed along a roadway the cover should face the road.
Do not drive channel into the ground as this may distort it.



INSTALLING ABOVE GROUND JOINTING POST

ERECTING POSTS (CONTD.)

Backfill the soil around the channel base up to the level of the cable trench while keeping the post vertical. Ram the soil firmly taking care to avoid damage to the cables. In poor holding ground it may be necessary to set the post in concrete.

INSTALLING CABLES

Lead cables up the channel so that the free ends or the bight of looped cable are 80 mm from the top of the channel.

Where the loop of large plastic cables cannot be fitted within the channel of the post a short section of sheath may be removed at the bight of the loop and cover with plastic bag.

Secure the cables permanently to the bottom guide by lashing with insulated wire.

Protect cables where they enter the channel by fitting sections of scrap plastic sheath over them and taping the cables to the channel at this point.

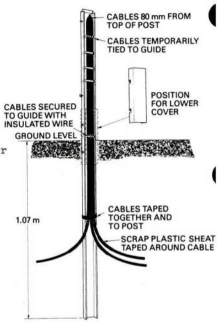
Fit lower cover and complete backfilling and ramming. Ensure that the post is kept vertical and that the cables are not damaged.

To identify the exchange side cable bind two turns of PVC tape around cable 75 mm below the fourth guide.

Secure cables in channel by lashing them to top guide.

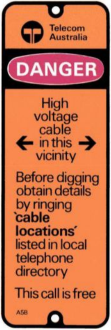
Fit upper cover and secure it by tightening the set screw into the main channel.

Jointing of cables is described in the Linemen's Handbook, Cable Jointing No. 1.



CABLE MARKERS

CAUTION SIGN (S.448/4)



DANGER SIGN (S.448/7)

LOCATION SIGN (S448/5)

ENTRY SIGN (S.448/6)

CABLE MARKERS

Item	Serial/ Item No.	Application
Post, Cable Marker, Steel	448/1	Star section steel post suitable for most soil types to which Caution and Location signs can be fitted.
Post, Cable Marker, Treated Wood (75-100mm)	448/3	Pressure treated softwood post for use as for Item 1.
Sign, Cable Marker, Caution	448/4	General purpose Caution sign for attachment to steel or wooden marker posts.
Sign, Cable Marker, Location	448/5	Location sign for attachment to steel or wooden posts. Distance to cable and depth can be stamped on sign.
Sign, Cable Marker, Entry	448/6	Sign for marking point of entry of lead-in cable to premises.
Sign, Cable Marker, Danger	448/7	Danger sign for use on coaxial cable routes which carry high voltages.
Sign, Cable Marker, Caution	448/8	Caution sign for attachment to above ground jointing post (S77/86).
Post, Cable Marker, Treated Wood (63-88mm)	448/10	Pressure treated softwood post for use as for Item 1.

INSTALLING CABLE MARKERS

NECESSITY FOR CABLE MARKERS

The provision of markers to indicate the location of underground cables is necessary to reduce the incidence of mechanical damage to the cables by persons who may be unaware of their presence.

INSTALLING MARKERS IN RURAL AREAS

In rural areas install markers to indicate the location of cables irrespective of whether they are buried directly in the ground or in ducts.

Before placing markers on private property discuss with the property owner and reach agreement on their location.

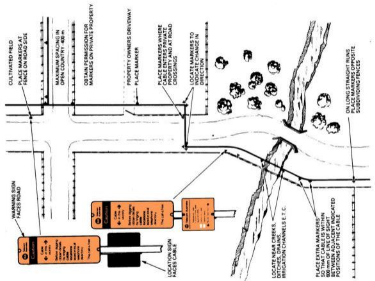
Provide markers to meet the following conditions:-

- Maximum spacing between markers 400 metres in open country, 200 metres in closer settled or lightly timbered areas.
- From any marker the adjacent marker on either side must be readily visible.
- Indicate angles in the route and points where spur cables lead off. Two markers may be necessary (See page Q-14).
- Provide markers to all points where the cable enters or leaves private property or passes under a fence.
- Provide markers on each side of road crossings, drains, irrigation channels, creeks or other potential hazards.
- Between any two markers the cable must be within 600 mm of a straight line between the indicated positions. This applies to cables laid in a smooth curve or where the route deviates slightly from a straight line.
- Place entry signs on both sides of boundary fences directly over the point of entry of lead-in cables. Where possible locate signs in a position where they will not be obscured by grass, shrubs, etc.

The layout of signs on a typical cable route is shown on Page Q-14.

WORK SAFELY. NO JOB IS SO URGENT THAT TIME CANNOT BE TAKEN TO DO IT SAFELY.

INSTALLING CABLE MARKERS



TYPICAL LOCATIONS FOR MARKERS - RURAL AREAS

INSTALLING CABLE MARKERS

INSTALLING MARKERS IN URBAN AREAS

Street Cables - In built-up areas markers should normally be installed only where there is insufficient evidence e.g. jointing pits, manholes etc. to indicate the presence of the cable.

Select locations for markers where they will be readily visible but will not detract from the appearance of the surroundings. Attach signs to existing structures such as fences, walls, poles etc. wherever practicable. Obtain permission from the owner before attaching to privately owned structures.

Lead-in Cables - Entry signs may be used to indicate the point of entry to premises, particularly commercial buildings where there is likelihood of the cable being disturbed. Place signs on both sides of the boundary fence directly over the lead-in cable and also on the wall above the point where the cable enters the premises.

TYPES OF MARKER POST

Steel Post (S.448/1) - This is a star section steel fence post on which plates are welded for mounting the signs. A stabilising plate (S.448/2) is available for use with the posts in poor holding ground.

Wooden Post (S.448/3 & 10) - This is a circular cross-section, pressure treated post, 1.8 m long and 63-88 mm in diameter. It is painted yellow and stencilled "TELECOM CABLE" in black.

Unstandard Posts - Suitable materials such as concrete, steel fence posts, G I water piping, steel rails or round or sawn length of durable timber may be used if desired.

SAFE WORK DEPENDS UPON SELECTING THE RIGHT TOOL FOR THE JOB AND USING IT CORRECTLY.

INSTALLING CABLE MARKERS

INSTALLING POSTS

Place posts close to the cable route about 600 mm clear of the cable. Where this is not practicable erect posts close to the property line.

Stamp distance to the cable in metres and depth of burial on the location sign.

Do not place posts where they could be a danger to the public or create an obstruction on side tracks etc.

Install posts to a depth of 600 mm. Where soil conditions are satisfactory or a mechanical driver is available drive the posts into the ground. Take care not to mutilate the top of the post when driving.

In poor holding ground use a stabilising plate with steel posts. Fit the plate on the pointed end of the post and allow it to remain free until the post is fully driven. Position plate 150 mm below the surface and tap down lugs to make firm fitting on post.

MOUNTING SIGNS ON POSTS

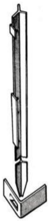
Mount Location signs so that they face the cable.

Caution and Danger signs should face the direction where they are readily visible to passers-by.

Attach signs to standard steel posts by No.14 x 30 mm shakeproof screws or similar.

Use 40 mm spring head nails to fasten signs to wooden posts.

Entry signs may be attached to fences or walls by 25 mm x 12 gauge GI clouts or masonry anchors where walls are brick or concrete.



STEEL POST (S.448/1)

WOODEN POST (S.448/3)

Cable Markers - Maintenance, Colour Coding and Temporary Provision

SE LC 9/7 SEPTEMBER 1983

1. INTRODUCTION

1.1 This insert amplifies the instruction re markers and gives direction re maintenance of cable markers, and temporary marking of underground cables. The purpose of providing temporary markers is to provide an indication to other authorities or individuals, who are about to dig near Telecom cables, of their location and so reduce the incidence of cable damage.

2. MAINTENANCE OF PERMANENT CABLE MARKERS

2.1 The provison and subsequent maintenance of cable markers is especially important in rural and developing areas, particularly where cable routes cross private property. Inspections of cable routes should therefore be made to ensure that adequate cable markers have been provided and that they are easily seen.

2.2 Inspections

In Sections which have cable maintenance responsibilities all officers should watch for any sign of disturbance to underground plant or markers whenever travelling along cable routes or workin in those areas. In addition complete cable route inspections should be undertaken as often as necessary for local conditions, but at intervals not exceeding the following:

i. Coaxial cables - three months.

ii. Trunk and junction cables and subscriber cable under air pressure - one year.

iii. Other subscriber cable - six years.

2.3 The following main points should be considered by inspection staf when conducting their routine inspections of cable markers.

i. Sufficient markers are installed in accordance with pages Q and Q15 of TPH 0055 (Linemans Handbook: Cables & Conduits) and all markers are fitted with appropriate signs.

ii. All cable markers on railway property are installed in accordance with the Code of Practice 'APO Underground Installations Within Railway Boundaries, 1973' Para 7.

iii. The need to repaint or replace marker plates or posts.

iv. The need to clear scrub and vegetation from around markers. Wood marker posts are vulnerable in fire prone areas and if close to the cable could damage the cable.

v. The correct setting of markers.

2.4 The effectiveness of cable markers depends on whether they are adequately provided and easily seen. Lines Officers should ensure that any maintenance required is carried out promptly.

COLOUR CODING OF MARKER POSTS

3.1 Along some routes it has been found convenient to colour code marker posts to indicate certain features of the cable and equipment in manholes.

3. (contd).

3.2 Should it be decided to so colour code a route, colours should be chosen as follows :

i.	Air Pressure Cable	YELLOW BAND 75mm wide
ii.	Contactor Alarm Point	RED BAND 75mm wide
iii.	Test Point	GREEN & RED BAND each 35mm wide
iv.	Flange	GREEN BAND 75mm wide
v.	Loading Coil	WHITE BAND 75mm wide
vi.	Air Seal	LIGHT BLUE BAND 75mm wide
vii.	Underground Repeater	BLACK BAND 75mm wide (see also EI LINES General TP3000(S)para 3)

The coloured bands are to be painted on the marker post in the sequence shown, starting immediately below the marker plate.

ROVISION OF TEMPORARY MARKERS

1 The method of providing temporary markers depends on the ground surface and the importance of the cable. Guidelines are given below.

2 Type of Surface

4.2.1 Asphalt or Concrete Surface

A Plastic stencil (Drawing No. SB11759 Sht 2) shall be used to paint the Telecom Australia logo on the surface. Place the stencil on the surface directly above the cable. Spray yellow spray ink from a pressure pack spray to reproduce the Telecom Australia cable indication on the surface.

4.2.2 Hard or Firm Ground

i. Trunk junction and coaxial cables - as for soft and sandy ground described in Para 4.2.3, unless the projection above ground level constitutes a hazard to staff or public, in which case use method as described for subscriber and distribution cables.

(ii) Subscriber and distribution cables - A 65 mm square hardboard block painted with the Telecom Australia logo shall be placed on the ground directly above the cable, and fixed in positon with a 150 mm nail driven through it into the ground. The hardboard block is to be 5 mm thick 'Masonite' or similar board.

4.2.3 <u>Soft or Sandy Ground</u>

A wooden peg approximately 300 mm long and 25 mm square in section, with one pointed end, shall be driven into the ground directly above the cable. A 65 mm square hardboard biock painted with the Telecom Australian logo shall be fastened to the top of the peg with a 20 mm nail.

5. MATERIALS FOR TEMPORARY MARKERS

5.1 The following materials are required and shall be stocked and distributed through sectional stores.

i. 65mm square hardboard blocks with Telecom Australia lo painted on it. (Drawing No. SB11760)

ii. Plastic stencil with Telecom Australia logo cut out. (Drawing No. SB11759 Sht 2) (Available from 'Dymark')

iii. 25mm square section wooden pegs, 300mm long.

iv. 150mm flat head steel nails.

v. 20mm flat head steel nails.

vi. Yellow pressure pack 'DYMARK' spray ink.

- END -

SECTION R
SAFETY PRECAUTIONS

- TELECOM SAFETY POLICY
- EFFECTS OF ACCIDENTS
- SAFETY PRECAUTIONS
- SAFETY WHEN WORKING ON ROADS
- ROAD WARNING SIGNS
- BARRICADES AND LAMPS
- SAFETY WITH PNEUMATIC TOOLS
- NOISE HAZARDS
- LOCATING GAS PIPELINES
- DANGEROUS GASES
- TESTING FOR COMBUSTIBLE GASES & CARBON MONOXIDE
- DETECTING CARBON MONOXIDE GAS
- GAS CLEARANCE OPERATIONS
- MANHOLE RESCUE
- REFERENCES
- MANUAL HANDLING
- DANGERS IN HANDLING LEAD
- ACCIDENT REPORTING
- HEART–LUNG RESUSCITATION
- SAFE WORKING PRACTICES FOR ASBESTOS CEMENT PRODUCTS
- PORTABLE 240V AC POWER TOOLS
- EXTENSION LEADS
- SAFETY HELMETS
- SAFETY VESTS

Throughout this handbook Safety Precautions have been highlighted in footnotes on many pages. Further safety precautions to avoid accidents are detailed in this Section so that we can overcome the hazards that exist at work and at home.

TELECOM AUSTRALIA POLICY ON SAFETY

It is the policy of this Commission that every employee shall be provided with a safe and healthy place in which to work. To this end, every reasonable effort will be made in your interest in the fields of accident prevention, fire protection and health preservation.
In particular terms, this policy is :

- To place the safety of employees and the public ahead of protection of the Commission's equipment and service.
- To provide and maintain a safe plant.
- To ensure that all staff are instructed how to perform their jobs safely.
- To train supervisors in high and potentially high accident rate areas in the basic principles of accident prevention.
- To establish safety committees in appropriate areas and to provide for employee consultation on accident prevention measures.
- To hold all levels of management fully responsible and accountable for accidents in the areas under their control.
- To ascertain the cause and take corrective action for every accident, whether it has caused injury or not.
- To regard all industrial accidents as preventable.

FIRST AID.

TELECOM AUSTRALIA POLICY ON FIRST AID IS THAT ALL STAFF WILL BE TRAINED IN BASIC FIRST AID, INCLUDING HEART-LUNG RESUSCITATION AND USE OF THE FIRST AID KIT.

EFFECTS OF ACCIDENTS

THE EFFECTS OF ACCIDENTS ON INDIVIDUALS

As individuals, we should consider the effects an accident has on us and our family :

. Permanent disability such as loss of an eye or limbs.

. Personal suffering and hardship.

. Consequent effects on our family due to reduced standard of living with the added inconvenience and cost of an incapacitated member of the family.

. Continuing disability, in many cases of injury.

. Incapacity for the same job again.

. Incapacity for activities outside normal work, for example, hobbies, sport, special activities etc.

Some of these effects can be measured in terms of money because the victims of industrial accidents usually receive compensation or social payments but such payments never compensate for the loss of good health and the inability of a person to persue a useful and satisfying career and personal interests. It is very clear that as individuals none of us wish to be involved in an accident.

BE ALERT FOR HIDDEN POWER CABLES WHEN WORKING IN CUSTOMERS PREMISES. ALWAYS APPLY THE WORKING PRECAUTIONS FOR EVERY JOB AND STAY SAFE. (Reference EI LINES General SP 4010).

SAFETY PRECAUTIONS

Attention is drawn to the following sections describing the safety precautions necessary for particular aspects of conduit and cable installation:-

Supporting Trenches	Page B-26
Safety with Trench Excavation	Page B-12
Guarding Excavations	Page C-1
Lighting Excavations at Night	Page C-1
Excavating Near Other Authorities' Plant	Page C-5
Excavating Near Electric Cables	Page C-8
Handling Drums of Cable	Page Q-7
Safety When Hauling Cables	Page G-19
Working in Rural Areas	Page I-18

General safety precautions, rescue operations and accident reporting procedures are described in this Section.

WORK SAFELY AND MAKE SAFETY PRECAUTIONS A PART OF THE JOB.

BE CONSTANTLY ON GUARD AGAINST AN ACCIDENT AND DO NOT COMMENCE A JOB UNTIL YOU ARE SURE THAT YOU CAN WORK SAFELY.

SAFETY WHEN WORKING ON ROADS

ADVANCE WARNING SIGNS (Workmen Ahead, Detour Ahead, Flagman Ahead, etc.)

Place signs on the side of the road facing oncoming traffic as shown on Page R-4. Set them in a position where motorists will be warned in ample time to enable speed to be reduced to a safe limit by the time the hazard is reached. In built-up areas 25-100 metres from the hazard is usually adequate but on maximum speed roads in rural areas the signs should be 100-200 metres ahead.

POSITION SIGNS (Road Closed, Excavation, Workmen)

Place these signs at or close to the work location. Where applicable use in conjunction with advance warning signs e.g. "Workmen" with advance warning sign "Workmen Ahead".

TRAFFIC DIVERSION SIGNS (Side Track Detour)

Used to indicate to road traffic the direction of a detour or side track to be followed. Place signs at the point of detour. An advance warning sign e.g. "Detour Ahead", will normally be required also.

HAND BANNER STOP/GO

Used to regulate the passage of traffic through or past a temporary obstruction which closes one lane of a two way road. They are operated by two men, one on each side of the obstruction and about 70 metres from it.

SPECIAL HAZARD SIGNS (Blasting, Stop, Await Signal; Blasting, Switch Off Radio Transmitter)

These signs are used in conjunction with blasting operations. Refer Explosives Handbook.

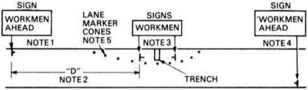
TEMPORARY BARRICADES AND WARNING LAMPS

Erect barrier posts and rails around open excavations, heaps of spoil, material stacks and any other hazards to ensure the safety of vehicular and pedestrian traffic. Attach red warning lamps to the barricades to outline the hazard at night. Flashing amber lamps may be placed on end barricades facing the oncoming traffic.

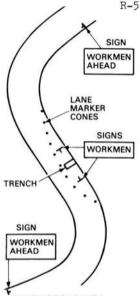
Trailers, compressors and other mechanical aids left over night in a position which creates a hazard must be barricaded and/or outlined with red lamps.

Use white lights for illumination only e.g. to light road warning signs. Shield the light source from oncoming traffic. Green lights must not be used.

ROAD WARNING SIGNS



LOCATION OF ADVANCE WARNING AND POSITION SIGNS (GOOD VISIBILITY)



WINDING ROAD WITH RESTRICTED VISIBILITY

NOTES

. Place WORKMEN AHEAD sign on road verge to warn oncoming traffic. Use other advance warning signs (e.g. Detour Ahead, Trenching Machine Ahead, Lane Blocked Ahead etc. See page R-4) where appropriate.

. Distance 'D' = 25-100 metres in built up areas.
100-200 metres on maximum speed roads in rural areas.

. Place WORKMEN signs close to the work site. For further protection of workmen a vehicle may be parked inside the barricades on the traffic side of the excavation.

. Place an advance warning sign on opposite side of road.

. Use lane marker cones (witches hats) to divert traffic smoothly around obstructions.

. Where necessary control flow of traffic past road obstruction by men with Stop/Go hand banners or flags.

REASSURE STAFF THAT WHAT THEY ARE DOING CAN ALWAYS BE DONE SAFELY.

ROAD WARNING SIGNS

DESCRIPTION	Serial/Item	Remarks
Flag, Warning Sign	148/37	Red bunting flag 450 mm x 600 mm
Banner, Stop/Go	148/38	For traffic control (use in S.A. illegal
Banner, Stop	148/89	For traffic control (for use in S.A. onl
Road Plant Ahead	148/152	Warning Sign 0.6 m x 1 m
Workmen Ahead	148/42	Warning Sign 0.6 m x 1.2 m
Detour Ahead	148/43	Warning Sign 0.6 m x 1.2 m
Caution-Loose Wire Ahead	148/153	Advance Warning Sign 0.6 m x 1.2 m
Lane Closed	148/154	Advance Warning Sign 0.6 m x 1.2 m
Roadwork Ahead	148/46	Advance Warning Sign 0.6 m x 1.8 m
Excavation	148/155	Position Sign 0.3 m x 1.2 m
Road Closed	148/48	Position Sign 0.3 m x 1.8 m
Workmen	148/49	Position Sign 0.3 m x 1.2 m
Half Road Closed	148/68	Traffic Diversion Sign 0.6 m x 1.2 m
Detour. Left pointing arrow.	148/53	Traffic Diversion Sign 0.3 m x 1.2 m
Detour. Right pointing arrow.	148/54	Traffic Diversion Sign 0.3 m x 1.2 m
Blasting, Stop, Await Signal	148/61	Special Hazard Sign 0.6 m x 0.9 m
Blasting Area. Switch Off Radio Transmitters.	148/62	Special Hazard Sign 0.6 m x 1.2 m
Stand, road warning signs	148/65	For erection of road warning signs. Two required per sign.

ROAD WARNING SIGNS - TYPES AVAILABLE

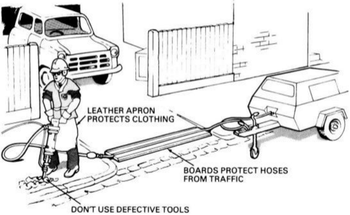
Position flagmen far enough away from both ends of the obstruction to caution or restrict traffic when working on highways and roads.

Item	Serial/Item	Remarks
Post, Barrier, Steel (Triangular base)	103/10	For use with steel barrier rails.
Post, Barrier, Steel (Disc base)	103/23	Preferred type-for use with steel barrier rails.
Post, Barrier, Wooden	103/28	For use with wooden rails S.103/30.
Rail, Barrier, Steel 1.8 m	103/11	Short rail, painted yellow and black.
Rail, Barrier, Steel 2.7 m	103/12	Medium rail, painted yellow and black.
Rail, Barrier, Steel 3.6 m	103/13	Long rail, painted yellow and black.
Rail, Barrier, Wooden	103/30	Rail 2.75 metres painted white. Interchangeable with S103/12.
Lamp, Traffic Warning, Red Lamp, Traffic Warning, White	159/21) 159/22)	Kerosene burning, 100 hour lamps for warning lights on barricades.
Lens, Red	159/24	For replacement in S.159/21.
Lens, Clear	159/25	For replacement in S.159/22.
Lamp, Flashing, Amber	159/31	For use at hazards in face of oncoming traffic.
Lane Marker Cones (Witches Hats)	NS	For diverting traffic around obstructions.

BARRICADES AND LAMPS - TYPES AND USES

SAFETY WITH PNEUMATIC TOOLS

Before attempting to operate any pneumatic tool make sure that it is in satisfactory working order. Do not continue to use any tool which becomes faulty as continued operation may lead to parts breaking off and causing injury from flying pieces.
Connect each tool to the compressor with a separate hose. Limit the length of hose to 20 metres as tools operate less efficiently on long hoses.
See that points of steels, rock drill bits and asphalt cutters are sharp.

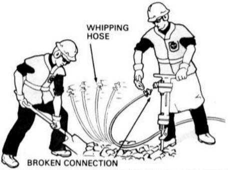


HOSE FITTINGS

Ensure that all hose couplings are in good condition and are reasonably tight.

Where leather washers are required in coupling assemblies to prevent air leakage make sure that they are fitted correctly.

Do not tighten hose fittings excessively by using a hammer. Serious injury can occur if the tail piece or nut fractures with high pressure air in the hose.



DON'T USE A HAMMER TO TIGHTEN COUPLINGS - INJURY CAN OCCUR

AIR HOSES

Do not use hoses that are in any way faulty.

Replace hoses as soon as they commence to perish.

If the hose end becomes soft and spongy remove a short length and refit the coupling.

Where hoses must cross traffic ways protect them by two boards of adequate dimensions laid on either wide of the hose.

Do not pull on the air hose to move or lift the tool.

Before fitting a pneumatic tool blow out the air hose to remove any dirt or loose pieces of rubber. Ensure that the end of the hose is firmly held so that it will not slip when air pressure is applied and cause injury to some person nearby. Point the hose in a direction where no person will be injured by the air blast or flying particles.

SAFETY WITH PNEUMATIC TOOLS

DANGERS IN USING COMPRESSED AIR

When improperly used, compressed air can cause serious injury which may result in death. If compressed air enters even a tiny puncture of the skin, the affected part, and sometimes the whole limb, may swell alarmingly, with intense pain. Where the jet forces air into the blood stream it can travel until it reaches the small blood vessels in the brain, bursting the vessels to cause death.

Do not direct a jet of compressed air towards your body or the body of another person.

Do not attempt to clean the compressor or tools with compressed air. Jet propelled particles present a serious eye hazard to the operator and bystanders.

Do not bend the air hose to cut off the air supply to a tool. This leads to premature hose failure and possible injury to the operator.

WEARING PROTECTIVE CLOTHING

Wear a leather apron when operating pneumatic tools as the exhaust contains oil and moisture which will affect clothing. Where the tool is fitted with an exhaust deflector adjust this to direct the exhaust away from the operator.

In very dusty conditions wear either a respirator or a disposable face mask (S.34/76-79).

To avoid foot injuries wear safety boots.

Safety Helmets must also be worn.

DANGER OF DUST IN EXCAVATIONS

Where dust from pneumatic tools constitutes a health hazard take precautions such as water spray or exhaust fan and wear a respirator or a disposable mask.

DRAINING AIR RECEIVERS ON PORTABLE COMPRESSORS

Drain air receivers at least twice daily to remove oil, moisture, etc. Accumulation of oil in the receiver can lead to explosive conditions.

TESTING SAFETY VALVES

Test safety valves daily by hand operation to ensure that they are in proper working condition. If the valve is out of adjustment or pressure gauge is faulty notify the officer in charge.

NOISE HAZARDS

Exposure to intensive noise can cause temporary or even permanent loss of hearing efficiency, depending on the length of time of the exposure and the intensity of the sound.

Ear muffs provide the best protection from high noise levels. The type purchased for use by Telecom staff may be worn comfortably with or without safety helmets.

WHEN TO WEAR EAR MUFFS

- When operating breakers, drifters, spaders and other pneumatic impact tools.
- When operating petrol engine driven chain saws.
- When working close to tools mentioned above particularly in the case of pneumatic tools if they are being operated in confined spaces such as deep trenches, manholes and tunnels.
- When operating or working close to machines which produce high noise levels.
- When using or working close to explosive powered tools in a confined space.
- Other situations as considered necessary by the Supervisor in charge of the work.

HOW TO WEAR MUFFS

Good protection depends upon a good seal between the surface of the skin and the ear muff. A very small leak can reduce its effectiveness.

Ear muffs may work loose as a result of talking, chewing etc and they must be reseated from time to time.

A good seal cannot be obtained without some initial discomfort.

Ear muffs will not make it more difficult to hear speech or warning signals.

STAFF RESPONSIBILITIES

All staff must learn to recognise situations where noise presents a hazard and must wear ear muffs to protect their hearing. Supervisory officers are responsible for ensuring that ear muffs are worn wherever necessary.

LOCATING GAS PIPELINES

GAS PIPELINES

Gas pipelines constitute a serious hazard for staff operating mechanical plant during excavating or earth boring operations. Pipelines carrying petroleum and other products are equally hazardous. Plant operators must exercise great care to locate and avoid contact with any pipeline.

Supervisors must make themselves familiar with the operating pressures used by pipeline and gas authorities in their district and liaise with their representatives for the location of such pipelines and service pipes.

IDENTIFICATION OF HIGH PRESSURE GAS MAINS

Gas authorities make plans of their medium, high and transmission pressure installations available to Telecom Australia, and on request, provide staff to assist in pin-pointing the location of their pipelines.

In some areas a continuous yellow plastic marker tape may be buried 300 mm below the surface and centrally above the transmission pressure gas pipeline.

In certain instances they may be protected with concrete slabs, on both sides and on top of the pipeline. Yellow polyethylene pipes may be used for medium pressure gas reticulation.

LOCATION OF PIPES

Sharp probes must not be used for locating any pipelines as the protective coating or the pipe itself may be damaged. Additional danger exists where the power reticulation is underground.

Supervisors should ensure that all staff using mechanical plant are fully informed on the location of all pipelines and gas pipes both before starting and during excavating and earth boring operations.

Some States have a local arrangement with the Gas Authority relating to transmission pressure pipelines where the authority must be approached before commencing to locate the pipeline.

SUPERVISORS RESPONSIBILITIES

Supervisors must keep themselves conversant with the location of gas pipelines in their district and brief staff accordingly before and during construction and maintenance operations. They should keep their staff informed of the dangers of contact with gas pipelines and ensure that :

. Information on work sketches and plans showing the location of gas pipelines is understood and applied. If necessary, make arrangements with the Gas Authority to be on the job to guide and assist in locating pipes.
. Cable locators are used for tracing pipeline routes.
. Pot-holding by careful hand excavation at successive positions is carried out to confirm that the indicated line and depth of the pipeline is accurate.
. Combustible gas detectors are available and are used.

Reference - Engineering Instructions :-

LINES	General	MA 4000
"	"	SP 4000
"	"	TE 1510
"	"	TE 4410
"	"	TE 4420
"	"	TE 4430
"	"	TE 4450
"	"	TE 4470
"	"	TE 4440

DANGEROUS GASES

TYPES OF GAS ENCOUNTERED

The dangerous gases most commonly found in underground plant are those reticulated for industrial and domestic use for heating, cooking, etc. Gas leakage can result in a built-up of gas in confined spaces with consequent risk of fire, explosion, poisoning and asphyxiation. Soil gases (marsh, sewer etc), industrial gases and liquid fuels (oil, petrol, etc.) may also enter ducts and manholes and create a hazard.

Type	Effect	How Detected	Possible Source
Natural Gas (Methane)	Asphyxiating and Explosive	Combustible Gas Detector	Areas of gas reticulation
Liquefied Petroleum Gas (L.P.G.) (Propane)	Asphyxiating and Explosive	Combustible Gas Detector	Areas of gas reticulation Leaks in L.P. Gas plumbing equipment.
Tempered Liquefied Petroleum Gas and Simulated Natural Gas	Asphyxiating and Explosive	Combustible Gas Detector	Areas of gas reticulation
Manufactured Gases (Contain Carbon Monoxide, Hydrogen or Methane)	Poisonous and Explosive	Combustible Gas Detector Carbon Monoxide Detector	Areas of manufactured gas reticulation

TYPES OF GAS RETICULATED FOR INDUSTRIAL AND DOMESTIC HEATING

NOTE: While gases can normally be detected by their characteristic odour it should be noted that under certain conditions dangerous gas can be present but can not be smelt. Combustible gas detectors must therefore be used in all cases.

TESTING FOR COMBUSTIBLE GASES AND CARBON MONOXIDE

Staff who smoke while on duty place themselves at personal risk if they smoke when removing the covers from manholes and pits, enter cable chambers or tunnels. Smokers should develop a habit of extinguishing their cigarettes, pipes etc before opening or entering any underground structure.

Test for combustible gas:

. Before any work is commenced in the following locations and always before any naked flame, including cigarettes etc are brought near the site or any flame is ignited or any spark producing device is used.

. Before entering any manhole, exchange entry chamber or tunnel.

. Upon entering a cable entry chamber or sub-floor room in large residential or commercial premises.

. In excavations adjacent to gas, fuel or chemical pipelines.

. Whenever LP gas cylinders are used underground a continuously monitoring gas detector shall be operating nearby whilst the equipment is in the manhole etc.

. In a jointing pit where the presence of reticulated gas, petrol vapour, industrial gas or marsh gas is suspected.

. Where gas was detected recently.

. Any above ground structure linked by pipe to the underground network in areas where gas is suspected ie, pillars, cabinets or end of pipe erected on poles.

TESTING FOR COMBUSTIBLE GASES AND CARBON MONOXIDE

All field staff particularly Supervisors should personally develop a routine of looking for possible gas sources. Accidents or highly dangerous situations have occured near:

. leaking underground petrol tanks,

. swampy or filled areas of land,

. old, supposedly abandoned gas pipes,

. excavations near gas pipes.

RECHECKING FOR THE PRESENCE OF COMBUSTIBLE GAS

Combustible gas may enter a manhole or cable entry chamber after an initial test has been carried out. It is therefore important to make repeated spot checks if a long period is spent in the manhole or tunnel. Tests should be repeated after returning from meal breaks, before relighting LP gas equipment or smoking. Smokers should use a continuous monitoring detector attached at working height whenever working for long periods in manholes, tunnels or cable entry chambers.

TESTING FOR CARBON MONOXIDE If the presence of carbon monoxide from any source is suspected additional tests using a carbon monoxide detector may be necessary. (See page R17 and R18).

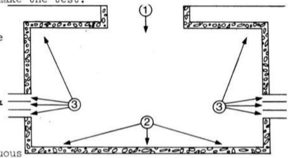
VENTILATION Where gas is suspected due to physical symptoms (headache, nausea, dizziness) and is not indicated on a combustible or carbon monoxide detectors, arrange for continuous forced draught ventilation or ventilate with a wind sail before entering the manhole. (See page R22 to R23).

TESTING FOR COMBUSTIBLE GASES AND CARBON MONOXIDE

GAS TEST PROCEDURE - Hold the gas detector at each test point between half a minute to a minute.

Manholes - Make tests as shown in sketch.

. Pass the probe 150 mm through the keyhole in the manhole cover and test the atmosphere. If no hole, open the cover about 50 mm to make the test.
. Remove cover and test close to floor.
. Test each nest of ducts and the upper level of the manhole. (Pump any water out before making this test).
. If a duct plug is to be removed loosen and tilt it in the duct sufficiently to insert the probe of the gas detector and test for gas before fully removing the plug from the duct.



TESTS FOR GAS IN A MANHOLE

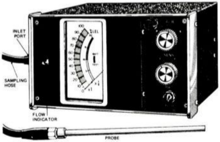
Side Entry Manholes and Tunnels.

. Make the same tests as above and also while traversing the shaft or tunnel make continuous tests at waist level.
. Jointing Pits - Make the same test as for manholes.
. Excavations - Test at bottom of the excavation and at intermediate levels.
. Test above ground equipment linked to the network by pipe or conduit - Cabinet bases through venting holes, where there are no vent holes test seals around terminal units and sealing plugs.
. Test at the end of conduit or riser pipes.
. Where it is suspected that petrol vapour could have permeated into cable, test the air inside at the nearest test point. If the jointing sleeve is to be removed and the test point is some distance away, make a small cut in the sleeve and test the air.

TESTING FOR COMBUSTIBLE GASES AND CARBON MONOXIDE

NOTE: Several types of Combustible Gas Detectors have been provided and the manufacturer instructions for correct use and servicing of the instrument must be followed. Where a continuous monitoring type is used, set it in the manhole or excavation close to the working position

GAS CHECK MODEL 74 GC



COSMOS TYPE XP-301B

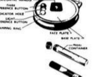
TYPICAL COMBUSTIBLE GAS DETECTORS

USE OF CARBON MONOXIDE GAS DETECTOR (S420/2)

In addition to testing with a Combustible Gas detector a Carbon Monoxide gas detector must be used where manufactured gas containing more than 10% carbon monoxide is reticulated or where carbon monoxide is suspected.

NOTE: The Carbon Monoxide gas detector will not detect natural gas, liquefied petroleum gases, petrol vapour and other combustible gases.

The Carbon Monoxide gas detector is supplied in a case together with a phial of sodium chlorpalladite solution and spare test papers.
Assemble the detector in the order shown on page R-20 clamping the face plate to the base moderately tight with the clamping ring.



CARBON MONOXIDE GAS DETECTOR

TESTING FOR CARBON MONOXIDE GAS

Apply just sufficient solution to saturate the small area of test paper seen through the hole in the face plate.
Immediately lower the detector into the manhole by a piece of string or wire attached to the support on the face plate and suspend it with the face place horizontal at or near the position the workman's head will occupy.
After 10 minutes, remove detector from the manhole and compare the colour of the test paper with the colour of the face plate and the reference buttons on either side of the indicator hole.

IF THE TEST PAPER HAS CHANGED TO A COLOUR DARKER THAN THE FACE PLATE CARBON MONOXIDE GAS IS PRESENT. THE ATMOSPHERE IS DANGEROUS AND MAY BE EXPLOSIVE.

ADVISE YOUR SUPERVISOR AND TAKE OTHER ACTION AS DESCRIBED ON PAGE R-21.

DETECTING CARBON MONOXIDE GAS

TESTING FOR CARBON MONOXIDE GAS (Continued)

To test duct entries suspend the detector with its face plate vertical and place it so that the sensitised part of the paper is close to the duct mouth.

Do not enter the manhole.

After each test loosen clamping ring and rotate face plate so that a fresh section of test paper is exposed. Approximately 10 tests may be made with the one paper.

Use only perfectly clean test papers.

SUPPLY OF SODIUM CHLORPALLADITE SOLUTION

The solution is supplied in a phial labelled with an expiry date because it deteriorates after about 12 months. The solution must not be used after this date.

MAINTENANCE OF DETECTOR

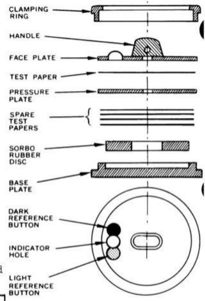
Do not expose phials of solution to strong daylight for long periods.

Keep indicator and associated equipment in its case when not in use.

Detectors will be checked quarterly by Lines Supervisors.

For all other maintenance the instruments must be returned to the Instrument Repair Centre.

Serial/Item	Equipment
420/2	Carbon Monoxide Detector (complete).
420/3	Glass phial Sodium Chlorpalladite solution
420/5	Test papers 70 mm diameter.



CARBON MONOXIDE DETECTOR - ORDER OF ASSEMBLING COMPONENTS.

GAS CLEARANCE OPERATIONS

ACTION TO TAKE WHEN GAS IS DETECTED

LOCAL FIELD STAFF. Any reading above 10% LEL on a portable combustible gas detector or any colour change on a carbon monoxide gas detector is to be regarded as potentially dangerous.

Take immediate action as follows:

- If reading is less than 40-50% replace the manhole covers and seek assistance.
- If reading is above 40-50% LEL safeguard the area by erecting warning signs (S148/150) and keeping the public at a safe distance. Prevent any burning material, flame or spark producing device being brought near any underground opening or gas leak. Replace manhole covers and use manhole guards to restrict access to the area. Obtain help to keep area clear.
- Inform the Lines Officer by telephone of the presence of gas.
- If reading is less than 10% LEL treat area with caution, test at frequent intervals. If reading rises above 10% LEL take action as above.

NOTE: This Section should be read in conjunction with any local State instruction in regard to action that is required when gas is detected.

If visiting field staff detect gas above 10% LEL the local External Plant Manager must be notified immediately. Visiting staff will take appropriate action as listed above.

SUPERVISORS. Ascertain if possible the origin of the gas entering the manhole, telephone the responsible authority.

Advise the External Plant Manager then supervise gas clearance operations.

The telephone report of gas must be confirmed in writing on Form E72 to the gas authority or commercial undertaking concerned.

If a reading is obtained near electric traffic signals advise the responsible authority and recommend that they de-energise the signals as soon as possible.

When the gas leak has been located, portable ventilation equipment may be used to clear the gas. If mechanical ventilators are not available use alternate methods. When the source of the leak has been repaired and gas cleared, close all manhole covers for an hour then retest again. If further reading obtained ventilate to clear remaining gas. Repeat test after one hour.

After gas has been cleared make sure the work area is well ventilated while staff are at work in the manhole.

Use a continuous monitoring combustible detector at the work face. Retest every hour if using a spot sampling detector and before using flame or spark producing device. This includes smoking .

Carry out a further test one week later.

Where mechanical ventilation is not available provide a man on duty aboveground for remainder of the day.

DISTRICT RESPONSIBILITY

Provide back up assistance. Confirm in writing the telephone reports of the presence of gas.

Make sure the origin of the gas leak has been located and repaired and that the underground network in the vicinity is free from gas after repairs.

Submit a Gas Incident Report to the Lines Practices and Protection Section.

EMERGENCY PRECAUTIONS FOR DAMAGED GAS PIPELINES

Staff must not attempt to plug any damaged gas pipe. If gas pipe is damaged the following action must be taken:

- Stop all machines and portable electric tools.
- Withdraw all staff to a safe distance.
- Erect barrier guards and warning signs.
- Prevent members of the public from entering the area.
- Extinguish any flame, cigarettes etc.

ENSURE THAT THE GAS AUTHORITY LOCATES AND REPAIRS THE SOURCE OF THE LEAK.

DISPOSING COMBUSTIBLE GAS FROM THE UNDERGROUND NETWORK

Use forced draft ventilators or windsails (see page R-22) to purge gas from manholes and conduits. Remove covers from adjacent manholes. Most situations requiring gas clearance will require strict control by Supervisory staff.

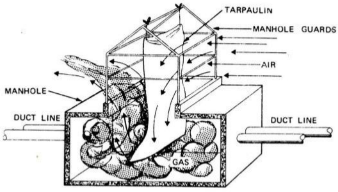
Extreme care must be taken when using the portable heater/ventilator/alternator (HVA) to disperse combustible gas from the underground network, because the engine exhaust, electrical system and alternator produce sparks sufficient to ignite combustible gas/air mixture.

To disperse combustible gas from the underground network :

- Locate the machine on the downwind side and as far away as practicable from the affected manhole/s.
- Remove covers from adjacent manholes each side of the affected manhole. Guard the surrounding areas to prevent the public, vehicles and flame or spark producing equipment entering the area.
- Start the engine and with the ventilator operating, partly open the cover of the affected manhole only sufficient to place the air delivery duct in the manhole.
- Continue ventilating until 10 minutes after tests show that the gas has been cleared from the network.
- Close all manhole covers for at least half an hour, then re-test for gas throughout the affected area.
- If the tests show that the network is still clear of gas, make sure that the area is well ventilated before staff enter the manhole and while working in the manhole.

THE HEATER IN THE HVA MUST NOT BE OPERATED DURING GAS DISPERSAL OPERATIONS.

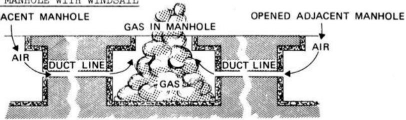
GAS CLEARANCE OPERATIONS



DO NOT ENTER A MANHOLE UNTIL ALL DANGEROUS GAS HAS BEEN CLEARED.

KEEP LIGHTED CIGARETTES AND NAKED FLAMES AWAY FROM THE MANHOLE.

REMOVING GAS FROM MANHOLE WITH WINDSAIL



 REMOVING GAS BY OPENING ADJACENT MANHOLE COVERS

MANHOLE RESCUE

SAFETY LINE

Every conduit or cable hauling party, manhole builder or other staff engaged on work which requires men to enter manholes or deep excavations must be equipped with safety lines to assist in rescuing any workman who may be injured or overcome by gas.

The Safety Line (12 Metre Length S.34/105 or 20 Metre Length S.34/133) consists of 12 mm diameter manilla rope with a snap hook spliced to one end.

REMOVAL OF UNCONSCIOUS MAN FROM MANHOLE OR EXCAVATION

If it is suspected that the workman has been overcome by gas he must be removed from the manhole as quickly as possible.

Call for assistance from other workmen or passers by.

Ask them to send for an ambulance or doctor.

Look for cause of accident (gas, electrical, fallen material, etc.) and take precautions accordingly.

Enter manhole with safety line.

Turn victim on his back. Move his head and shoulders under the manhole opening if possible.

Pass safety line under his armpits and clip snap hook around the rope.

Leave manhole and haul victim to the surface.

If breathing has stopped apply artificial respiration.

When victim regains consciousness keep him quiet and warm until assistance arrives.

SAFETY LINE AROUND LINEMAN

ALTERNATIVE METHOD

Manholes greater than 1.5 m deep.

Pass the snap-hook end of the safety-line between the top and middle rails of the tent frame. Loop the remaining length over the top rail and allow to hang down into the manhole. Position the victim on his back with his head and shoulders under the manhole opening.

MANHOLE RESCUE

Pass the snap hook end beneath the victim's shoulder blades, under his arms and tie a thumb knot allowing approximately 200 mm of free line.
Clip the snap hook into the remaining length of line and leave the manhole. Position yourself opposite the tent frame and progressively haul the victim out.
When the victims head is above the top of the manhole opening, tie off the safety line to the tent frame.
Place free end of rope under victims feet and swing him free of manhole. While assistance in hauling the victim to the surface is desirable it is normally possible for one man to haul another 10 kg heavier than himself from a manhole.

DANGER TO RESCUER FROM GAS

As a rescuer will be in the manhole for only a short time he is unlikely to be overcome by gas but he must be alert for indications of the effects (headache, dizziness or nausea) and leave the manhole immediately if affected.
Spend short periods in manhole interspersed with short rests in the open air to avoid being overcome.

CHECK SAFETY ROPES PERIODICALLY FOR WEAKNESSES AND REPLACE IF NECESSARY.

REFERENCES

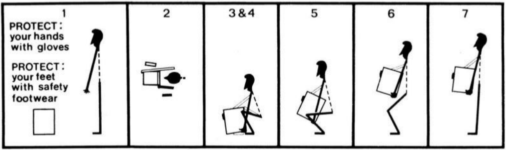
EI LINES	General	SP 4000	Dangerous Gases In The Underground Network
"	"	TE 4410	Portable Combustible Gas Detector Model AE10-40
		TE 4420	" " " " Cosmos Model XP301-B
		TE 4430	" " " "
		TE 4440	Carbon Monoxide Gas Detector
		TE 4450	Portable Combustible Gas Detector
		TE 4470	" " " " Gas Check Model 74GC

MANUAL HANDLING

Manual handling of material and equipment in the external environment demands more care by staff because many of our manual handling accidents occur at the job site where mechanical aids may not be available.

Strained back muscles, ruptured spinal discs, hernia and other painful injuries result from incorrect lifting methods.

- Size up the load.
- Position your feet correctly for balance
- Lower the body
- Take a firm hold
- Keep head erect and chin in
- Keep arms close into the body and inside legs
- Lift and use body weight

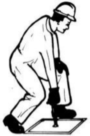


Seven steps for manual lifting.

LIFTING MANHOLE AND JOINTING PIT COVERS

LIFTING MANHOLE COVER

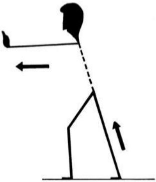
- Point your advanced foot in the direction of travel.
- Place your unoccupied hand on your knee.
- Keep your head up and your chin in.
- Keep your back straight and lift with your legs.
- Always get assistance to lift heavy manhole covers.



LIFTING PIT COVER

BREAKING SEAL ON COVER

Where the cover is sealed or jammed strike around the edge with hammer or bar. Heat may be necessary to soften bitumen. Do not heat if gas is suspected.



PUSHING

One foot forward to provide balance. Rear foot gives thrust, back kept straight.

PULLING

Advanced leg with knee bent gives thrust, rear foot safeguards balance. Keep back straight.

Stand bag upright.
Obtain secure grip.
Keep back straight
and head up.
Lift with the legs.

Rest bag on thigh
so that leg muscles
can assist forward
movement.

LIFTING AND CARRYING A BAG OF CEMENT

Keep arms
straight.

Relax knees and lift with legs.
Keep back straight and head up.

RAISING AND PUSHING WHEELBARROW

DANGERS IN HANDLING LEAD

When handling lead (including lead covered cables) it is essential to prevent any trace of lead entering the body which may cause lead poisoning.

DO NOT EAT, DRINK OR SMOKE WHILST HANDLING LEAD.

Wash your face and hands with soap and water and clean your finger nails with a nail brush before mealtime or rolling or smoking a cigarette. After washing do not get lead dust from your clothes on your hands, and be careful that lead dust does not get in your food.

Never use a knife that has been used to cut lead, to cut food as any trace of lead entering your body by the mouth or nose may cause lead poisoning.

Clean your mouth and teeth regularly, watch for digestive upsets and avoid constipation.

HAZARDS WITH HAND TOOLS

Cold chisels and gads with mushroomed heads are safety hazards. Injuries may be caused by hammers glancing off the head or by flying metal splinters. Grind the head to a slight taper for safe work.

Do not use a hammer or an axe with a loose head or a split, splintered or rough handle.

Take care to avoid burns when using a soldering iron. Test whether the tool is hot enough with a piece of solder held against the tip. DON'T HOLD THE TOOL NEAR YOUR FACE OR HAND TO FEEL ITS HEAT. Avoid flicking molten solder off the tip of the tool. Watch where you place a hot soldering iron - it can set fire to combustible material.

Be careful to avoid injury when using sharp edged tools such as knives, chisels and saws. Store these tools with a guard over the cutting edge. Never leave a knife with the blade upright.

DO NOT USE ANY TOOL WHICH IS NOT IN GOOD ORDER - DEFECTIVE TOOLS CAUSE ACCIDENTS.

ACCIDENT REPORTING

REPORT ALL ACCIDENTS, NEAR MISSES AND EVEN MINOR SCRATCHES, TO YOUR SUPERVISOR AS SOON AS POSSIBLE AFTER THE OCCURANCE.

An Accident Report, Form P 400, must be prepared by your supervisor for all accidents involving personal injury and when a disease due to employment is contracted.

An injury which may appear only slight when it is sustained may develop into something more serious later. It is essential that all injuries, however minor, be reported. If there is no official record you may find it difficult to substantiate a claim for compensation if this becomes necessary.

The onus is on you to report any injury sustained on duty or when travelling to or from work by the usual route.

Treat minor cuts and abrasions immediately.

After completing form supervisors must forward set intact to District/Branch Head immediately.

If the reported accident is a skin rash or other apparent skin disease, possible hernia or potentially serious back injury, the employee should be referred to a Government Medical Officer for examination as soon as possible or if unavailable, a private doctor.

REMEMBER WHAT IS A MINOR SCRATCH TODAY MAY BECOME A MAJOR INJURY NEXT WEEK IF IT BECOMES INFECTED.

ACCIDENT REPORTING

Keep a First Aid Kit with your equipment and see that items used are replaced promptly.

Portable first aid kits (S.540/62) are provided for each conduit and cable installation party and a small kit (S.540/61) is available for individual workmen such as manhole builders.

Read your First Aid Booklet (S.540/24) and learn how to treat injuries correctly.

IT IS YOUR RESPONSIBILITY TO:

- Work safely, follow the safety rules. They are for your protection.
- Use the safety equipment provided by Telecom.
- Dress in a manner which will assist in protecting you from injury.
- Report defective tools, equipment or safety equipment and obtain replacements promptly.
- REPORT ACCIDENTS PROMPTLY.

REMEMBER, ACCIDENTS DON'T JUST HAPPEN, THEY ARE CAUSED.

REFERENCE

ACCIDENT REPORT FORM P400

HEART-LUNG RESUSCITATION

GENERAL

Heart-lung Resuscitation (HLR) is used to maintain blood circulation and supply air to the lungs after breathing and heart beating has stopped.

Artificial ventilation only supplies air to the lungs and is used where a person stops breathing or when applying heart-lung resuscitation.

Cardiac compression compresses the heart thereby forcing blood into the arteries and can only be used when applying heart-lung resuscitation.

HLR is used in cases of drowning, electrocution, heart attack, suffocation or any other condition where breathing and heart beating stops. Signs indicating the need for resuscitation are :

- Lack of pulse
- Lack of breathing
- Blue - grey skin colour
- Pupil not contracting when exposed to light

Remember the ABC of heart-lung resuscitation :

A - AIR PASSAGE	Must be clear. Feel breath with your cheek and watch for chest movement.
B - BREATHING	If weak or stopped apply artificial ventilation immediately.
C - CIRCULATION	If stopped apply heart-lung resuscitation.

SPEED IS ESSENTIAL - IRREPAIRABLE BRAIN DAMAGE OCCURS 3 to 5 MINUTES AFTER BREATHING OR HEART BEATING STOPS.

A - AIR PASSAGE - clear obstructions

. Roll victim on side
. Sweep throat clear with fingers
. Deliver a few good sharp blows between the shoulder blades to help drain fluid.

. Lay on a flat surface face up
. Tilt head back to clear airway
. If tilt ineffective pull jaw up and forward.

For adults only - during prolonged resuscitation it may help to place a rolled towel or loose soil under the shoulders.

CLEARING AIR PASSAGE MAY BE SUFFICIENT TO RESTORE BREATHING

B - BREATHING

If breathing weak or stopped IMMEDIATELY GIVE FIVE QUICK BREATHS by one of the following techniques:

MOUTH - TO - MOUTH

- Maintain head tilt
- Pinch nostrils with thumb and forefinger
- Open your mouth and place it over the victims slightly opened mouth

MOUTH - TO - NOSE

(Useful if victim has a broken jaw or badly cut mouth)

- Maintain head tilt
- Seal mouth with your cheek
- If nose obstructed change to MOUTH-TO-MOUTH

B - BREATHING (continued)

. IF AIRWAY OBSTRUCTED roll victim on side and clear throat again. Where necessary deliver blows between shoulder blades to drain fluid. Repeat as necessary.

. CHECK CIRCULATION (see page R-36) If no pulse, start cardiac compression (page R-39).

If pulse present blow into lungs until chest rises a normal amount :

Adults forcefully

Children gently

Infants light puffs

. Allow to breathe out naturally. Listen to air being exhaled. When flow stops re-inflate lungs :

Adults every five seconds

Children and Infants every 3 seconds

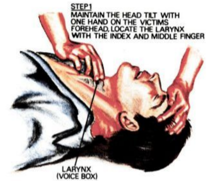
NOTE : Slight stomach swelling can be disregarded. Gross swelling is relieved by rolling victim on side and exerting gentle pressure on stomach.

ALL LINES STAFF MUST RECEIVE INSTRUCTION IN HEART-LUNG RESUSCITATION METHODS.

HEART-LUNG RESUSCITATION

C - CIRCULATION

CHECKING CIRCULATION



Adults - feel the carotid pulse. If not definitely present start cardiac compression immediately (page R-39)

Children and Infants - feel for heart beat with fingers

NOTE : Other indications of lack of circulation :

- Blue-grey skin colour
- Pupil not contracting when exposed to light - a similar effect may be caused by drugs, brain damage or a glass eye.

C - CIRCULATION (continued)

CARDIAC COMPRESSION

. Lay victim flat on rigid surface

. Locate position for cardiac compression:

Adults
. Locate tip of breast bone (xiphoid bone)
. Measure from tip of xiphoid towards head a width of 3 fingers
. Place heel of other hand next to 3 fingers
. Place measuring hand on other hand

Children use heel of one hand applied over midpoint of sternum (breast bone)
Infants use index and middle fingers over midpoint of sternum

. Sternal Movement: (COMPRESSION OF CHEST)

Adults	40 - 50 mm
Between Infants and Adults	20 - 40 mm
Infants	10 - 20 mm

For compression keep elbows straight and position arms vertically before applying pressure. The heel of the hand is used without the fingers touching the chest wall.

FOR HEART-LUNG RESUSCITATION TO BE EFFECTIVE, SPEED IN APPLICATION IS ESSENTIAL.

HEART LUNG RESUSCITATION

C - CIRCULATION (continued)

LOCATE LOWEST POINT OF PRESSURE

PLACE HEEL ON PRESSURE POINT

BOTH HANDS IN POSITION

HEART-LUNG RESUSCITATION

Heart-lung resuscitation is the combination of artificial ventilation and cardiac compression. Cardiac compression must always be done in conjunction with artificial ventilation.

TWO OPERATORS

Rescuer A . Gives cardiac compressions:

Adults	60/minute to a count of "one thousand and one"
Children	80-100/minute
Infants	100-120/minute

Rescuer B . Gives one ventilation after every 5th compression, and as pressure is released from the sternum

. Checks for signs of life (page R-43)

HEART-LUNG RESUSCITATION (continued)

ONE OPERATOR

Cardiac Compressions	. 60/minute to a count of "one and two and three......"
	. To give time for artificial ventilation, cardiac compressions must be done at a rate of 80/minute.
Artificial Ventilation	. After 15 compressions give 2 ventilations within 6 seconds.

HEART-LUNG RESUSCITATION (continued)

RECOVERY SIGNS

- Pulse return
- Breathing
- Skin colour returning to normal
- Movement and contraction of pupils

When victim can breathe unaided, lay in a coma position. Keep under observation until medical assistance available.

COMA POSITION - FRONT VIEW

COMA POSITION - BACK VIEW

SAFE WORKING PRACTICES FOR ASBESTOS CEMENT PRODUCTS

Products manufactured from asbestos cement include pits, pipe bushes, 100 mm conduits and building sheets. Asbestos cement is basically a safe material and it is only the dust generated when the material is cut, ground, etc. that may constitute a health hazard.

WORKING WITH ASBESTOS CEMENT

Work with asbestos cement products can be carried out safely with hand saws and other hand tools. Work with power drills, and occasional power sawing are also considered to be safe. However, the wearing of a suitable respiratory protection device and protective clothing is mandatory when power tools are used.

RESPIRATORY PROTECTION

Respiratory Protection may be provided by either a cartridge respirator or a disposable face mask. The recommended type of cartridge respirator is the class M and the face mask is 3M Brand No. 8710.

It is essential that correct fitting procedures are followed for both types of respiratory protector to ensure a good facial seal and effective operation of the device.

ASBESTOS CEMENT DUST MUST NEVER BE SWEPT UP IN A DRY STATE

SAFE WORKING PRACTICES FOR ASBESTOS CEMENT PRODUCTS

PROTECTIVE CLOTHING

For work with power tools a "boiler suit" type of overall must be worn, after completion of the task and while still wearing respiratory protection the clothing must be freed from loose dust in the open air and well clear of people.

If power tools are used the following practices should be followed :

. avoid extensive power sawing or grinding of asbestos cement products

. dampen the asbestos cement being worked to reduce airborne dust

. perform the work outdoors

. remain up wind of the work.

CLEANING AND DISPOSAL OF WASTES

A method of clearing up small quantities of asbestos cement dust is to dampen the dust. This will form a slurry which can safely be swept or shovelled up.

Where asbestos cement dust has collected indoors, industrial vacuum cleaners approved by the relevant occupational health authority for use with asbestos also provide a suitable method for cleaning up asbestos cement dust. It is essential that only the approved type of cleaner is used.

All recovered asbestos cement dust should be placed in a suitable plastic bag, labelled and securely sealed before removal. It should be disposed of by burial at a suitable dump.

AN AIR JET MUST NEVER BE USED FOR CLEANING UP ASBESTOS DUST.

DAMPEN ASBESTOS CEMENT DUST BEFORE SWEEPING UP.

Reference : EI LINES General SP 9041

Portable power tools when used must always be plugged **directly into an approved** Earth Leakage Core Balance Relay unit (S.435/11).

Sparks generated by power tools can create a potentially hazardous situation if used in a combustible atmosphere, therefore it is imperative to test for combustible gases before working in an enclosed environment.

Before drilling or cutting into a ceiling, wall or floor at a customers premises, ensure that there is no danger of penetrating electrical wiring, gas pipes or gas cylinders etc.

For additional protection wear rubber gloves S.34/14-21 and stand on a rubber mat S.34/54.

Always wear protective goggles S.137/11 when using power tools that create sparks, flying chips or dust.

Remove unnecessary material from the work area to ensure maximum freedom of movement.

Before using any power tool ensure that it is the correct tool for the job.

Power tools must not be exposed where there is a possibility of the tools being splashed or immersed in water. If this happens :-
- . Disconnect the power from the tool.
- . Shake thoroughly and wipe the casing with a clean cloth or paper towel.
- . If the tool has been completely immersed in water or if the condition of any power tool is in doubt it must be withdrawn from service.

Power tools must not be carried by their cords.
If damage occurs to the cord or plug of a tool obtain a complete cord replacement (7m cord and moulded plug) S435/14 and 15. The cord must be fitted to the tool by a qualified Electrician.
Workmen must not use power tools which are in doubtful condition.

EXTENSION LEADS

Extension leads are generally more susceptible to damage than electrical tools, therefore they require special care and should be used in situations where they are not subject to damage. The use of extension leads should be avoided whenever possible. Where their use is unavoidable an approved portable extension lead, reel and carrying handle is provided under S.435/10.

USE AND MAINTENANCE OF EXTENSION LEADS

Protect extension leads from vehicle or pedestrian traffic by placing a board either side of the lead.

Keep extension cords free from oil or grease and ensure that plugs and sockets are kept free of moisture.

Under no circumstances should a 2 core flexible cord be used irrespective of whether the tools are double insulated or not.

The full length of extension leads on reels should be completely unreeled so as to prevent overheating also plug/socket adaptors must not be used in extension sockets.

Examine extension leads for :

- Damage and deterioration of sheathing
- Damage to plugs and sockets
- Loosening or deterioration of cord anchorage
- Firm conductor terminations.

Regular inspection of Extension Leads are to be conducted at intervals not exceeding four months.

Reference : EI LINES General SP 4010

SAFETY HELMETS

SAFETY HELMETS FOR LINE STAFF

Two types of safety helmets are available, they are :-

- . a cap style (S.34/109) with frontal peak and rain gutter surround for general use or in confined spaces
- . a hat style (S.34/112) with an all-round brim for tropical or open space conditions.

Both styles are available with a number of accessories :

. Protector, neck, white cotton cloth	(S.34/42)	
. Liner, cotton	(S.34/114)	
. Sweatband, absorbent, washable	(S.34/107)	
. Strap retaining, elastic webbing	(S.34/40)	
. Peak Detachable, green tinted	(S.34/41)	For use with cap style only.
. Brim Detachable	(S.34/113)	For use with hat style only.

Peak Detachable fitted
to Cap Style Helmet

Brim Detachable fitted
to Hat Style Helmet

THE CORRECT SIX POINT HARNESS MUST BE USED IN YOUR HELMET.
ANY HELMET WHICH SUFFERS A SEVERE IMPACT MUST IMMEDIATELY BE REPLACED.

SAFETY HELMETS

WHERE SAFETY HELMETS MUST BE WORN

Safety Helmets Must be Worn by All Staff in situations set out below :

- Staff associated with conduit and manhole construction, cable hauling, pit and pipe construction, buried cable installation, the operation of mechanical aids or working in any other excavation.
- Aerial line work including drop wire distribution.
- Where staff work below other persons.
- Work associated with masts and towers.

  NOTE: For work associated with masts and towers a safety helmet area is that unprotected area around the base of the tower or mast of a diameter equal to the tower height whilst any staff are working on the mast or tower.
- When entering or working in tunnels.
- When using explosives.
- On building sites other locations and industrial organisation who have "Safety Helmet Areas" or "Hard Hat Areas".
- Other work situations where the supervising officer considers there is a danger that staff are likely to injure their heads.

SAFE USE AND CARE OF HELMETS

Clean helmets regularly with warm soapy water or household detergent. The harness can be disinfected with a Hibitane concentrate 5% solution obtained from chemist shops. When used it should be diluted 1 part to 500 parts of water.

SAFETY HELMETS

Do not paint the helmet shell. In vehicles, store your safety helmet out of the sun and where it cannot be damaged.

Safety helmets are not to be carried on the front or rear window ledge of motor vehicles.

Never use helmets for such purposes as seats, liquid receptacles or wheel chocks.

RESPONSIBILITY OF SUPERVISORS

It is the responsibility of supervising officers to ensure that adequate stocks of helmets and replacement harnesses are always available and that helmets are worn in situations as described previously.

Harnesses must be replaced at intervals no longer than two years from the date of issue which is punched on the harness by the issuing officer.
After a further two years service as indicated by the replacement harness the helmet shell will have been in field service for four years and the complete safety helmet must be replaced.

A SIGNIFICANT PROPORTION OF ACCIDENTS TO EXTERNAL PLANT STAFF RESULT IN HEAD INJURIES, AND THESE INJURIES CAN BE SUBSTANTIALLY REDUCED BY THE CORRECT USE OF SAFETY HELMETS.

Reference : EI LINES General SP 1020

WEARING OF SAFETY VESTS

Safety Vests are provided so that the wearer will be conspicuous for some distance to approaching drivers especially in dull or overcast weather and at night.

Two sizes of safety vests are available :-

S.34/131	Size 16-18	Small
S.34/132	Size 20	Large

SAFETY VEST

WHEN SAFETY VESTS SHALL BE WORN

Safety Vests shall be worn by staff where high visibility warning is required. Typical situations are :

- Conduit parties.
- Manhole building parties.
- Cable hauling parties.
- Pit and pipe parties.
- Cable pressurisation installation and maintenance parties.
- Aerial parties, including faultmen.
- Pole installation or removal.
- Erecting aerial cable or drop wire close to or over roadways.
- All staff working in roadway manholes.
- Staff working near moving, driven machinery.
- Staff controlling traffic.
- Other situations as directed by the Supervising Officer.

SAFETY VESTS

ISSUE OF VESTS

Safety vests shall be issued on a personal basis to all staff whose duties require them to frequently work on or close to roadways. Safety vests will be issued on loan to all other staff as required.

CARE AND MAINTENANCE OF SAFETY VESTS

Staff who wear safety vests shall be responsible for cleaning them.

Safety vests can be cleaned as follows :

. Hand wash in warm soapy water.
. Rinse in clean water.
. Iron at wash and wear setting.

Important Do not scrub reflective material with a hard bristle brush, use a soft cloth or sponge;
Repeated machine washing in hot water will reduce brightness;
The safety vest can be dry cleaned.

RESPONSIBLITY OF STAFF TO WEAR SAFETY VESTS

Supervisors are required to ensure that their staff have vests available and that they are worn when required.

SAFETY OF STAFF IS INCREASED BY WEARING SAFETY VESTS.

IT IS THE RESPONSIBILITY OF EACH OFFICER OR EMPLOYEE TO WEAR SAFETY VESTS IN HAZARDOUS AREAS.

REMEMBER

NO JOB IS SO IMPORTANT

AND

NO SERVICE IS SO URGENT

THAT WE CANNOT TAKE TIME

TO DO IT SAFELY